Chapter 3

Sustainable water projects: The task of economic instruments and supporting institutions

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Abstract

In this chapter, a number of critical institutions are identified that improve the financial sustainability of irrigation and water projects over time. The framework for analysis is based on Williamson's four levels of institutions (Williamson, O.E. 2000. The new institutional economics: taking stock, looking ahead. Journal of Economic Literature, 38(September): 595–613). The four levels are used to highlight the problems that arise in designing institutions and implementing institutional change. Examples are provided of institutional reforms and changes that have helped different countries raise both cost recovery rates and rates of collection. A key objective in designing water instruments is to provide water users and managers assurance regarding the actions of others within the irrigation project. Without the appropriate institutional setting, it will be difficult to effectively use different economic instruments, such as water prices, taxes, quotas, or markets, to improve the financial sustainability of water projects.

Keywords: Cost recovery; Economic instruments; Financial sustainability; Institutional arrangements; Water pricing

1 Introduction

One of the keys to sustainable water systems, particularly irrigation, is the finances to support and maintain water delivery and its associated drainage or disposal system. Historically, the lack of adequate finances has resulted in inadequate system operation and maintenance (O&M) and caused many water systems to be built with inadequate delivery and control structures and, in many cases, no facilities for drainage and wastewater disposal. The end result has been projects that decline rapidly in their ability to provide adequate and timely water service. After a number of years, many irrigation projects face declining irrigated...
acreage as waterlogging and salinity problems force agricultural land out of production (Ward, 2002, pp. 107–108). Thus, once it has been determined that it is appropriate to build, and benefits are estimated to exceed costs of an irrigation or water project of a given size and design, we need to determine how to appropriately fund the project over time. The key questions we will try to address in this chapter are what share of project costs can reasonably be paid by different groups of water users and how this share can be effectively collected on a sustainable basis.

Setting up a system that will provide sustainable funds for water projects, including the necessary drainage and water disposal infrastructure, will involve establishing effective institutional arrangements to support efforts to collect water charges from users. Institutions can be thought of as the “rules of the game” while the “players or groups of players” are the organizations, firms, and individuals using, operating, and managing the systems (North, 1990). Institutions are important in structuring incentives as well as providing order and predictability, particularly regarding the actions of others. Livingston and Garrido (2004, p. 25) argue that institutions are important for effective water management. “Institutional arrangements are critical in creating incentives because they (1) define who has access to water resources, (2) establish the range of (legal) options open to legitimate water users, and (3) determine who can claim income from water use and who will bear the costs of water use.” Thus, effective institutional arrangements will need to be in place to have sustainable finances and to sustain water systems in general.

The remainder of the chapter will start with a brief description of the institutional framework used in the analysis. This is followed by a section dealing with fee collection and the determination of how much users should pay. Next, is a discussion of water pricing mechanisms, followed by examples of projects where new institutional arrangements have helped improve cost recovery from users, resulting in improved sustainability of irrigation systems. This leads to a section that suggests how the institutions can be combined to provide a stable source of funding for O&M and a more sustainable irrigation system. The final section provides a brief conclusion.

2 Institutional setting

A good way to think about institutions and how they influence outcomes is to use Williamson’s (2000) four levels of nested institutions (Figure 1). They include, first, the informal institutions such as social norms, customs, and religion, which change very slowly. These norms and customs constrain or enable what can be done at the other three levels. For example, strongly held customs or values regarding open access to water and free public services may have a large impact on who gets water and how much, if any, they pay. It may prevent or make it difficult to establish private property rights for water or its use and to introduce water markets. Also, values or beliefs concerning the environmental services provided by water will strongly influence an area’s efforts to reduce water pollution.
The second level of institutions is the formal rules of the game or the policies that guide water use and allocation. To make changes at this level will usually take several years to over a decade. For example, if you want to establish a water market, one of the needed changes is to establish and allocate water rights or use rights to individual water users. As noted above, such changes in property rights, laws, or policy can be difficult to make. Existing systems are usually changed only after a number of years of hard negotiation and bargaining or after a significant change in a country’s economic policy that favors markets as happened in Chile in the 1980s (Hearne & Easter, 1995). The content of water policies and water laws is addressed at this level, including the question of whether water can be sold separately from land and, if it can, what end uses it can be sold for outside of agriculture. In terms of financing water systems, it is this level where water policies are crafted that specify who pays for water projects and their operation, as well as any rules regarding the discharge of drainage water. These latter rules can be critical for the sustainability of irrigation systems facing potential waterlogging and/or salinity problems.

