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# **DOES SOCIAL CAPITAL MATTER IN WATER AND SANITATION DELIVERY?**

## **A REVIEW OF LITERATURE**

*By Satu Kähkönen*

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## FOREWORD

There is growing empirical evidence that social capital contributes significantly to sustainable development. Sustainability is to leave future generations as many, or more, opportunities as we ourselves have had. Growing opportunity requires an expanding stock of capital. The traditional composition of natural capital, physical or produced capital, and human capital needs to be broadened to include social capital. Social capital refers to the internal social and cultural coherence of society, the norms and values that govern interactions among people and the institutions in which they are embedded. Social capital is the glue that holds societies together and without which there can be no economic growth or human well-being. Without social capital, society at large will collapse, and today's world presents some very sad examples of this.

The challenge of development agencies such as the World Bank is to operationalize the concept of social capital and to demonstrate how and how much it affects development outcomes. Ways need to be found to create an environment supportive of the emergence of social capital as well as to invest in it directly. These are the objectives of the Social Capital Initiative (SCI). With the help of a generous grant of the Government of Denmark, the Initiative has funded a set of twelve projects which will help define and measure social capital in better ways, and lead to improved monitoring of the stock, evolution and impact of social capital. The SCI seeks to provide empirical evidence from more than a dozen countries, as a basis to design better development interventions which can both safeguard existing social capital and promote the creation of new social capital.

This working paper series reports on the progress of the SCI. It hopes to contribute to the international debate on the role of social capital as an element of sustainable development.

Ismail Serageldin  
Vice President  
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# **DOES SOCIAL CAPITAL MATTER IN WATER AND SANITATION DELIVERY?**

## **A REVIEW OF LITERATURE**

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# DOES SOCIAL CAPITAL MATTER IN WATER AND SANITATION DELIVERY?

## A REVIEW OF LITERATURE

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*“...It must be stressed that irrigation is as much an expression of human organization and its adaptation to the physical environment as it is a technical achievement.”*

*Cantor (1967, p.62)*

*“...in large formalized institutions the social structure and the values of the society will show through, like a stain that cannot be painted out.”*

*Hunter (1976, p.202)*



## INTRODUCTION

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Failure of the state and private sector to provide adequate levels of water and sanitation services in many developing countries has in the past two decades led to the adoption of a community-based approach to water and sanitation delivery. This approach calls for cooperation between the government and community in the delivery of water and sanitation. By emphasizing demand-led design of services and community management of water and sanitation systems, it represents a dramatic shift from the traditional top-down, state-centered approach to water and sanitation management.<sup>1</sup> The community-based approach is argued to have three benefits: it provides a means to better tailor the water and sanitation systems to communities' needs and preferences by involving users in the system design; it enables the use of local resources (such as labor and materials) by involving users in construction and system management, thereby alleviating fiscal pressures on government; and it increases transparency and accountability in resource use by increasing the flow of information and interaction between system users and the government (Korten 1986, Isham and Kähkönen 1998a).

Community management of water and sanitation systems requires a group effort. Community members are expected to act collectively and design, construct, operate, and maintain the systems together. For this purpose, they are expected to build up a network or an association of users which coordinates and regulates the actions of different community members for system management. Community members are thus made to work together and depend on one another for the provision of water and sanitation.

How effectively the community acts as a group and provides the services has been argued to depend, among other things, on certain aspects of the social structure of the community: in particular, the social and economic homogeneity of users, and the existence of other social networks, associations, and trust between households. The cooperation, networks, and associations established among users and other stakeholders for water and sanitation delivery, and the above mentioned elements of the social structure that affect the relations among people are referred to as social capital in this paper.<sup>2</sup>

The objective of this paper is to explore the role of social capital in community-based rural water and urban sanitation delivery. This is done by reviewing the existing empirical literature on the impact of social capital on irrigation management, rural drinking water delivery, and urban sanitation. The paper reviews the performance of efforts that rely on the cooperation of users to deliver water and sanitation and the factors that influence that cooperation.

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<sup>1</sup> Since water and sanitation systems have certain technological and economic characteristics that lead to their underprovision in markets, they have traditionally been viewed as a government responsibility. For a discussion on the evolution of approaches to water and sanitation delivery over time, see Black (1998).

<sup>2</sup> There are several definitions and interpretations of social capital in the literature. See for example, Putnam (1993), Coleman (1988), and Grootaert (1998a).

Irrigation and drinking water delivery are traditionally, and thus also in this paper, dealt with separately because of the different nature of these goods and their different economic and social contexts. Both irrigation and access to safe drinking water have an impact on welfare, but through different routes: irrigation is a critical input in agricultural production affecting welfare through increased yields, while access to safe drinking water affects welfare primarily by reducing water-borne diseases and infections. At the same time, the similarities between irrigation and rural drinking water delivery are striking: this is manifested by the application of the community-based approach to the delivery of both services.

The review of existing literature indicates that the community-based approach that empowers users to collectively design and manage water and sanitation systems has a lot of promise: the systems built following that approach generally perform better than systems built and managed by government alone. However, cooperation and collective action among users is not always forthcoming. Several factors have been shown to influence the success of communal cooperation. One of these factors is social capital in the community — for instance, in the form of other community groups, networks, and associations, and mutual trust among users. Social and economic homogeneity of users also has been shown to have a positive impact on user cooperation. In these instances, people tend to know one another, be accustomed to working together, and share social norms which makes collective action easier. Social capital alone, however, does not ensure that the water system performs well. A host of other factors, such as actions of the government, appropriateness of technology used, technical skills of users, access to spare parts, and legal recognition of user groups, have been shown to have a critical bearing on the performance of collective effort.

