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CHAPTER 2

Transition of Self-Managing Irrigation Institutions in Developing Countries

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MANAGEMENT PERFORMANCE AND INSTITUTIONS

The Problem Management Turnover is Meant to Address

Poor Management Performance. THERE ARE ABOUT 220 million hectares (ha) of irrigated land in the world. This represents about 18 percent of the total cultivated land. But this land produces about 33 percent of the world's total harvest (Repetto 1986, p.3). About 158 million ha of irrigated land (72 percent of the world's total) are located in less-developed countries. In recent years, roughly US$10 to 15 billion has been spent per year on irrigation development in the Third World. One study on Asia (where two-thirds of the world's irrigation is) has projected that 38 percent of the needed increase in food production would have to come from existing irrigated areas and 36 percent from new irrigated areas (op cit. p.3).

Given the importance of irrigation for the world's food supply and the vast resources expended on irrigation development, it is tragic that the actual performance of irrigation systems has been so disappointingly low. This is largely due to faulty design and construction, poorly managed operations and inadequate maintenance. (Carruthers 1983; Bottrall 1981;). Frequently, the actual area irrigated is a fraction of the design area. Water is wasted in the upper parts of systems and is rarely available in the lower - end sections. Water deliveries are often untimely and unreliable. Canals and gates, whether built properly or not, are allowed to fall into disrepair. In general, only about 25 to 30 percent of water diverted into large canal systems in developing countries reaches the crops needing it (Rangeley 1985).

Irrigation performance has generally remained relatively poor -- after widespread and repeated physical improvements, extensive training efforts and attempts to elicit farmer participation. This indicates that something else is more fundamentally constraining its effective management. More attention should be given to turning to the nature of the managing organizations themselves, and in particular to the

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question of "what are the institutional incentives to manage in such a way as to achieve good performance, however, defined?"

Management Turnover as a Solution

By the late 1980s, the emphasis on "farmer participation" shifted in many countries to a different and more thoroughgoing approach -- which is the turnover of primary management authority itself to water users' associations or other nongovernmental institutions. In response to poor management performance, financial pressures, increasing agricultural diversification and commercialization and increasing numbers of rural nongovernmental institutions, many governments in developing countries are privatizing irrigation institutions and turning over their management to water users' organizations, or other nongovernmental institutions.

What is it? By the term, *irrigation management turnover,* we mean the contraction of the government's role in irrigation management and the corresponding expansion of the role of water users and other private-sector institutions in irrigation management. This includes various types of institutional changes involving greater private-sector control, authority, responsibility, resource mobilization and profit-sharing in the management of irrigation. Management turnover does not necessarily mean the total withdrawal of the government from all activities. It can be selective, in accordance with local management contexts. By the term, *privatization,* we mean the transition from governmental to private-sector ownership of irrigation system assets. Worldwide, there is considerable diversity in the kinds of private-sector irrigation management models and in methods for transferring management. By *self-management,* we mean the implementing or direct supervising of operations, maintenance and system improvement functions by an institution whose jurisdiction and membership are based on local "hydro-management" boundaries (such as a common water source or diversion). Through management turnover or privatization, many governments are pursuing the objectives of: 1) improving the management performance and sustainability of irrigation systems, 2) reducing government costs for O&M and 3) reallocating scarce revenues to more technical or more inherently governmental purposes (such as regulating water use along river basins). However, management turnover and privatization policies are normally driven by two assumptions: 1) that farmers are financially and organizationally ready to assume ownership and/or management and 2) that management turnover will improve the performance and sustainability of irrigation systems. Both assumptions are crucial. But they are largely undocumented.

Why should self-management improve irrigation performance?

Repetto (ibid, p.7) notes that:

> *The dynamism of private irrigation is instructive... because it illustrates how successful a different kind of irrigation service can be. Since farmers can control water availability with little risk of supply shortages at critical growing periods, and then apply water to optimize farm income, agricultural yields under private irrigation are larger than under public canal or tubewell irrigation.*

The main argument for turning over irrigation management to self-managed or private-sector organizations, such as water users' associations, is that nongovernmental institutions tend to have the proper structure of incentives to manage according to performance criteria. The argument is as follows:

> *Nongovernmental irrigation management institutions are forced to be locally self-sustaining. Their organizational survival depends on financial viability. Viability can only be achieved by recovering O&M costs from the users or beneficiaries. The ability to recover O&M costs from beneficiaries is directly related to the productivity of irrigated agriculture. The users have a personal interest in ensuring the long-term productivity of their irrigated agriculture. This is ensured through good O&M management performance.*

The turnover of irrigation management is an attempt to both economize on government budgets and to achieve more productive and sustainable irrigated agriculture through local control and enterprise. Due to its widespread occurrence and implications, turnover may shape the nature and performance of irrigation management more profoundly over the coming few decades than any other innovation in irrigation. In reversal of the effects of bureaucratization on local resource management institutions (somewhat analogous to loss of genetic diversity through biotechnology), it may help reopen the path toward institutional diversification through local adaptation.

In addition to its potential benefits for O&M efficiency, turnover to self- management may provide an approach to improving equity and capital investment efficiency. Because turnover shifts the role for setting objectives and priorities to the users, it may help establish social legitimacy for irrigation fees and a shared understanding of the need for equitable contributions from all users. It can also help engender an understanding that the costs of O&M are not the only costs involved in an irrigation system. The costs associated with capital investment, such as system improvement and rehabilitation, are also important management responsibilities.