Level three focuses on governance structures for transactions. This is the level where decisions are made concerning the mechanism for allocating water, for example, hierarchy versus markets or contracts. In other words, do water managers, every year, decide who gets water or is this determined ahead of time by water rights or contracts? There will also be concerns about mechanisms for enforcing water allocations and resolving conflicts that are likely to arise over time. The complexity of the governance structures will increase as water scarcity and its value rise and conflicts accelerate. Yet the structures will be constrained to a significant degree by past institutions or what economists call path-dependency.

In Valencia, Spain where water is scarce the water court meets every Thursday. 

on the church steps to resolve any water disputes. The past experiences Valencia has had in providing irrigation under scarce water conditions clearly influenced its choice of governance structure. A good experience in providing such collective good makes governance easier. In contrast, a bad experience with cooperatives or other user-run organizations may make user-based governance structures very difficult to establish. Birner and Wittner (2004) argue that the most efficient forms of governance and their structure and complexity will depend on water scarcity and other characteristics of the resource, including the water infrastructure put in place and the social and political characteristics of a country.

The fourth or final level of institutions falls in the domain of neoclassical economics where governance is ignored and the emphasis is on the firm as a production unit. The first three levels of institutions are generally assumed to be fixed and treated as exogenous constraints. At this stage, questions are raised regarding the firm’s or water user’s ability to pay for water and how water charges or fees may change water use or the adoption of new water-saving technology. Level four institutions are very important in determining the actual level of water charges paid by different types of water users and the services provided to them by the water system. (See Easter & McCann, 2009 for a more detailed discussion of water institutions.)

3 Financial failures in public irrigation

Traditionally, both developed and developing countries have found it difficult to establish a sustainable source of funding for operating and maintaining their irrigation systems and, more generally, their water projects. In his 1995 study, Jones (1995) illustrates how cost recovery and charges for irrigation water have been a problem for decades. In many countries, less than 20% of the cost of irrigation projects has been recovered from water users (Easter & Liu, 2007). This is the result of poorly designed collection rates and practices combined with relatively low water fee levels. The end result has been a large public subsidy for water users, particularly irrigators.

There are many reasons for this poor record of cost recovery in public irrigation projects. Although the reasons vary somewhat among countries and individual projects, Easter and Liu (2007) list some of the most important ones. They are listed below in no particular order of importance and not all are likely to be a problem in each financially strapped water project. “(1) no link between fees collected and funds allocated to a given water project, (2) lack of water user participation in planning and management of projects, (3) poor communication and lack of transparency between water users and management, (4) poor delivery of water services (timing, duration, and quantity are inadequate), (5) no penalties for managers and staff who provide poor service, (6) no penalties for water users who do not pay water charges, (7) low priority given to fee collection, efficient water use, or system O&M, (8) inappropriate infrastructure design and technology to effectively manage water system, and (9) corruption among officials and

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those collecting water charges.” Easter and Liu (2007) go on to make it clear that the basic underlying causes for the poor cost recovery stem from “the collective good nature of water projects, combined with open access to water resources, the principal-agent problems, and rent-seeking activities of water officials. It also can be thought of as an assurance problem: assurance for managers concerning what water users will do and assurance for water users concerning what water managers and their staff will actually do as opposed to what they say they will or can do given the existing project design and technology (Easter, 1993).”