After this introduction, the paper comprises of three self-contained sections that can be read independently. Section 2 reviews the empirical evidence on the influence of social capital on irrigation management. Section 3 describes the impact of social capital on rural drinking water delivery, and finally Section 4 covers the influence of social capital on urban sanitation. A few concluding remarks are made in Section 5.

## SOCIAL CAPITAL AND IRRIGATION MANAGEMENT

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The performance of many large-scale, government-managed irrigation systems has fallen short of expectations: the provision of irrigation water has been inadequate and its allocation unsatisfactory. Faulty design and construction, ineffective operation, and insufficient maintenance have led to poor performance of systems (Carruthers 1988, Chambers 1988, Ascher and Healy 1990, Ostrom, Schroeder and Wynne 1993, Subramanian, Jagannathan, and Meinzen-Dick 1998).

The nature of irrigation services complicates their management, often leading to conflicts in water allocation and inadequate system operation and maintenance. First, irrigation services are rival: the use of water by one farmer reduces the amount available to others, since the flow of water available at any one time in an irrigation system is limited. This implies that it is essential to have a fair and transparent system to allocate water among irrigators to avoid conflicts. Second, irrigation services are non-excludable: once the irrigation system has been constructed, partly due to its large size, it is costly to exclude farmers from using it and from drawing more water than the allotted amount.<sup>3</sup> Thus, even if there were an allocation system in place, illegal water drawing could distort it. Indeed, to increase their access to water, especially in large-scale government projects, farmers commonly construct illegal outlets, break padlocks, draw off water at night, and bribe officials to issue more water (Chambers 1980). The combination of these two characteristics — rivalry and non-excludability — leads to Hardin's (1968) "tragedy of commons" in irrigation: inefficient use of irrigation water and lack of maintenance of the irrigation system as irrigators compete for water and have no incentives to contribute to maintenance, since they cannot easily be excluded from the use of the system even if not contributing.

As a response to poor performance of large-scale, government-managed irrigation systems, donors and national governments have begun to advocate community management of irrigation systems at the watercourse level. While community management of small-scale irrigation systems has been prevalent for decades, involving users in the management of large-scale systems has been rare. This change in approach has meant shifting the emphasis in irrigation projects from the engineering designs to the organization of farmers to make the most effective use of irrigation systems (Ostrom 1992).

Involving farmers in system management has been viewed as a way to ensure their cooperation and improve the provision and allocation of irrigation water, and the maintenance of the system. Users of the system have been considered to be in a better position than government officials to craft and enforce a fair water allocation system and create mechanisms to curb illegal

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<sup>3</sup> Irrigation services are common pool goods: rival and non-excludable (Ostrom 1994). Based on the presence or absence of rivalry and excludability, goods and services can be classified into four categories: private, public, toll, and common pool goods. See Ostrom, Gardner, and Walker (1994) and Picciotto (1997) for a more detailed discussion.

use, given the existing social networks and connections among them. The Asian Development Bank (1973, p.50), for example, has written:

The success of an irrigation project depends largely on the active participation and cooperation of individual farmers. Therefore, a group such as a farmers' association should be organized, preferably at the farmers' initiative or if necessary, with initial government assistance, to help in attaining the objectives of the irrigation project. Irrigation technicians alone cannot satisfactorily operate and maintain the system.

Empirical evidence indicates that community management indeed improves the performance of irrigation systems, and that community-managed systems tend to work better than government-managed schemes. For example, Lam (1998) reports that in Nepal, an average community-managed irrigation system is better maintained, delivers water more effectively, and ensures higher agricultural productivity than an average government-managed system. According to Cernea (1987), the establishment of farmer organizations on the San Lorenzo irrigation project in Peru has helped improve the maintenance of the system and increase agricultural productivity. Also, in the Mexico Third Irrigation Project, farmers that are members of local irrigation groups have experienced a three-fold increase in average farm income (Cernea 1987). Further, Uphoff (1998) reports that the introduction of farmer organizations for decision-making, resource mobilization, management, communication, and conflict resolution turned the Gal Oya irrigation system, known to be the most deteriorated and disorganized irrigation system in Sri Lanka, into one of the most efficient and cooperatively managed systems. Community management of irrigation increased the production of rice per unit of irrigation water by about 300 percent. According to Uphoff, at least two-thirds of this increase was due to the creation of new roles and social relationships, and to the activation of certain norms and attitudes among irrigators.

Though promising, community management is not a panacea. Community management of irrigation requires collective action of irrigators, which is not automatic. Farmers who use the system need to act as a group, make decisions about the water allocation, and organize the operation and maintenance of the system. Typically, irrigators in each community form an irrigation association to manage the system.<sup>4</sup> However, since irrigation services are rival and non-excludable, each irrigator still has an incentive to free ride on others efforts, if given a chance. Irrigators will act as a group and hold to their commitments only if they are provided selective incentives—that is, rewards or punishment for action and non-action, respectively (Olson 1965). The experience with community-managed irrigation projects confirms that organizing farmers is often a challenge: many irrigation projects have failed in that effort (Ostrom 1992, Lam 1998).

Under what circumstances is collective action among irrigators likely to be successful—what are the needed selective incentives? There is a large body of literature on community-managed irrigation that attempts to answer this question.

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<sup>4</sup> These groups are sometimes called councils, committees, and water user groups. In this paper, the term 'irrigation associations' is used to refer to user groups at the watercourse level.

Several factors that are either internal or external to the community have been identified to influence the success of collective action in irrigation. Some of these factors are listed in Table 1.