In a number of countries it is gradually being recognized that increased productivity is not a sufficient measure of success. And there is often a danger that increased production will be sought through expensive investment in infrastructure rehabilitation or replacement, at an overall net cost both to those who must bear the cost and to the national economy. As observed above, government agencies sometimes seek to improve performance through construction or rehabilitation rather than through effective maintenance, in a context of separated budgetary arrangements for recurrent and capital expenditure. Hence, there is no planning on the basis of optimal trade-offs between the two.

It is possible that turnover could constitute a creative solution to this issue. If farmers can come to accept responsibility not only for O&M but also for at least a share of the cost of capital/investment, then a climate of incentives can be provided to make rational decisions on the efficiency of capital investment and the optimum balance between that and O&M.

It does not follow that the observed poor management in the public sector proves that the private sector will do better. The argument for turnover may be compelling and preliminary indications of results justify optimism. But we do not mean to imply that management turnover should be accepted *a priori* as a solution for most management problems. Nor does IIMI intend to take an advocacy position for it (at least not until much more is known about it). Like any other management innovation, it must be evaluated on the basis of its actual effects on performance. Turnover can be justified if and only if it supports:

1. sustainable economic viability at the farm level,
2. sustainable performance at the system level, and
3. overall net benefit at the national level, measured so as to include increased levels and equity of rural income and greater efficiency in the use of government resources, including the cost of capital.

Institutional challenges for irrigation. Experiences in privatizing management in sectors other than irrigation can provide some lessons for irrigation. However, we are limited in our ability to translate methods used from other economic sectors into irrigation management. Irrigation management differs from other sectors according to its own characteristics. These characteristics together tend to make nongovernmental management more challenging in irrigation than in many other sectors. They require new solutions not directly translatable from other sectors. While such organizational challenges exist in other sectors, it is their relative importance and overall configuration that are characteristics of irrigation. Some of these key features are listed below.

1. Irrigation has extensive and varied kinds of *externalities* (salinity, waterlogging, inequity) which originate from group and individual actions.

2. While the demand for amounts and timing of water deliveries normally varies by individual, it is often *difficult or impossible to measure and assign charges for deliveries* at the individual level (unlike electricity or municipal water supply). Water often flows between fields. Farmers often use more than one water source. More often than not, in the developing countries, the "transaction cost" of measuring and pricing water deliveries would exceed the benefits, even if the technical and practical constraints could be overcome.

3. Irrigation involves a profound managerial challenge of matching complex demands for water with constraints in supply and delivery. This often makes it difficult to define and achieve equity. To be effective, *matching variable demands and supplies* generally requires some amount of local control and collective information use.

4. Maintenance problems frequently have unequal and indirect effects on water users. The *link between payer and beneficiary is vague* where irrigation fees are not based on real needs at the system level. The ability to collect fees and maintain systems properly may be difficult where farmers do not help set maintenance priorities. And it is often difficult to exclude free riders from O&M services.

5. Irrigation often has extensive indirect and variable forms of *subsidization and taxation* by governments, markets, and powerful interests.

6. Irrigation systems often approximate *natural monopolies,* where only one organization at a time can deliver operational or maintenance services.

7. In many environments the *economic value of irrigation water* is low enough to constrain the range of viable management alternatives (Young 1985).

8. Poorly developed land tenure, water rights, regulatory supports and *nongovernmental management institutions* often constrain private-sector alternatives (Woodhouse and Ndiaye 1990).

9. *Resistant bureaucracies* lack incentives to reorient themselves for turnover and for post-turnover roles (Wolf 1991).

Such constraints, however, do not make management turnover or local self-management impossible. But they do require considerable political will power (including strong support from planning and finance ministries). They also require effective regulation and/or competition in service delivery, clarity about water rights, legally sound and socially viable local managing organizations and supportive incentives for agencies and local organizations.

EXPERIENCES WITH MANAGEMENT TURNOVER IN DEVELOPING COUNTRIES

Examples in Asia

Water users' associations in Japan, South Korea and Taiwan often have considerable political strength and elaborate rules and procedures. They are among those who achieve the highest rice yields in the world. Such associations often act as bodies which commission third parties to handle management tasks. There are systems in China where farmers' organizations sponsor auctions to award irrigation management contracts to private parties (Svendsen 1990; Svendsen and Liu C. 1990).

In the Kakrapar Irrigation System in Gujarat State, India, the Mohini Water Distribution Cooperative Society reportedly manages effectively a large distributary canal. The Cooperative Society purchases water on a volumetric basis from the Irrigation Department and manages the distributary and tertiary canals (Datye and Patil 1987).

A study comparing private tubewell irrigation with government tubewell and canal irrigation in Uttar Pradesh, India, found that cropping intensities, irrigated crop yields and agricultural income of farmers were significantly lower in the public tubewell and canal irrigation systems than in the private tubewell systems. In the government systems, farmers generally complained of unreliable and inadequate deliveries of irrigation water. The overall average for food grain yields in India is about two to three tons per hectare in public canal-irrigated areas. This can be contrasted to about five to six tons per hectare generally attained in private tubewell irrigation systems (Dhawan 1985; Repetto 1986:5).

Another recent study comparing public and private tubewell irrigation found that public tubewell irrigation in India scores poorly in terms of survival of pumps continuing to function, actual versus planned area irrigated, hours operated, financial viability, and access of resource-poor farmers to water (Chambers et al. 1989). Chambers et al. note that over 95 percent of the area irrigated in India by tubewells is served by private tubewells. They attribute a large part of the problem on public tubewells to lack of accountability of the public operator to the users. They conclude that "the poor performance of public tubewells presents such strongly interlocking weaknesses that we doubt if they will emerge as an effective large-scale means of supplying water to resource-poor farmers" (ibid. 88-89).