Another part of the problem stems from the fact that many times no one thinks about sustainable finances early enough in a project’s development. During the planning stage, and before the project is built, decisions need to be made that provide an effective means for financing O&M. As part of this financial planning, it should be determined what share of the costs should be paid by water users and how the cost should be allocated among the various users, for example, irrigators, hydropower users, domestic water users, commercial and industrial water users, and those protected from floods. The allocation of costs is an important issue because many water projects are multipurpose, particularly those in Asia where 90% of the dams for irrigation are multipurpose. There is also a good argument to be made that some of the water project costs should be allocated to consumers who benefit from the lower food costs due to irrigation, particularly in developing countries. In fact, if commodity markets are localized, the increased crop production, due to irrigation, may mean farmers receive only modest increases in net returns because of the drop in commodity prices caused by increased production in the irrigated area. Yet many times decisions have been made to allocate farmers most of the project costs to be recovered, since they receive much of the water. A better allocation of project costs might be based on who receives direct project benefits or who gets direct and indirect project benefits combined. Easter and Liu (2007) show that it makes a significant difference. For example, if the costs to be recovered are allocated based on water delivered in the Srilam Sagar Project in India, farmers must pay 95% of the costs (Table 1). If the costs are allocated based on direct benefits, farmers only pay 88% of the costs (Easter, 2003). The percentage of cost allocated to farmers would drop even more if the allocation was based on direct and indirect benefits. The cost allocated to farmers would probably drop to something less than 75%. In contrast, two other multipurpose projects in Andhra Pradesh, India would still have over 90% of their costs allocated to irrigation even when costs are allocated based on direct benefits (Table 1).

Once a reasonable allocation of costs has been decided on, the next question is, what economic instruments can be used to effectively collect the water fees necessary to cover the allocated costs? An equally important question that needs to be addressed at the planning stage is, what are the critical institutional arrangements that need to be in place, which will help make the fee collection effective? This is important because the design of the project infrastructure may well place limits on the institutional options that are feasible as will existing institutional arrangements. In many cases, work has to start on implementing new institutional arrangements before project construction starts. This is particularly
true if water rights or new governance arrangements are to be introduced to help allocate water and collect fees.

4 Economic instruments

The approach one selects for charging water users will depend a lot on what institutions already exist and the size of the project in terms of both hectares irrigated and the numbers of farmers actually served. For large projects in developing countries serving a large number of farmers, but with limited farmer participation, area-irrigated-based fees have generally been used. The problem is that there is no relationship between what farmers pay and the amount of water they receive. This also means that water charges fail to create incentives for farmers to use less water. A better alternative may be to vary the charge by type of crop grown with higher per hectare water charges for crops such as rice and sugarcane that use more water. In some cases, water charges might be varied based on the irrigation technology used. If farmers adopt improved irrigation technology such as sprinkler irrigation, which distributes water more uniformly across the field than does flood irrigation and uses less water per hectare, they would be charged a lower water fee per hectare.

Table 1: Alternative cost allocation for three water projects in Andhra Pradesh, India.

<table>
<thead>
<tr>
<th>Cost allocation for three consumptive uses based on water delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Three water projects</strong></td>
</tr>
<tr>
<td>Nagarjunasagar</td>
</tr>
<tr>
<td>Tungabhadra</td>
</tr>
<tr>
<td>Sriram Sagar</td>
</tr>
</tbody>
</table>

Cost allocation among three projects based on direct benefits

<table>
<thead>
<tr>
<th>Three water projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose or use</strong></td>
</tr>
<tr>
<td>Irrigation</td>
</tr>
<tr>
<td>Hydropower</td>
</tr>
<tr>
<td>Domestic</td>
</tr>
<tr>
<td>Industry</td>
</tr>
<tr>
<td>Fisheries</td>
</tr>
</tbody>
</table>

For smaller projects, particularly in more developed countries that face high water demands relative to supply, we need to be moving toward *volumetric-based* water charges. With recent improvements in technology, arguments that water use or delivery is hard to measure are no longer very convincing. The big issue may be the infrastructure cost, but as Easter and Liu (2007) discussed, even this may not be a true constraint today in areas facing severe water scarcity, given the new technology available (see Wang & Lu, 1999). Volumetric-based water charges have two clear advantages. First, farmers are charged based only on the quantity they receive. Second, it gives farmers an incentive to not overirrigate and to conserve water, since if they use less, they pay less. This, of course, will require not only water measurement and appropriate infrastructure but also effective staff to manage water deliveries.