**Table 1. Community Managed Irrigation:  
Selected Factors Influencing Performance of Community Management**

<i>Factor</i>	<i>Evidence</i>
<i>Size of irrigation system</i>	Tang (1992); Lam (1998); Dayton-Johnson (1998)
<i>Operational rules of irrigation associations</i>	Ostrom (1992); Maass and Anderson (1986)
<i>Social homogeneity of irrigators</i>	Lowdermilk, Early, and Freeman (1978); Fresson (1979); Merrey and Wolf (1986); Tang (1992); Lam (1998); Lynch (1998)
<i>Economic homogeneity of irrigators</i>	Tang (1992); Bardhan (1995); Lam (1998); Dayton-Johnson (1998)
<i>Mutual trust among irrigators</i>	Lam (1998)
<i>Legal recognition of irrigation associations</i>	Ostrom (1992); Subramaniam, Jagannathan, and Meinzen-Dick (1997)
<i>Coordination with government</i>	Freeman and Lowdermilk (1985); Wade (1987); Chambers (1988); Hunt (1989); Lam (1996)
<i>Water scarcity</i>	Wade (1988); Uphoff, Wickramasinghe, and Wijayaratna (1990)

As Table 1 indicates, some elements of the social structure — in particular, social and economic heterogeneity, and mutual trust among irrigators — have been argued to influence the emergence and sustenance of collective action, affecting, among other things, compliance with the operational rules. Freeman and Lowdermilk (1985, p.111), for example, state:

Compliance with organizational rules for allocation, maintenance, construction, and conflict resolution always occurs within a nested set of other social relationships — kinship, political, religious, educational, work, and recreational networks. Compliance with the rules of the local irrigation command organization will be judged not only according to the expectations of local irrigators, but also according to different sets of rules formulated for behavior in these other networks.

Although they may be established for other purposes, social networks — other than the one established for irrigation delivery — can facilitate cooperation in irrigation. In communities with a set of dense social networks, people tend to know one another and be accustomed to working together. This may make the organization of farmers for irrigation easier. Also, the social pressure exerted through these networks may help to deter free riding. Each of the factors listed in Table 1 will be discussed in more detail next.

## **Size of the Irrigation System**

The size of the irrigation system — measured by the system area or the number of users — is commonly held to influence the success of collective action among farmers. In his theory of collective action, Olson (1965) suggests that the larger the group, the less likely it will succeed in acting collectively. As the size of the group increases, the net benefits from collective action for an individual decrease as the costs of coordinating and organizing activities increase. However, Hardin (1982) and Sandler (1992) have pointed out that the group size affects simultaneously the contexts in which individuals organize for collective action in different ways. How group size affects collective action in a particular situation is not necessarily negative but depends on the sum of these effects.

Not surprisingly, empirical evidence on the impact of system size on the performance of community-managed irrigation systems is mixed. While some studies suggest that the performance does not depend on the size of the irrigation system, others indicate the opposite.

The results of Lam (1998) and Tang (1992), for example, indicate that the size of an irrigation system is not associated with the system performance. Lam (1998) explored the performance of irrigation systems in Nepal using data from 89 Nepalese case studies. He converted the qualitative information in these cases into quantitative data by using a standard set of structured coding forms and then analyzed the data econometrically. He shows that the size of irrigation systems, whether it is measured by the system area, number of irrigators, or total length of canals, does not have a statistically significant effect on the physical condition of the system and water delivery. Tang (1992) obtained similar results. He analyzed systematically 47 case studies on community managed irrigation systems around the world. Like Lam (1998), he converted the qualitative information in case studies into quantitative data by using a standard set of structured coding forms, then entered the results into a database for analysis. He found that the size of the irrigation system, number of irrigators, and the size of the irrigated area do not have a significant relationship with the system maintenance and irrigators' compliance of rules. Similar evidence on the impact of group size has been obtained in areas other than irrigation (Esman and Uphoff 1984).

Dayton-Johnson (1998), by contrast, suggests that the size of the irrigation association — that is, the number of irrigators — influences indirectly the collective effort to manage the irrigation system by affecting the operational rules of the group. The operational rules then influence the performance of the system. His empirical analysis is based on data collected from 54 community-managed irrigation systems in the Mexican state of Guanajuato.

## **Operational Rules**

For the collective action of farmers to be sustainable, it is critical that these groups craft operational rules that govern the use, operation, and maintenance of the irrigation system and thus the interaction among irrigators (Ostrom 1992).<sup>5</sup> These rules affect the day-to-day decisions

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<sup>5</sup> Ostrom (1990, 1992) differentiates between operational, collective-choice, and constitutional choice rules. For simplicity, they are combined here into one category.

made by users about access to and allocation of water (who, when, where, and how can withdraw water); each irrigator's maintenance responsibilities (who, when, where, and how maintains the system); monitoring arrangements (who monitors the actions of irrigators and how); and sanctions against misconduct (what rewards or sanctions will be assigned to those who obey or disobey the rules). By providing order to the operation and management of the system, these rules promote stability and help farmers plan their activities.

Irrigation associations typically craft operational rules. The rules may differ to some extent from season to season as the availability of water varies: a set of rules crafted during the wet season may work well when water is abundant, but not work at all during the dry season when water is scarce. In southeastern Spain, for example, irrigators have crafted different rules for allocating water in three different conditions of water availability: abundance, seasonal low, and extraordinary drought (Maass and Anderson 1986).

### **Social and Economic Homogeneity of Irrigators**

Previous studies on irrigation indicate that social and economic homogeneity of irrigators can also affect the emergence and sustenance of collective action (Singleton and Taylor 1992). Social homogeneity refers to whether irrigators are from the same village, ethnic group, kinship, caste, or religion, while economic homogeneity refers to the landholding size or income of irrigators.