In 1982, the Philippines cut off government funding for National Irrigation Systems operated and maintained by the National Irrigation Administration (NIA). Since then NIA has accelerated its institutional efforts to create water users' associations and raise the collection rates of water service charges. NIA staff generally acknowledges that the best way to improve the collection rate (which is about 50 to 55 percent nationwide) is to either improve the management of irrigation according to the farmers' objectives or to turn over full management to water users' associations. It is generally considered that a 65- or 70-percent fee collection rate would enable NIA to be financially self-sustainable.

The Philippine model of turnover proceeds in three stages, going from user charges, to devolution of tasks, to NIA withdrawal at the distributary or system level. In stage one, NIA contracts with users' associations for the management of O&M, while NIA manages the diversion or pump and collects the fee. In stage two, the users' associations still receive contracts for O&M management but they also handle collection of the fee and receive a greater share of the proceeds. In stage three the users' associations take over full management and receive all fees collected. Institutional organizers from NIA, from nongovernment organizations (NGOs) and from farmers' groups themselves have been used in the turnover process. Despite reports of successful cases of turnover (Bautista 1987; Gonzales 1991), few systems in the Philippines have moved to full turnover. So far, there is little systematic evidence about the effects of turnover or about why full turnover has not been more widespread in the Philippines.

In 1988, the Government of Indonesia embarked on a 15-year program to turn over full management to water users for all of its public irrigation systems below 500 hectares in size. This constitutes 70 percent of all government systems in Indonesia. Trained agency staff are being used as institutional organizers. Repairs are made in the systems according to farmer priorities prior to management "turnover." The government is also introducing, for the first time, an irrigation service fee to recover costs of irrigation operations and maintenance for the main and distributary levels of its public systems. These structural adjustments are part of World Bank and Asian Development Bank irrigation sub-sector loan programs.

In Sri Lanka, the government is extending management turnover from pilot areas to distributaries of large-scale systems throughout the country.

Financial pressures and the recognition of the potential for effective farmer management have led to the adoption of this policy, which includes the formation and development of water users' associations, transfer of O&M responsibilities to users' associations and the development of a new division of responsibilities between the government and the farmers in irrigation systems. USAID, the Asian Development Bank and the World Bank have been assisting, or are planning to assist Sri Lanka with institutional and policy aspects of management turnover. In Nepal, the government wants to expand the role of farmer management of agency systems, turning over partial management of these systems. USAID and the Asian Development Bank are also involved with this "joint-management" strategy in Nepal.

During the 1980s the Government of Bangladesh has taken a series of actions to deregulate and "privatize" the distribution and purchasing of irrigation pumps and related supplies. It is selling off its public tubewells and withdrawing from both the providing of pumps and management of tubewell irrigation. The well-known Grameen Bank is purchasing and managing some of the public tubewells. Some are being sold on credit to landless farmers' or women's groups, who then manage pump operations. The Asian Development Bank and other donors have assisted the government in aspects of the privatization of public tubewell irrigation in Bangladesh. There is some concern that the privatization of tubewell irrigation in Bangladesh may lead to greater concentration of power and access to irrigated land among elites. The privatization of public tubewells and transfer of management to local groups are also on the policy agenda in Pakistan (Chaudhry and Young 1988).

Examples in Africa

As of January 1991, the Government of Nigeria "commercialized" its River Basin Development Authorities (RBDAs), which manage the approximately 100,000 hectares of large-scale irrigation systems in northern Nigeria. Federal government funding has been cut off and they must now become self-financing. The recovery rate of water charges in large-scale irrigation systems in the more successful schemes in northern Nigeria is running at roughly 50 percent. The RBDAs are currently seeking ways to expand the role of farmer management and to increase the fee collection rates in these systems. The recent increased profitability of irrigated agriculture due to import restrictions may support the move toward expanding the role of farmers in managing these systems. The government is also supporting the expansion of private-sector pump irrigation management in the *fadama* sector (low-lying areas with flood recession or residual moisture), which already serves approximately 800,000 hectares (IIMI 1990).

In 1984, the Government of Senegal initiated a policy of "disengagement" of the State Agency for Senegal River Basin Irrigated Agriculture (SAED). SAED is withdrawing from irrigation management and the providing of agricultural inputs. Irrigators' Associations and their higher-level federations are being created and are already taking over functions of water management within and between the river lift pump schemes. In its recent five-year plan (1984-89), SAED has been withdrawing from the provision of credit, inputs and marketing and from the operation and maintenance of rice mills, agricultural machinery and irrigation in large-scale "perimeters." There have been reports of both successes and failures in various areas along the Senegal River Valley, with poor maintenance of canals cited as an early problem in the process (Woodhouse and Ndiaye 1990). There is also concern about the possible negative effects of the disengagement on the ability of the poor and those with insecure land tenure to secure access to water and land.

In Madagascar, which has 1.2 million hectares in irrigation schemes, a 15-year program was initiated in 1986 for the rehabilitation and management turnover of systems from 100 to 3,000 hectares in size. The program involves the creation of water users' associations and turning over of full responsibility for O&M in these systems. As an incentive for farmers to take over management, the government offers to rehabilitate the systems, or distributary canals, if the farmers agree to finance or directly manage O&M. As of 1990, of the 380 small-scale schemes eligible for turnover under the program, farmers have already agreed to the terms for rehabilitation (i.e., O&M sponsorship) in 187 of them. Of these, 176 systems, or 8,000 hectares, have been "inventoried" (for identifying development needs) and 29 systems are under implementation.