*Block water* charges or prices can also be used with volumetric-based fees as a means to provide a minimum amount of water at low prices while charging much higher prices for levels of use exceeding a set volume of water use per hectare (see Figure 2). This type of charge has several benefits. First, it gives water managers at least three instruments to change cost recovery: the levels of the first and second block charges and the quantity at which the second block charge or price starts (e.g., 3,000 ℓ ha⁻¹ versus 4,000 ℓ ha⁻¹). Second, the last block charge can be set at the marginal cost (MC) of new water supplies. The charge based on MC will encourage farmers to conserve water and use it efficiently. Finally, the higher charges will have less of an adverse impact on farmers’ income since they are only charged higher rates for the units of water used beyond the first block. Of course, in many surface water irrigation systems impacts on farmers’ income may not be a critical issue since water fees usually do not represent more than 2–7% of farmers’ net income (Cornish & Perry, 2003).

![Figure 2: Pricing schedule for irrigation water.](image-url)
A two-part charge can also be used, combining volumetric charges with a fixed charge. Such a system of charges may be necessary if water availability varies a lot from season to season and/or from year to year. The fixed charge allows water managers to obtain a basic amount of funding even in years of low water supplies when many farmers do not receive much water. If water charges were only based on volumetric charges, then in the years of low supplies the volumetric charges might have to be very high to cover project costs. The two-part charge for water also recognizes that there is a large fixed component in O&M that does not depend on the amount of water delivered. These costs need to be paid even if little or no water is delivered.

A final option is to introduce a water market. This could be in addition to water charges for O&M. If farmers are allowed to trade water, this will improve allocation efficiency by increasing water’s value to farmers and shifting water to its highest valued uses. In turn, this would increase the user’s ability to pay since water would be used to produce higher valued crops and/or provide income directly through water sales. As discussed above, the introduction of markets would require a number of key institutions, including a water law that allows the sale of water independent of land and specifies how disputes over water rights will be resolved. In addition, a court or council should be established to resolve disputes over water rights and third-party effects.

5 Institutions to improve cost recovery

One good measure of the success of a water system in sustaining its financial base is to look at the collection rate from its water users. In many systems, only 10–60% of the users pay their fees (Easter & Liu, 2005). Table 2 lists eight irrigation projects that have been quite successful in obtaining high rates of fee collection, with half reaching 100%. In addition, with their improved system of water charges, four systems reported significant water savings (Table 3). Using the projects listed in Tables 2 and 3 as examples of successes in sustaining finances, what institutions were important in their success? There are several key institutional arrangements that have helped these systems move closer to financial sustainability. Institutions do this by helping to correctly align incentives. First, a country needs to be able to legally establish water management entities that are, primarily, financially autonomous from government. This helps create an important set of incentives for water management that will foster improved collection rates. Second, a law is needed that allows users to organize legally into water user associations (WUAs) and participate in management decisions regarding the water allocation. If possible, WUAs should have some authority to allocate water among users and authority to tax them. Through active participation, water users will establish a closer working relationship with management that will help increase system transparency and accountability, which, in turn, will improve users’ willingness to pay their water fees. To be effective, WUAs have to be given some authority and important management functions so that they
Table 2: Factors influencing fee collection rate.