Homogeneity is argued to influence the outcome of collective action by increasing the number of social ties and norms that irrigators can draw upon in building cooperation (Subramaniam, Jagannathan, and Meinzen-Dick 1997). In general, the more socially or economically heterogeneous a group is, the less likely it is considered to organize for collective action. Heterogeneity is seen to increase potential factionalism within a group, which can be manifested in disputes or in one faction's dominance of the organization. The type of empirical evidence supporting these conjectures is discussed next. The evidence on the role of social homogeneity is reviewed first. After that the evidence on the impact of economic homogeneity of irrigators on collective action is discussed.

#### *Social homogeneity of irrigators*

A number of case studies provide anecdotal and qualitative evidence on the impact of social homogeneity of irrigators — with respect to caste, kinship, ethnic and cultural background — on the effectiveness of collective action.<sup>6</sup> In addition, a couple of studies provide quantitative evidence on the topic.

**Caste.** Fresson (1979), who studied the functioning of irrigation associations in Senegal, shows that in some cases heterogeneity of irrigators with respect to caste contributes to disputes. She argues that while the large number of irrigators makes the group organization difficult, the size of the group is less important than the homogeneity of its members for effective collective action. Fresson's argument is based on qualitative data on caste and disputes collected through

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<sup>6</sup> Since some of the results are also based on very small samples, they need to be treated with caution.

interviews from four irrigation communities in Senegal. She reports that although the irrigators in these communities were heterogeneous with respect to caste, no one caste was monopolizing the irrigation associations — in each community the association was representative of the whole community. However, in two of the four communities, caste had played a role in disputes about water distribution: the dominant castes in these communities had tried to monopolize the use of irrigation water, which had resulted in violent confrontations.

***Kinship and cultural norms.*** Lowdermilk, Early, and Freeman's (1978) study provides qualitative support for the argument that the homogeneity of irrigators with respect to kinship is likely to ease collective action. They studied irrigation associations in Pakistan, where kinship groups known as *biradaris* are the prevailing pattern of collective action. They found that irrigation associations in "polarized" communities are less effective than associations in more homogenous settlements.

The factions among kinship groups are reinforced in some Pakistani communities — in particular, in the northern part of the country — by the cultural concept of *izzat*, which means honor. One can acquire *izzat* only at someone else's expense, which implies that the success of one person is a threat to all the others (Merrey and Wolf 1986). This concept of honor can hinder the cooperation among irrigators as Merrey and Wolf (1986, p.39) describe:

Men oppose or support decisions and programs based on their perceptions of their competitors' position. For example, even though all farmers suffered the exactions of a corrupt tubewell operator, they did nothing because, informants explained, if one man or group proposed petitioning for his removal, others would oppose. This would be done not out of love for the tubewell operator but to prevent others from gaining some advantage from the issue or to pursue some long-standing grudge.

***Ethnic and cultural background.*** Lam (1998) and Lynch (1988) provide anecdotal evidence on the negative influence of ethnic and cultural heterogeneity on collective action for irrigation. According to Lam (1998), Nepalese farmers of the same ethnic background are often unwilling to work with farmers of different ethnic backgrounds. In particular, this is common among ethnic groups with a high level of solidarity. Lynch (1988) in turn reports that in the La Huyalla irrigation system in Peru, immigrants, because of their different background and habits, caused a major disruption to the management of the local irrigation system. The fact that they lacked experience or a tradition of working in a group further hindered their assimilation into the local group.

People with different ethnic or cultural backgrounds may sometimes have difficulties communicating with one another and acting collectively. As Denzau and North (1993) point out, since people have limited cognitive capabilities, they adopt a variety of conceptual orientations to make sense of the world. These include values, norms, experiences, and perceptions of the world that have been taught and ingrained in a community where one has grown up. Hence, people that have grown up in different communities may have different values, norms, and perceptions of the world, which may in some cases hinder communication and collective action among them.

*Social factions.* Tang (1992) shows that in some situations social and cultural factions can inhibit coordination among irrigators by raising the cost of organizing collective action. Unlike the previously cited studies, Tang made an attempt to provide more systematic evidence on the impact of social factors on collective action by analyzing systematically 47 case studies on community managed irrigation systems. One of the issues he studied was whether in the communities sampled there were any ethnic, cultural, clan, racial, caste, or other social differences among the irrigators that may have affected their capacity to communicate with one another effectively, and how the irrigation systems had performed in these communities. Of the 47 cases analyzed, seven were reported to have factions among irrigators that had inhibited communication. In two of these seven cases, the irrigation system had performed satisfactorily — that is, the system was reportedly well-maintained and irrigators complied with the operational rules. In the other five cases, the irrigation system had performed poorly — that is, the system was reportedly poorly maintained, operational rules not followed, and water supply inadequate.<sup>7</sup> Tang’s results, however, have to be treated cautiously because of his very small sample size.

#### *Economic homogeneity of irrigators*

Economic inequity is another source of heterogeneity among farmers in many irrigation systems. It is commonly measured by differences in land holding size or household income.

Empirical evidence indicates that economic inequality of irrigators has a negative effect on collective action. Lam’s (1998) analysis indicates that in Nepalese communities where wealth distribution among irrigators is highly uneven, irrigation systems tend to be associated with lower levels of performance. In these communities, rich farmers are frequently unwilling to cooperate with poor farmers. Rich farmers often find themselves able to provide and maintain systems without any contribution from their less wealthy neighbors. As a result, although a certain level of collective action may be organized and provided by rich farmers, such a level is likely to be less than optimal. Tang (1992) obtained similar results.<sup>8</sup> He states: “...a low variance of the average annual family income among irrigators tends to be associated with a high degree of rule conformance and good maintenance.” Dayton-Johnson (1998) also found that economic inequality, measured by differences in land holding size, has a negative impact on collective action of irrigators in Mexico. Bardhan (1995) reviewed case studies of community-managed irrigation systems in Asia and reports that case studies from the Indian states of Gujarat and Tamil Nadu suggest that the egalitarian nature of the community and/or small differences in farm sizes are conducive to the formation of irrigation groups.