Under the program, the water charge collection rates have gone up from 16 to 20 percent before the program to about 65 percent in 1990. In the larger systems, the associations manage distributary canals while federations of associations oversee management of the primary canals (Nguyen 1990). The World Bank has provided financial and technical assistance to the turnover program in Madagascar. Elsewhere in several parts of Africa, there are signs that privately managed irrigation is showing better performance than government-managed systems, especially for small-scale irrigation (Barghouti and Le Moigne 1990).

Examples in Latin America

Latin America has had longer experience with transferring irrigation management to the private sector than has Asia or Africa. But until recently, much of it has been in pilot areas rather than nationwide (Plusquellec 1990). Mexico started a program in 1988 to transfer management of its 77 irrigation districts (3.2 million ha) from the government to water users' associations (WUAs) for lateral canals or sets of laterals. This includes the creation of federations of WUAs at the main system level. The transfer program is currently being implemented in four pilot districts. Implementation is expected to spread to 20 districts in 1991 and to all 77 districts within 5 to 10 years. Irrigation districts manage systems which exceed 1,500 ha in area. Systems smaller than this are already managed by the water users (Velez 1990).

In the 1970s, a few public irrigation systems in Colombia were converted to management by WUAs. The process was accelerated in the 1980s, becoming a national program by the end of the decade. Uniform accounting procedures establish rate costs per O&M task for all agency systems. Water charges are set on the basis of actual total system-level costs. In 1989, three irrigation districts (totalling 17,850 ha) were "taken over" at the request of farmers' organizations because they felt they could manage the systems more cheaply than the government was doing at the prior level of charges. Such calculated group decisions behind farmer takeovers are only possible where water charges are based on open information about the actual costs of O&M at the system level. As Savas (1987) has noted, the real value of user charges is not to raise revenue, but to "reveal fully the true cost of service." (ibid. p.248). In Colombia, heavy emphasis is given to training farmer water association leaders. There are early signs of successful results in some locations (Plusquellec 1989).

The rehabilitation and turnover of management in project schemes in the Dominican Republic have shown encouraging early results. It is reported that turnover of management from the public agency to locally empowered water users' associations has, in general: 1) reversed negative environmental degradation due to salinization, waterlogging and declining land productivity; 2) increased the total area under irrigation; and 3) improved the equity of irrigation and its benefits, regardless of size or location of fields within the systems (Hanrahan et al. 1990). Both the World Bank, the Inter-American Bank and USAID have been key donors that have assisted several Latin American countries with irrigation management turnover initiatives.

A FRAMEWORK FOR COMPARATIVE ASSESSMENT OF THE TRANSITION TO SELF-MANAGEMENT

We suggest that an assessment of irrigation turnover and self-management should consist of the following four components:

Identifying basic physical and social characteristics of the resource. This concerns key physical and social uses of the resource which constrain the range of feasible and appropriate institutional alternatives for self- management. These resource characteristics relate primarily to how irrigation water is, and should be (according to policy) acquired, used and measured.

Describing the relationship between management functions and institutional arrangements. This component enables us to analyze which types of organizations perform which management functions, and under what sets of rules and incentives. This will be done to help build a typology of institutional alternatives for full or partially self-managed irrigation.

Assessing institutional performance. Self-managed irrigation will be assessed according to institutional and management performance criteria, including both management outcomes and impacts.

Hypotheses about the transition to self-management. Criteria or working hypotheses are posed and used to guide analysis about essential conditions conducive to the development of effective self-managed irrigation institutions. They are based on the current state of knowledge about institutional development in irrigation and provide a conceptual framework for explaining the emergence of turnover and self-management and the realization of positive or negative results. They will be further developed during the program.

The first component enables us to define the social purposes and basic physio-technical constraints imposed in a given irrigation environment. The second component provides a framework for specifying the relationship between management functions, types of organizations, and institutional rules and incentives. The third component is the assessment of how well organizations are managed and what their impacts are, either before or after turnover to self-management. The fourth component is the analysis of why some turnover processes or self-managed institutions perform well and others do not.

Basic Physical and Social Characteristics of the Resource

Based on the literature about collective action and natural resource management, we assume that efforts to develop effective and locally sustainable institutions should begin from a clear understanding about the physio-technical nature of the resource, its social uses, and proprietary rights related thereto (Ostrom 1990a). Water becomes a "resource" when social purposes are attached to it. It becomes a form of property when social rights of access and use are attached to it (Furubotn and Pejovich 1972; Coward 1985a). It is at the convergence of the physio-technical and human purposive characteristics of resources that institutions are forged (Ostrom 1990b; Coward 1985b). Hence, when we refer to the nature of the "resource," we refer not to physical attributes per se, but to aspects related to the resource's social uses.

Basic institutional forms for resource management are fundamentally shaped by three characteristics of the resource. These are: 1) whether access to the resource can be excluded or proscribed, 2) whether the resource is consumed individually or jointly, and 3) whether resource use can be measured, either at individual or group levels. By answering the questions of exclusivity of access and singularity of consumption, we can designate whether a resource is a private good, a toll good, a common pool, or a collective good (Savas 1987, chap. 3).

If a resource is consumed individually and it is possible to exclude some people (such as non-payers) from access to the resource, then it is considered a "private good." An example of this is water purchased from vendors in bottles or storage drums ( ). If a resource is consumed individually but it is not possible to exclude unauthorized access to it, it is called a common pool good. An example of this is an underground aquifer where there is extensive use of small, private tubewells in a setting where effective regulation is not feasible.