<table>
<thead>
<tr>
<th>Cases</th>
<th>Financial autonomy</th>
<th>Incentives to collect</th>
<th>Incentives to pay</th>
<th>Improved irrigation service</th>
<th>User participation</th>
<th>System transparency</th>
<th>Collection rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awati, China</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>N.A.</td>
<td>Yes</td>
<td>N.A.</td>
<td>98</td>
</tr>
<tr>
<td>Bayi Irrigation District, China</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>100</td>
</tr>
<tr>
<td>Nanyao Irrigation District, China</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>N.A.</td>
<td>Yes</td>
<td>N.A.</td>
<td>95</td>
</tr>
<tr>
<td>Shangdong, China</td>
<td>N.A.</td>
<td>N.A.</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>Yes</td>
<td>100</td>
</tr>
<tr>
<td>Gujarat, India</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>100</td>
</tr>
<tr>
<td>Haryana, India</td>
<td>Partly</td>
<td>N.A.</td>
<td>N.A.</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>85–85</td>
</tr>
<tr>
<td>Mexico</td>
<td>Yes</td>
<td>N.A.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>90</td>
</tr>
<tr>
<td>Alto Rio Lerma, Mexico</td>
<td>Yes</td>
<td>Yes</td>
<td>N.A.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>100</td>
</tr>
</tbody>
</table>

N.A. Not available; 1μm = 0.067μha.

Table 3: Factors influencing water use efficiency.

<table>
<thead>
<tr>
<th>Cases</th>
<th>Increase per unit price</th>
<th>Switch to volumetric metering</th>
<th>Pricing structure</th>
<th>Watersaving technology availability</th>
<th>Assurance of water delivery</th>
<th>Education</th>
<th>Annual saving</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awati, China</td>
<td>Yes</td>
<td>Yes</td>
<td>Increasing block</td>
<td>N.A.</td>
<td>N.A.</td>
<td>Yes</td>
<td>N.A.</td>
</tr>
<tr>
<td>Shangdon, China</td>
<td>N.A.</td>
<td>Yes</td>
<td>Volumetric</td>
<td>N.A.</td>
<td>Yes</td>
<td>N.A.</td>
<td>5 Bℓm³</td>
</tr>
<tr>
<td>Yangtze basin, China</td>
<td>N.A.</td>
<td>Yes</td>
<td>Volumetric</td>
<td>N.A.</td>
<td>Yes</td>
<td>N.A.</td>
<td>1.18 Mℓm³ in WUA</td>
</tr>
<tr>
<td>Katepuma, India</td>
<td>N.A.</td>
<td>Yes</td>
<td>Volumetric</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>7.71 Mℓm³</td>
</tr>
</tbody>
</table>

can, and will be, active participants. WUAs need to feel a “sense of ownership” in the water projects (Ward, 2002, p. 102). Too many times, WUAs have been constituted and given only limited responsibilities, such as contributing “free” labor, but no authority or “ownership.” This is why a number of WUAs have not improved the sustainability of their irrigation systems (Zekri & Easter, 2007).

However, if WUAs are given adequate authority over system management, labor contributions by members can be used as a partial substitute for higher water charges and help reduce financial constraints. This has been done with limited success in irrigation systems serving small-scale farmers with limited cash income. Paying a share of their water fees with labor can be particularly effective if system maintenance can be done during periods when farm families are likely to have surplus labor. If done right, WUAs can effectively reduce their financial resource requirements through members actively participating in system O&M.

Why is it that establishing financial autonomy and active user participation improves the sustainability of irrigation projects in terms of both their operation and finances? The financial autonomy changes several important incentives. First, the fees collected from users go to the project and do not go back to the state or federal treasury where they would be commingled with other tax returns. In other words, if you do not pay your water fees, it will have an impact on “your” project’s ability to deliver water. That is not the case in many countries such as India where the revenue arm of the government collects or tries to collect the water charges, which then go to the federal or state treasury. In such cases, irrigators do not see any relationship between what they pay and the service they receive from their irrigation system. Over time, without enough funding for resources to operate and maintain a project, it will deteriorate rapidly and the sustainability of the irrigation project will be at risk.

The Yangtze Basin Water Resource (Yangtze) Project in China is a good example of an effective water management entity that is financially autonomous. It also requires direct involvement of WUAs in water management decisions. This has helped increase crop yields and saved significant amounts of water (Table 3). The financial autonomy created a second important incentive: to save water. The Yangtze basin authority invested in upgrading its water delivery infrastructure so that it could reduce water losses and save water. This gave the basin authority more water to sell, which increased their cost recovery (Lin, 2003).