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<sup>7</sup> Interestingly, all the five cases of poor system performance were from India or Pakistan. This may be due to the fact that almost all complex irrigation systems in the sample were from these countries. However, it may also reflect the fact that in many parts of these countries, farmers are divided into various caste or kinship groups (Tang 1992). Although these factions may not prohibit cooperation among farmers, they may make communication among farmers difficult and thereby raise the cost of collective action.

<sup>8</sup> However, the results of Tang need to be treated with caution because of his small sample size.

## **Mutual Trust among Irrigators**

Lam's (1998) study also indicates that a high level of mutual trust among irrigators is associated with a high level of irrigation system performance: mutual trust enhances system performance by counteracting irrigators' incentives to free-ride and ignore the operational rules. Lam used the degree to which oral promises were kept among irrigators as an indicator of trust: high credence given to oral promises indicated a high level of trust. The performance of the irrigation system was in turn measured by its physical condition, water delivery, and agricultural productivity of the community.<sup>9</sup>

## **Legal Recognition of Irrigation Associations**

The social structure of the community is not the only factor influencing the emergence and sustenance of collective action: for example, it is obvious that the policy environment needs to be conducive to community management and farmers need to have a legal right to organize for community management of irrigation to work at all (Subramanian, Jagannathan, and Meinzen-Dick 1997, Ostrom 1992). However, as Ostrom (1992) points out, as long as the irrigation system is in an isolated location and used primarily for subsistence agriculture, legal rights are not crucial. But in densely populated areas, where farmers grow cash crops, conflicts about water allocation are likely to escalate and legal rights gain importance.

If an irrigation association is not recognized as a legitimate form of organization, the leaders of the association cannot represent the interests of their members before administrative and judicial bodies. Also, the police or formal courts may not enforce any decisions made by the group and it is difficult to hold group officials and members accountable for their actions. Legal recognition thus increases the credibility of the association not only in the eyes of outsiders, but also in the eyes of irrigators.

## **Coordination with Government Irrigation Bureaucracy**

The coordination of activities between the irrigation association at the watercourse level and the government bureaucracy at the higher levels of the irrigation system also critically influence system performance. Irrigation associations at the watercourse level do not operate in isolation: they are typically part of a larger irrigation scheme. They maintain the system and control the allocation of irrigation water within the community, while the government irrigation bureaucracy above the watercourse level is responsible for integrating the community's needs into the overall irrigation plan and ensuring that the promised water is actually delivered to the community. Farmers and government officials are thus engaged in a shared project aimed at ensuring that enough water reaches the community at the right time.

The functioning of this partnership between the irrigation association and government officials requires careful communication and coordination across different organizational levels. Freeman and Lowdermilk (1985) emphasize that this partnership requires disciplined

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<sup>9</sup> The condition of canals and economic efficiency of system maintenance were used to measure the physical condition of the system. Water delivery was in turn measured by water adequacy, equity, and reliability.

organizations at both ends. In particular, clear understanding of the division of labor and good working relationships between officials and farmers are needed at the hand-over points (Wade 1987, Chambers 1988, Hunt 1989). Farmers need to be able to trust the government irrigation bureaucracy, and government officials in turn need to respect farmers' views and control of the system at the community level.

Lam's (1996) study of Taiwanese irrigation systems provides an example of a strong working relationship and good coordination between farmers and government officials. According to Lam, there are two key elements to the good relationship in Taiwan. First, government officials frequently reside in local communities where they work. Because of this, they automatically become part of these communities and any wrongdoing on their part that harms the community could put them under much social pressure or ostracism. Second, officials tend to serve in particular stations for long periods of time. Knowing that they have to deal with the same group of farmers for a long time, investing time and effort into developing a good relationship with farmers makes strategic sense. The networks of trust and collaboration that are created this way span the public/private boundary and bind the state and civil society together.

### **Water Scarcity**

Previous empirical studies indicate that farmers are likely to act collectively in irrigation projects where farmers face sufficient water scarcity so that they are motivated to invest in organizing themselves, and where they are assured that organization could make a substantial difference in their yields. Wade (1988) studied the conditions for collective action in irrigation in the Indian state of Karnataka, collecting qualitative data from 41 villages. He found that water scarcity and the resulting risk of crop loss led some villages to overcome the obstacles to collective action and set up an irrigation association to manage the irrigation system. According to Wade, villages at the tail-end of the irrigation system, where the water was most scarce, were most likely to have farmers acting collectively. In those instances, the potential net benefits from collective action were clear and substantial.

Uphoff, Wickramasinghe, and Wijayarathna (1990) further refined these results and showed that farmers are willing to collectively manage and maintain irrigation systems where the water supply is relatively scarce rather than absolutely scarce or abundant. Their results are based on quantitative analysis of survey data gathered from 500 farmers in the Gal Oya irrigation scheme in Sri Lanka. According to Uphoff, Wickramasinghe, and Wijayarathna, there is an inverted-U relationship between water scarcity and returns to organization. Specifically, where water is abundant — typically at the head-end of the irrigation system — access to water is not a problem and thus net benefits from collective action are minimal. Where water is absolutely scarce — typically at the tail-end of the system — even collective action of farmers cannot alleviate the water shortage, and hence the net benefits from organization are low. In the middle range of the irrigation system, by contrast, water is relatively scarce and potential net benefits from collective action are high.