If a resource is consumed jointly but it is still possible to exclude access to it, such as for non-payers or "free riders," then it is called a "toll good." An example of this might be tubewell or pipe irrigation for groups of farmers who buy into use rights. They use the pumped water together and exclude others from using it.

Figure 1. The nature of exclusion and consumption of water resources in different environments.

	Feasible	Exclusion	Infeasible common pool
Private goods	Bottled water	Groundwater at the level of underground aquifer	
Individual	Tubewell or pipe irrigation for individual fields		
Consumption	Surface irrigation at farm level (no return flow drainage)	Surface irrigation at farm level (return flow drainage)	
Joint	Tubewell of pipe irrigation for groups	Water from public well in town square	
Toll goods	Surface irrigation at canal level in tightly controllable settings. Return flow drainage	Surface irrigation at canal level in loosely controlled settings. Return flow drainage	Collective goods

Source: Savas 1987.

Perhaps, the most difficult situation for the development of the private-sector or local self-management of irrigation is when irrigation water becomes a "collective good," especially if the scale of resource access and use is large. Collective goods are inherently consumed jointly and exclusion of access to free riders is not feasible. More pure examples of this type of resource, outside the water sector, are the provision of a national defense, a lighthouse, or advertisements. An example of irrigation approximating a collective good would be where there is unrestricted access to flood recession land. A less extreme but more common example, would be at the level of a distributary canal in a loosely controlled surface irrigation system, especially where there is substantial reuse of drainage water by other farmers in the system. In this case, canal water is used jointly, often through syphoning or tapping directly from the canal, and it is reused by other farmers through drainage.

This shows that irrigation water could be either a private, a toll, a common pool or a collective good, depending on the nature of the local socio-technical setting. In fact, the nature of irrigation water as a social "good" may be different at different hydro-management levels of the same system. It may social "good" may be different at different hydro-management levels of the same system. It may approximate a toll good at one level (such as at the point where it is purchased and supplied to a group on a volumetric basis) and become a common pool or collective good at another level (such as along a distributary canal). Which type of a good irrigation water resembles tends to determine (within broad parameters) how social or elaborate the resource management institution will need to be, and to what extent the public sector is likely to be involved in management or regulatory functions. Although diverse resource management settings produce a considerable variety of institutional forms and rules, there appears to be a tendency for greater government involvement in resource management the closer a resource approximates a common pool or collective good, especially where access and use are managed on a large scale (Savas 1987).

Whether and how resource use is measurable also has an effect on the type of institutional arrangements which are feasible for paying for and controlling the service. Forms of payment and allocation will differ according to whether water use can be measured, and if so, if it is done at the individual or group levels on a volumetric, area or seasonal basis. In many irrigation environments the effort and "transaction cost" that would be required to effectively measure and charge volumetrically for individual water use may exceed the potential benefit to be obtained from it (Young 1985). This may occur where there is substantial flow of water between fields, where there is use of local supplemental water sources, where there is reuse of drainage water, where illegal syphoning or tapping of water occurs frequently, or where functional measurement structures do not exist or would be too costly. In such cases, size of landholding, cropping intensity, or other simpler bases for fee assessment levels can be used (Small and Carruthers forthcoming).

The problem of measurement is greatly simplified for pump irrigation, where fuel use becomes a surrogate measure for water use. In surface irrigation, the measurement problem can be dealt with at the group level. It is more practical for an agency to deliver and charge for a measurable volume of water to a distributary canal turnout than to individual fields. In the Philippines, water users' groups are assessed as a unit. They, in turn assess farmers individually for water use, often making adjustments on the basis of local knowledge about field-level water availability. As an incentive to collect fees, users' groups are given discounts or rebates for higher collection rates (Svendsen et al. 1990; Bautista 1987).

Measurability is likely to shape the nature of regulation and the extent of government involvement in setting fee levels, resolving conflicts, and limiting water use.

The characteristics of exclusion, consumption and measurability are determined by combinations of local, physical, technical and social factors. Drainage reuse patterns, irrigation infrastructure, control of water theft, or collective action of farmer groups are all potentially equal in importance in determining what type of good the irrigation resource may be in a given setting, and consequently what types of institutional arrangements will be feasible. This also implies that changes in the local socio-technical environment can potentially transform a resource from one type of good to another, which in turn is likely to lead to pressures for other basic institutional changes.

In a comparative analysis of irrigation institutions, Ostrom (1990b) implies that the more collective the good, the more "social capital" (i.e., organizing and organizational investment) is likely to be required to craft effective institutions. This does not argue that there is a smaller range of institutional possibilities for common pool or collective goods. Instead, we posit that the range of institutional possibilities probably increases for common pool and collective goods because of the greater "social capital" or organizational investment required in order to integrate social and individual purposes. Diverse environmental factors, gradual trial-and-error experiments and negotiations lead to the emergence of site-specific institutional forms, which continue to evolve over time.

Management Functions and Institutions

Much of the discussion on turnover and private-sector management creates an image of either all private or all public. Some of the opposition to privatization arises from a misunderstanding that it necessarily means that all management functions and ownership are to be transferred to the private-sector. More opposition arises when it is assumed that prior functions ensuring public accountability will be lost to private interests. However, Savas (1987) has documented numerous examples where privatization programs turn over regulatory functions to private sector organizations while the government retains essential review and sanctioning authority. Such transfers usually lead to an increase in the efficiency and effectiveness of regulation, rather than the opposite.