Financial autonomy means that subsidies from government are not available and they must rely on fees collected from users to cover O&M costs. This is another important incentive. Now the water management entity will want to create conditions that result in good collection rates from water users. As a result, management will employ several different strategies. One is to use strictly enforced penalties for those who default on payment. For example, in the Bayi Irrigation District, irrigation water was denied to those who defaulted (Johnson et al., 1996). A second strategy is for the management entity to give awards or penalties to encourage staff to achieve higher rates of collections. In Awati, China, they made staff salaries completely dependent on water charges and collection rates reached 98% (Awati County Government, 2002). The Bayi Irrigation District achieved 100% collection
rates by combining user penalties with staff rewards for turning in collected fees by a deadline and fines for any late payments (Johnson et al., 1996).

In terms of user participation, it is beneficial to get them involved early in the process of project design and building. This is particularly true for project rehabilitation where farmers are expected to repay the costs or contribute labor. This makes the decision-making process more transparent and increases users’ willingness to pay for improvements. The Laur Project in the Philippines provides one example where the WUAs were able to review the rehabilitation proposal before it was implemented. Coward (1980) found that this improved the project design and the users’ willingness to pay.

Finally, a water management entity that is financially autonomous has an incentive to provide users a good service. This will not only give users more reason to pay their fees but also increase their ability to pay. Better irrigation service should result in increased yields as it did in the Yangtze and Katepurna Projects and even make it possible to grow higher valued crops. Both should increase farmers’ incomes and ability to pay for the water.

Another more dramatic way to increase user participation and create management incentives has been irrigation management transfer (IMT) to the users. This strategy has had mixed results partly because of what management was actually transferred and the condition of the infrastructure at the time of the transfer. Several of the transfers have gone well (Kloezen et al., 1997) while others have not. As Zekri and Easter (2007, p. 573) found, IMT tended to be “successful where farmers had their water rights established, farms were medium and large scale with good access to markets and the government had a strong willingness to empower users.” In contrast, programs that emphasized only farmer participation with no decision-making authority over water allocation were not very successful. In other words, farmers need to perceive some clear benefits from participation and taking over the extra work and responsibility. Again the incentives need to be aligned by having the benefits to farmers exceed their costs.

6 Supporting institutions

Too many times the focus is only on the technical or engineering side of irrigation projects. Of course, the engineering aspects of a project are important and, in a technical sense, determine the type of irrigation that is possible. What have been left out are the institutional arrangements that provide the restrictions and incentives to encourage appropriate human actions. These institutions will determine who actually has access to the irrigation, who can claim income from the water, and who will bear the cost of water use. As Livingston and Garrido (2004) point out, the allocation and allotment of water will depend on the institutional arrangements that establish the rules for water use and the payment for this use.

Some of the institutions that are critical for sustainable financing of irrigation project have been discussed above. These include the legal institutions that allow financial autonomous water management entities to be established and effective
WUAs to be created. It is also becoming clearer that water users need some types of water rights that can give them assurance regarding when and how much water they will receive during the crop season. These might be outright water rights that can be traded either permanently or temporarily, or water use rights that have a set life span, for example, 30–99 years. Another option that establishes the right incentives is a water contract, between farmers and the water management entity, that is enforceable and clearly specifies the amount and timing of water to be delivered to farmers. This was one of the keys to the success of the improved irrigation project in Katepurna, India where they have been saving 7.7 million m³ of water annually and expanded the area irrigated by 80% (Table 3). Overirrigation in the wet season was greatly reduced since the farmers no longer had to store irrigation water in their soil during the wet season so that it would be available to grow crops in the dry season. They now have a contract assuring them water for the dry season (Belsare, 2001).