## Summary

To summarize, available case study and quantitative evidence indicates that community management that builds on social networks, norms and interaction among irrigators often improves the performance of irrigation systems. However, collective action and cooperation among irrigators is not guaranteed.

Different dimensions of social capital have been shown to affect the effectiveness of collective action and collective decision-making at the community-level. Empirical evidence indicates that economic and social homogeneity of irrigators with respect to caste, kinship, and ethnic and cultural background aides collective action. This is achieved through increasing the number of norms and social ties that irrigators can draw upon in building cooperation. Also, mutual trust among irrigators is shown to promote collective action by counteracting irrigators' incentives to free ride and ignore the operational rules.

However, whether collective action can be expected to emerge at all depends heavily on factors other than the social structure of the community that influence the returns to cooperation. For example, the relative degree of water scarcity in a community is shown to affect the returns to, and thus the emergence of, collective action: households in communities with relatively scarce water supply having highest expected returns and thus strongest incentives to act collectively, while households in communities with absolute scarce or abundant water supply having very low expected returns to collective action and thus weak incentives to cooperate.

Since irrigation associations are typically part of a larger irrigation scheme — they manage the system within the community, while the government is handling the system above the watercourse level — actions of the government also influence the performance of community management and irrigation systems. Coordination of activities between the government and community is critical. A clear understanding of the division of labor and good working relationships between officials and farmers are needed at the hand-over points for the system to work properly.

## SOCIAL CAPITAL AND RURAL DRINKING WATER DELIVERY

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The delivery of rural drinking water is another aspect of rural water services where donors have begun to advocate a community-based approach. In rural drinking water delivery, this approach adopts a demand-responsive focus on what users want and what they can afford (Briscoe and Ferranti 1988). Failure of governments — partly due to limited funds, imperfect information on demand, and poor governance — to provide adequate levels of safe drinking water to rural villages and maintain the existing water systems, has led to this changed thinking about water delivery.<sup>10</sup> The community-based approach to rural water delivery is based on the premise that water is an economic good that has a value, and it should be managed at the lowest appropriate level with users involved in the planning and implementation of projects (Garn 1998, Sara and Katz 1998). This approach recognizes that knowledge, skills, and time of villagers could be productively harnessed into water delivery to expand the pool of resources available for the effort, in addition to ensuring that the services provided match the demand.

In drinking water delivery, the community-based approach typically calls for a joint effort by community members and government in service design and construction (Watson and Jagannathan 1995). Community members are expected to participate in the design process: in particular, to choose collectively the type and level of service based on their willingness to pay. In addition, communities are typically asked to contribute cash or labor to construction, and take care of the operation and maintenance of the system collectively. Community members are also expected to form a water user group to coordinate the management of the system in the community.

Narayan (1995) shows that user participation in rural water projects indeed contributes significantly to project effectiveness. She analyzed data from 121 case studies of rural water supply projects in different developing countries. Like Tang (1992) and Lam (1998), Narayan converted the qualitative information in these case studies into quantitative data using structured coding forms, and then carried out empirical analysis of the data. She used several different measures of participation, differentiating between options where water users were merely provided information about the project and where users were empowered to make decisions. Also, the measures used reflected whether the users participated in all stages of the project (design, construction, and operation and maintenance). Narayan's analysis indicates that user participation significantly increases overall economic benefits from water systems, percentages of target population reached by water systems, and environmental benefits from these systems. While Narayan (1995) did not establish causality from participation to water system performance, Isham, Narayan, and Pritchett (1995) later found evidence on the causal link.

Sara and Katz (1998) obtained similar results: sustainability of water systems is higher in communities where a demand-responsive approach was employed and water users participated in

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<sup>10</sup> Briscoe and Garn (1995) and Garn (1997) review the poor performance of the traditional top-down approach and the economic underpinnings of the community-based approach.

the system design than in those where the approach was not followed. Specifically, they found that in communities where household members made informed choices about whether to build a system, the type of system to be built, and the level of service to be provided, sustainability of water services was higher. These results are based on an econometric analysis of quantitative data from six community-based rural water projects in Benin, Bolivia, Honduras, Indonesia, Pakistan, and Uganda. In total, 125 rural communities in these countries were included in the study. Quantitative data was collected through household and water committee surveys, and technical assessments of water systems. This data was supplemented by qualitative data gathered during the surveys.

However, all is not well: the performance of rural water projects that have adopted the community-based approach varies a great deal. While in some communities water systems have performed well, in others the systems have failed. One reason for the varied performance of water projects is that, even if required by the project, users and government officials do not always cooperate in different stages of the project as expected. Government officials do not always involve users in the system design and pay attention to the user demand and preferences for the system. They may also fail to monitor the construction of the system. Since contributing to the system management has a cost, users also often fail to cooperate and participate in the design process, contribute labor or cash to construction, or carry out the assigned operation and maintenance tasks without additional incentives, even if they had initially agreed to give their services and manage the system as a group. As in the case of irrigation, each water user has an incentive to free ride on others' efforts and not do his/her share of system management. In other words, users often fail to cooperate and build a network that functions and provides benefits to all participants. The desire to have a functioning water system is not always enough to sustain the group effort.

In the existing literature on community-based rural water delivery, several factors have been identified to influence the incentives of users to act collectively and the effectiveness of this collective action as reflected by the performance of water systems. Table 2 summarizes selected factors that have been shown to influence the performance of community management.