In reality the proportion of irrigated land in the world which either has no government or no farmer investment in the systems is very small. Much of the concern with farmer-managed irrigation gravitates to a concern about government intervention strategies (IIMI and WECS 1987). The vast majority of surface irrigation involves a mixture of government and private management. Some responsibilities, such as regulatory oversight can be retained by the government. Locally self-managed organizations may opt to have specific operations or maintenance tasks to be performed by third parties. The challenge is to be as institutionally discerning and selective as the socio-technical purposes and capabilities require.

Hence, an analysis of institutions for self-managed irrigation must adopt a framework which admits a mixture of roles for governmental and nongovernmental organizations, but which nevertheless allows us to identify an overall expansion of the role of nongovernment or self-managing organizations in irrigation management and a corresponding contraction in the role of the government. And it must enable us to depict the functional and organizational situation before and after turnover. This requires a somewhat elaborate framework. But the complexity, diversity, and partial nature of self-managing arrangements requires it. Table 1 below provides a matrix for analyzing which types of organizations perform which management functions, and at which levels of the system. The set of six basic management functions related to irrigation is listed below:

Producing the service. The actual implementation of operations, maintenance, and system improvement tasks.

Providing resources. The mobilization of resources to sponsor operations, maintenance and system improvement.

Commissioning the service. Identifying who will perform what services (i.e., O&M, system improvement) and under what terms, conditions, and standards of performance.

Regulating and auditing. The administrative granting and issuance of permits to water using entities in accordance with the above legal rights and responsibilities. Also, seeing that the legal rights and responsibilities are complied with, through inspection, performance assessment and application of sanctions.

Authorizing resource access and use. Legally defining basic rights and responsibilities for water access and use.

Owning facilities. The activities of purchasing, selling, paying taxes, inventorying, reporting to auditors, etc.

Functions one through five can be subdivided into the essential tasks of: 1) operations (i.e., the movement of water), 2) maintenance of structures, and 3) system improvement (i.e., rehabilitation and modernization). And these functions may be discharged by different organizations at different levels of the irrigation system. We can distinguish four "hydro-management" levels as follows: 1) water acquisition (such as at the weir or pump), 2) conveyance (such as through the main canal), 3) distribution (such as along distributary canals), and 4) application (such as between and within fields below a turnout).

Table 1. Organizations performing different management functions at different hydro-management levels of irrigation systems.

Functions		Hydro-management levels of irrigation systems			
		Acquisition	Conveyance	Distribution	Application
Producing the service	O	(Government)		(WUA)	
	M	(Government)		(Local contractor)	
	SI	(Government)		(Government)	
Providing resources	O				
	M				
	SI				
Commissioning the service	O				
	M				
	SI				
Regulating and Auditing	O				
	M				
	SI				
Authorizing Resource Access and Use	O				
	M				
	SI				
Owning System Facilities	O				
	M				
	SI				

O = Operations. M = Maintenance. SI = System Improvement.

Table 2 below lists a preliminary set of basic types of organizations which can be placed within the cells of Table 1, according to respective functions and hydro-management levels. These range from government legislative bodies to interpersonal networks. In many cases, the same organization may perform all three of the management tasks of operations, maintenance, and system improvement at the same level. In other cases, responsibility for different tasks may be given to separate entities. An example of this is shown, as an exemplary entry in Table 1, under the function of "producing the service." A water users' association conducts operations directly while it contracts out maintenance to another local group. System improvement is implemented by a government agency. At the level of water acquisition, which may be a weir, the government performs all three basic management tasks.

Table 2. Types of organizations potentially involved in irrigation management.

Type of organization	Example
1. *Government legislative body*	*Parliament, Provincial Council*
2. *Ministry*	*Water Resources, Finance, Planning*
3. *Government line agency*	*Irrigation Department*
4. *Semi-independent line agency*	*NIA (Philippines)*
5. *Government area development authority*	Command Area Development Authorities *(India) Sudan Gezira Board*
6. *Semi-independent area development agency*	*ORMVA (Morocco), Mahaweli Development Authority (Sri Lanka)*
7. *Agribusiness corporation*	*Agricultural Enterprises (Mozambique, Zimbabwe)*
8. *Non-local NGO*	*Grameen Bank (Bangladesh)*
9. *Private contractor*	*O&M Contractors (Hunan, China)*
10. *Irrigators' organization*	*Water Users' Associations*
11. *Interpersonal networks*	*Ad hoc or informal interactions between farmers*

Tables 1 and 2 provide a comparative framework for identifying what kind of organizations have the authority and/or responsibility to perform different management functions. A distinction is made between authority and responsibility for functions because of the often-observed situation where governments attempt to turn over responsibility for tasks but not the related decision-making authority. Besides its comparative utility, this kind of matrix can be useful in identifying the range of possible institutional options for different management functions. Turnover need not be all or none, but often will involve degrees of turnover or mixtures of types of institutions, even within the private sector.

Table 1 can also be used in another way -- to relate basic institutional rules and incentives to different functions. Rules and incentives provide the basic direction and "energy" for organizations to function according to their stated purposes. Identifying what rules and incentives exist, or do not exist, for different management functions will help us eventually to determine causes of success or failure of institutions to meet their performance objectives. A gate tender who receives no bonuses or no more intensive supervision during dry-season rotational irrigation has little incentive to control gate adjustments more intensively during the dry season than during the more relaxed wet season (unless of course "irregular" incentives exist).

Using the Philippines again as an example, NIA estimates that an irrigation service fee recovery rate of about 70 percent is generally needed in order for systems to be financially viable. The fact that the average recovery rate is about 55 percent, indicates that weaknesses exist in the current set of incentives or rules for farmers to pay the fees. The fact that water generally flows regardless of whether or not farmers follow the rule to pay the fee, the perception that the fee includes unnecessary overhead charges, and/or the perception that the O&M service is poor -- are indications of weaknesses in the system of rules and incentives. Turnover to complete local management would alter the rules and incentives (including perhaps lower fees and greater control over performance) and may create a more positive match between rules, incentives and performance objectives. However, existing rules and incentives related to NIA's own financial survival may militate against it giving widespread support for implementing full turnover.