As part of any institutional arrangement that establishes farmers’ rights to water, it is important to have a clear mechanism for allocating the rights. For existing systems, this is not as difficult a question as it is for new systems. In Chile when they established water rights in 1981, the consumptive use rights were allocated based on past water use. This turned out to be fairly equitable since most irrigated land holdings were relatively small, 50 ha or less, and widely distributed among farmers in the irrigated areas (Hearne & Easter, 1995). It is a more difficult question for new irrigation projects. If the area to be irrigated is already farmed, then past land ownership usually has to play a significant role in the allocation of water rights. Yet some, or even all, of the water rights could be auctioned off, particularly in developed countries. Another option is to limit the water any one person can receive or the area they can irrigate. For example, the US Bureau of Reclamation, which has, in the past, funded irrigation projects in the US West, has tried to limit the acres one person can irrigate from a reclamation project to 160 acres or 65 ha. This restriction was never very effective particularly in California even after the 160 acres acreage limit was increased sixfold in the 1980s (Wahl, 1989, Chapter 4).

You also need an effective local system for enforcing water use rules and water rights. In more developed countries, this might be the court system, a water agency, a WUA, or some combination of the three. For example, in Chile, WUAs play a major role in the operations of local systems. In less developed countries, such as China, the village leadership is likely to play a much larger management role. In some cases, the village leadership makes it difficult to establish other methods of managing water by essentially running any WUA. This is a case where existing organizational and institutional arrangements limit what you can do in managing the irrigation project and how you can do it.

Another important set of institutional arrangements that need to be in place to improve fee collection is mechanisms to make the process of setting water charges more transparent. If the charges are based on the cost of O&M, as they are in many cases, then users need to know how the costs are calculated and what costs are to be included. This knowledge can help reduce the fear among some water users that the fees will just be used to enrich the water managers and their
families. You do not want water users thinking that an increase in water charges will be used to buy new jewelry for the water manager’s wife.

Finally, institutional arrangements are needed that foster the establishment of village councils or boards that can review the record of farmers who are not paying their water fees. This review can serve two important purposes. First, the council can determine if there are circumstances that make it difficult for some farmers to pay their fees such as crop failure. In such cases, the council can then decide to forgive some or all of the farmer’s delinquent fees. Second, they can use the review as a time to make public in the villages who is not paying their water fees. Finally, the council could also be responsible for addressing any farmer’s complaints raised about management of the WUA.

7 Conclusion

This chapter emphasizes the importance of institutional arrangements in successful irrigation and focuses on those institutions that are critical to a water project’s financial sustainability. Williamson’s (2000) four levels of institutions are used to show how institutional arrangements at these different levels can guide water use and facilitate the process of determining who should pay for the water. A well-constructed irrigation system only assures that water can be delivered, not that water will be delivered and used effectively or that it will be financially sustainable.

Based on past projects that have been successful in maintaining high rates of fee collection from their users, several institutional arrangements appear to be critical. One is for the management or operating entity to be financially autonomous from government. This creates a set of incentives for management that focus on good service, accountability, and the importance of fee collection. If the farmers are going to pay for the irrigation, they want some assurance that the service will be timely and dependable. One set of institutional arrangements that increase these assurances for farmers are water rights or water use rights. There is also a possibility that a similar assurance can be achieved through establishing contracts between management and water users regarding water delivery and payment schedules. The trick is to make these contracts transparent and binding on all parties.

Another set of institutional arrangements that will be important in maintaining high levels of fee collection are those that improve communication between management and water users. Here, WUAs that are given authority along with responsibility for management can play a key role. They can also be important in making the process of determining and setting water charges more transparent and in helping establish mechanisms to deal with farmers who default.

Finally, financial sustainability of a water system is critical for the overall sustainability of the system. Adequate finances will allow the system to be built in a timely manner with adequate control structures and drainage. Financial sustainability will provide the funding necessary for effective system management.
and maintenance over time. Third, it will enable management to employ staff that enforces the rules for water use and allocation. This will give water users assurance that the rules will be followed by the other users. Finally, a strong financial position will allow a water management entity to adequately compensate its staff so that the incentives to seek bribes are significantly reduced.

References


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