**Table 2. Community-based Rural Drinking Water Delivery:  
Selected Factors Influencing Performance of Community Management**

<i><b>Factor</b></i>	<i><b>Evidence</b></i>
<i>Social homogeneity of water users</i>	Watson, Jagannathan, Gelting and Beteta (1997)
<i>Operational rules of water user groups</i>	Sara and Katz (1998); Isham and Kähkönen (1998)
<i>Prior organization of water users</i>	Narayan (1995)
<i>Participation of users in other community groups</i>	Isham and Kähkönen (1998)
<i>Coordination with government</i>	Sara and Katz (1998); Isham and Kähkönen (1998)
<i>Legal recognition of water user groups</i>	Watson, Jagannathan, Gelting, and Beteta (1997)
<i>Skills and knowledge of users</i>	Rondinelli (1991); Sara and Katz (1998); Isham and Kähkönen (1998)
<i>Appropriate technology and access to spare parts</i>	Rondinelli (1991)

The list in Table 2 is by no means exhaustive: since this paper focuses on social capital, other factors have been aggregated into a few categories such as “coordination with government.” Not surprisingly, many of the factors listed in Table 2 are the same as those that influence the performance of community managed irrigation systems. Each of the above mentioned factors will be discussed in more detail below.

### **Social Homogeneity of Water Users**

Watson, Jagannathan, Gelting, and Beteta (1997) present isolated case study evidence on how social heterogeneity of water users may hinder collective action. They tell a story of a village in Pakistan that was made up of two social groups: people displaced by the construction of a major dam, and immigrants from the Indian portion of Kashmir. In 1980, the government and villagers jointly constructed the village water system. A water committee consisting of representatives from both groups was formed to manage the system. Management of the system through this committee, however, failed. In a few years, the social and political conflicts between the two groups had reached such a level that the water committee dissolved and management of the system had to be handed back to the government.

### **Operational Rules of Water User Groups**

As in the case of irrigation, the existence and effectiveness of operational rules that govern the operation, use, and maintenance of a water system within a community influence the effectiveness of collective action by guiding interaction among users. In particular, rules about decision-making, monitoring, and sanctions are seen as critical for the effectiveness of community management. These rules, if properly implemented and enforced, provide households an incentive to participate in the design process, contribute the required inputs to construction, and operate and maintain the system together with other community members.

Isham and Kähkönen (1998) show that operational rules about community participation in the design process and the existence of arrangements to monitor household contributions to the management of the system are, in particular, positively associated with the success of collective action and performance of the water system. Isham and Kähkönen studied the performance of three community-based rural water projects in Sri Lanka and India, and collected quantitative and qualitative data on the performance and impact of water systems from 50 Sri Lankan and Indian communities that had been served by these projects. Quantitative data was collected through a survey of 1088 households and 50 water committees. This data was supplemented by qualitative data that was gathered through focus group interviews with community members and interviews with local government officials. The analysis of this data reveals that in communities where household contributions to construction, operation, and maintenance of the system are monitored, community management is more successful and systems perform better than in those communities where contributions are not monitored. Also, the results indicate that user participation in system design and having users make the final decision about what type of a system to build leads to greater satisfaction with system design and better system performance. The results of Sara and Katz (1998) complement these findings. Their analysis indicates that it is important to craft rules that allow *all* users participate in

decision-making. They found that unless *all* water users were given a chance to express their preferences about the system directly, community representatives often failed to consider the demand of certain segments of the population, such as women or the poor.

### **Prior Organization of Water Users**

Narayan (1995) shows econometrically that the extent to which water users were organized prior to the project is positively associated with user participation in system management. If users are already organized, there is a social basis for cooperation: users already know each other through existing networks and have a tradition of working together. In other words, pre-existing social capital promotes collective action.

### **Participation of Users in Other Community Groups**

Isham and Kähkönen (1998b) provide further and more extensive empirical evidence on the importance of pre-existing social capital in the form of other community groups for the success of collective action and performance of water systems. While the organization and functioning of water user groups creates social capital, the organization and operation of these groups may be enhanced by the existence of prior social capital in the community. Isham and Kähkönen's paper represents the first attempt to systematically measure and econometrically evaluate how the performance of community-based rural water systems is affected by pre-existing social capital in the form of other community groups and associations.

Pre-existing social capital, such as other community groups and networks, is argued to promote the participation of water users in system management by reducing the cost of collective action. During the design phase, the collective demand for the type of system and level of service is more likely to be expressed in communities where community members are accustomed to working together, where leaders are accountable, and where all stakeholders have a voice. During the construction as well as the operation and maintenance phase, water user groups are more likely to function well in communities with cohesive community groups and a tradition of civic activities. Communities that have strong social ties often work well together because they share values about mutual assistance. In tightly networked communities, the formal and informal social ties among people may constrain free riding and provide incentives for water users to hold to their commitments. For example, when a user does something that violates the community norms, that person may be punished through gossip and ostracism.

Isham and Kähkönen used three different indicators of social capital to test these conjectures. The first indicator was the number of community groups or associations that a household belongs to. The second one was an index that captured the characteristics of these community groups. Group characteristics that were included in the index were the heterogeneity of group members by religion, gender, and occupation; decision-making mechanisms within the group; and members' assessment of the effectiveness of group functioning. In an attempt to capture the quantity and quality of community groups, a third indicator, a "social capital index," was introduced. This indicator combined the number of groups and their characteristics.<sup>11</sup>

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<sup>11</sup> The indicator was based on the "Putnam index" in Narayan and Pritchett (1997).