So, in some cases, rules and incentives can be further introduced to bridge gaps between objectives and functional practices. When this gap cannot be bridged in this manner, however, pressures may need to come from higher levels in the government to bring about a realigning of organizations to take over the management functions. The challenge of how to gain enough bureaucratic support for turnover may be greater in some countries than the challenge of how to create effective local, self-managing institutions.

Institutional Performance

The performance of irrigation institutions can be assessed in terms of management outcomes and impacts. By *outcomes*, are accomplished or not we mean of implementation objectives and what levels of efficiency are achieved. *Impacts* are the indirect results or effects of the management activity on the human and physical environment.

We suggest the following five performance criteria, as essential elements of a comparative assessment of outcomes of irrigation turnover or self-management: reliability, manageability, financial viability, physical sustainability and institutional sustainability.

Reliability. How timely, adequate, and predictable are the implementation of operations, maintenance, and system improvement services? To what extent are implementation targets achieved?

Manageability. Are the management procedures practical and implementable, given physical and resource constraints?

Financial viability. Is the irrigation system financially self-sustaining for all necessary management functions? How cost-effective are investments in operations, maintenance, and system improvement -- both in terms of meeting management objectives and overall productivity?

Physical sustainability. Is the institution keeping the irrigation system's physical structures and agricultural land in favorable condition over the long term, so as to achieve the enduring social objectives of irrigation? More specifically, are maintenance and system improvement activities able to keep the system functional enough to continue to meet operational objectives?

Institutional sustainability. Is the institution able to continue to meet its members' needs and adapt to changing demands? Will future government regulation or socioeconomic pressures interfere with its ability to function and survive?

We suggest the following four criteria as elements in a comparative assessment of impacts of turnover and self-management:

Agricultural productivity. This can be measured in terms of cropping intensities, yields, or profitability for the system as a whole or per unit of land, water, or labor (depending on what the main limiting factor of production is).

Replicability. This refers to the ability of a given type of institution or management to be disseminated widely and be perpetuated as long as desired, without dependence on skills and materials which are not available locally or on external and temporary forms of assistance.

Environmental impact. What are the impacts of the irrigation institution and its management on the physical and social environment? This may include physical aspects such as waterlogging, salinity, erosion, soil and water quality, or social aspects such as health, population, or gender relations.

Equity. How fair is the allocation and distribution of water and its effects on spatial variations in cropping intensities, yields, and productivity of land? How are fairness and water rights defined locally?

These criteria are selected because of their widespread, comparative relevance. However, other performance criteria, such as employment generation or local conceptions of equity criteria, may be found to have important local significance. Any comparative assessment should also document what performance criteria take priority in different settings.

Hypotheses about the Transition to Self-Management in Irrigation

The most important research task for a comparative assessment of irrigation turnover and self-management is to specify what conditions bring about successful turnover processes and effective self-managed irrigation institutions.

A typology of turnover processes. We have defined management turnover broadly as the expansion in the scope of nongovernmental or self-managed institutions in irrigation management and the corresponding contraction of the role of the state. This definition includes a variety of steps which can be taken to shift management from governmental to nongovernmental institutions. The following are some steps which governments take in the process of irrigation management turnover. The steps are listed roughly in the ascending order from conservative to more complete measures.

Introducing irrigation service fees. The government begins charging fees to water users to pay for part or all of the cost of O&M, and sometimes part of the capital investment costs. However, the government continues to produce the O&M service. This is perhaps the most widespread initial step in management turnover -- turning over responsibility to help pay for the service.

Fostering competition in service delivery. The government takes steps to enable or encourage private-sector organizations to provide some irrigation O&M services, either for existing agency irrigation systems or for new development. Examples are in Bangladesh, Pakistan, and Nigeria where the governments are actively encouraging private-sector development of locally managed tubewell irrigation.

Contracting. The government specifies the scope of work, terms, and conditions and pays nongovernmental contractors or water users' associations to do the work. This is used at the level of distributary canal organizations in Sri Lanka and is considered as stage one of the turnover process in the Philippines. Depending on incentives applied and the extent of farmer involvement in decision making, it may or may not serve to engender self-reliant local management.

Vending. The government produces a service upon request and payment by a nongovernmental entity. When the user requests for and specifies the terms for the service and the governments charge a service fee vending differs; otherwise, the service will not be defined or delivered. An example is found in many African countries where the irrigation agency provides agricultural inputs to individuals or groups upon request and payment. Another example is in the case of the Mohini Water Distribution Cooperative Society in India, where a local cooperative orders and purchases water volumetrically.

Franchises. The government awards rights to nongovernmental organizations to supply the irrigation service for a specified period of time. However, unlike service contracts, with franchises, the clients or users pay for the service. An example of this in Hunan, China, where local irrigation management organizations hold auctions and grant franchises to local groups to manage O&M for a specified period of time.

Grants. The government provides a subsidy to a local organization, which could be whether the user or the service producer, to reduce the cost of using the service. Grants may be provided in the form of payments, materials or special loan privileges. An example in Indonesia is the Village Subsidy Program, wherein the government makes annual grants to villages and allows the village to decide in what development projects to invest the funds. Experience showed that a large proportion of such funds was used for village irrigation and that the funds stimulated significant amounts of local investment (Hafid and Hayami 1979).

Joint agency/users' investment. The investment by the government in irrigation O&M or system improvement is contingent upon some corresponding level or proportion of local investment. An example is when the agency provides materials and technical guidance for maintenance if the water users' association agrees to provide the necessary labor. Other arrangements are based on proportional equity investment, such as 50/50 sharing of costs.

Agency becomes financially autonomous. The agency, which was funded by central government revenues, is converted into a semiautonomous or fully autonomous agency which must become largely self-financing through payments for its own services. NIA in the Philippines and the recent "commercialization" of the River Basin Development Authorities in Nigeria are examples.

Joint agency/users' management. Joint agency/users' management includes the participation of farmers in an advisory or joint decision-making capacity in the planning of water allocations and delivery schedules, operations, maintenance and system improvement or rehabilitation.

Devolution of responsibility and/or control. Governments turn over management responsibility and authority for certain functions, at certain levels and under certain conditions. Generally, the government retains some role in the activity, such as regulation or authorization, or perhaps direct management -- but at a higher level. An example is when governments turn over O&M to water users' associations up to a certain level in the irrigation system or for systems up to a certain limit in size. The agency retains a management role at the main system or river course level and provides oversight and technical service roles for O&M at lower levels. This is the common approach to turnover being used in Indonesia, the Philippines, Sri Lanka, Madagascar, Mexico, and Colombia.

Load shedding of functions. When the government agency totally withdraws from an activity or sector, at all levels load shedding of functions occurs. An example is the withdrawal of the Government of Senegal from the function of irrigation O&M management. However, this would not be a total withdrawal from the irrigation sector if the State still retains a role in regulating water use.

Privatization of assets. Privatization of assets is the conversion of ownership of irrigation property from the government to nongovernment organizations or individuals. Such property may include irrigation infrastructure and/or water rights. The Privatization may be implemented through the sale of assets, the sale of stock, or the legal transfer of ownership. Examples are the sale of public tubewells in Bangladesh and Pakistan.

Whatever steps taken in a country to implement a turnover process reflect official images of intended outcomes and assumptions about how best to achieve them. But the potential diversity of institutional alternatives, mixes and sequencing is very great and policy analyses should not be limited to any single or limited model, such as training water users' associations, etc. Third parties, subcontracting arrangements, private-sector oversight, competing O&M companies, and so on are among other options to be considered.

Working hypotheses about turnover. An assessment of these perspectives will help in identifying location-specific performance criteria and working hypotheses about turnover processes. However, as a starting position, and based on currently available literature about irrigation management turnover and autonomy (Wolf 1991; Svendsen et al. 1991; Cowan 1990; Vermillion and Johnson, 1989), the following five criteria or working hypotheses are posed herein, to seek to specify necessary conditions for successful turnover:

1. Whether financial and political pressures are strong enough to threaten the agency's basic mandate, resources or the job security of several classes of staff.

2. Whether new roles have been identified for the agency which substantially replace management roles being turned over and whether the new roles are supported by clear policies, resources and incentives for reorientation.

3. Whether irrigation institutions taking over management are becoming primarily financially autonomous.

4. Whether most members of the farmers' organizations taking over management share the view that sustainable financial viability can be achieved.

5. Whether the new managing entity has clearly recognized legal rights and authority to manage O&M prior to turnover.

6. Whether the turnover process enhances local collective authority through group investment and decision making about operations, maintenance, and system improvement.

Working hypotheses about conditions for effective self-managed irrigation institutions. We now wish to propose a few working hypotheses to help explain or predict under what conditions self-managed irrigation institutions will perform effectively or not. Literature relevant to this concern falls into three categories:

1. *Institutional alternatives for privatizing public services* (Savas 1987; Cowan 1990; Roth, 1987; Small and Carruthers forthcoming).

2. *Theories of common property resource management and collective action* (N. Sengupta 1991; E. Ostrom 1990a; Ostrom 1990b; Shui forthcoming; Berkes 1989; Hardin 1982; Olson 1965).

3. *Irrigation management performance* (Chambers 1988; Small and Carruthers forthcoming; Small and Svendsen 1990; Uphoff 1986).

From this literature we can identify a list of propositions about necessary criteria for the development of effective irrigation institutions. Ostrom (1990b:38) has made a useful synthesis of the existing knowledge about what is needed for the emergence of viable irrigation institutions. Some of the hypotheses below are adapted from her synthesis.

1. Whether system boundaries and service access rights are clearly defined.

2. Whether there is a proportional relationship between management inputs and benefits among those investing in the irrigation institutions.

3. Whether benefits of investing in irrigation institutions exceed competing opportunity costs.

4. Whether the corporate body which specifies the rules is largely constituted by the irrigators who are affected by them (at operational and collective levels).

5. Whether there is a practical system of monitoring and regulating behavior which is accountable to the corporate body of rule makers.

6. Whether those who break the rules are likely to receive graduated sanctions as authorized by the rule-making body.

7. Whether irrigators and their representatives have ready access to conflict resolution arrangements.

8. Whether irrigators have the legal right to organize and make institutional changes commensurate with their perceived management needs.

9. Whether management functions are spatially and vertically integrated at multiple levels, according to functional requirements.

10. Whether performance results: are in accordance with the expectations of irrigators, whether they are visible to irrigators and whether they have no serious negative side effects.

11. Whether the system design is compatible with the institution's basic rules, rights and procedures and whether it is manipulable by the managing institution.

Perhaps such hypotheses can help integrate comparative efforts to understand why certain results occur in different turnover approaches and what conditions are necessary for successful outcomes.

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