Isham and Kähkönen show that the existence of and active participation in other community groups (that is, other than the water user groups) leads to more participation in system management, in particular in service design, and also enhances the water user group's effectiveness to craft operational rules to govern the use of the water system, in particular, rules about construction monitoring. Their analysis reveals that all three indicators of social capital are positively associated with users' participation in the design process and construction monitoring. In other words, the greater the number of community groups that households belong to and the more heterogeneous and well-functioning these groups are, the more likely the water users are to hold to their commitments, all of which results in better water system performance. This last result regarding the group heterogeneity may at first seem inconsistent with the literature that emphasizes the importance of group homogeneity. However, this is not necessarily the case.<sup>12</sup> Isham and Kähkönen's results imply that the existence of community groups that have a heterogeneous membership which is satisfied with the functioning of the group indicates that there are unlikely to be any major social factions in the community that could hinder collective action. Water users of different gender, religion, occupation, and background are accustomed to working together — social heterogeneity does not hinder communication. Unfortunately, Isham and Kähkönen did not test separately the impact of community heterogeneity on household participation in system management.

### **Coordination with Government**

Coordination of activities within the community is not enough to ensure effective community management of rural drinking water systems: coordination of activities between government agencies and water user groups at the community level is also needed. As mentioned earlier, the community-based approach to water delivery requires a joint effort by the government and community in the design and construction of a water system, both parties providing complementary inputs into the process.<sup>13</sup> For the approach to work, both parties, not only the community, have to cooperate and honor their commitments to carry out their assigned tasks. Above all, to ensure that the system matches the demand, the government has to involve community members in system design, construction, and management as designed and then coordinate the tasks between the government and community. However, that does not always happen.

Sara and Katz (1998) found that government agencies were often unresponsive to communities' needs and did not carry out their assigned tasks properly in the six community-based rural water projects they studied. In many of these projects, private contractors were used for construction. Hiring and monitoring the work of these contractors was the responsibility of the government. However, due to the lack of accountability in government agencies, officials in some countries had failed to monitor the work, which had led to sub-standard construction quality and delays in implementation. Communities in turn had no way to ensure that contractors or government agencies honored the choices they have made, or to held the project

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<sup>12</sup> Also, the empirical evidence on the impact of social heterogeneity on group functioning in general is mixed. See for example Grootaert (1998b).

<sup>13</sup> Government providing technical knowledge and partial funding, while users provide labor and other production inputs.

staff accountable if the system was poorly constructed or incomplete. This eroded community members' trust in government and hampered the collaboration as well as incentives of users to manage the system.

Brown and Pollard (1998), who studied the sustainability of water systems in Indonesia, found that in several cases users had been ignored in the design of systems. Further, even when government officials had involved community members in system design, they had often ignored the expressed preferences of users when the final decision about the type of the system was made.

How effectively, if at all, the government carries out its tasks depends on the structure and operational rules within the government (Isham and Kähkönen 1998). These rules govern the behavior of government officials by providing them incentives to perform their assigned tasks. They include, for example, rules about monitoring and sanctions. Isham and Kähkönen provide some qualitative case study evidence on the importance of these rules but no quantitative evidence on what kinds of rules are most critical for system performance.

### **Legal Recognition of Water User Groups**

Like in the case of irrigation, for water user groups to be fully effective, they need to be recognized as legal entities by the government. For example, in Bolivia, water user groups that had existed for over a year became effective organizations only after the government had recognized them legally. Among other things, the legalization permitted them to open bank accounts. Only at that point did community members trust the organizations enough and make their required financial contributions for the system's management (Watson, Jagannathan, Gelting, and Beteta 1997). In other words, without government backing, water user groups sometimes have difficulties enforcing the operational rules: the threat of sanctions is not credible. If the group, however, is recognized as a legal entity, police and other judicial bodies can be used to enforce its decisions if and when needed. This threat of governmental coercion promotes rule compliance as well as accountability among group leaders.

### **Skills and Knowledge of Users**

In addition to the social structure, operational rules of the water user group and government, and other factors mentioned above, the effectiveness of community management depends critically on the skills of community members to operate and maintain the water system. Bringing users together to manage the water system is not sufficient for successful management, it is necessary also to ensure that users have sufficient skills to do the work. Even when a community has a high demand for water and willingness to manage the system, it may lack the capacity to operate and maintain the system on its own. In Tanzania, for example, community management failed in many villages because the users did not know how to maintain and repair the systems — no operation and maintenance manuals or training in basic system maintenance and repair had been provided to them (Rondinelli 1991).

Sara and Katz (1998) show quantitatively that training of household members and water committees in system operation and maintenance improves system sustainability by building

capacity and commitment to maintain it. Water systems are likely to perform better in those communities where users are provided basic skills to operate and repair the water system, and trained to identify and address minor problems in the system before they become major.

The provision of hygiene education is also positively associated with the willingness to maintain the system, according to Sara and Katz (1998). People in rural communities often do not recognize that some of their diseases are caused by water they consume. Educating users of the health benefits of safe water handling, hygiene practices, and protection of the water source may affect how people value their water source and increase their willingness to maintain the system. Isham and Kähkönen (1998) show that the provision of hygiene training also enhances the health impact of rural water projects.

### **Appropriate Technology and Access to Spare Parts**

Without appropriate technology, however, even the best-organized and trained community management efforts will fail. One of the lessons from water supply projects during the 1960s and 1970s was that community management in developing countries was difficult or impossible with the pumps and equipment imported from industrial countries (Rondinelli 1991). Most of these pumps were made of materials that broke down easily in the climates and under the conditions of use in developing countries. Spare parts were difficult to obtain in a timely manner and replacements were costly. Hence, using appropriate technology and developing a reliable system for the provision of spare parts are essential conditions for successful community management.

### **Summary**

In sum, the empirical evidence indicates that the community-based approach, which relies on cooperation of community members to manage the water system, can enhance the performance of rural drinking water systems. However, the success of collective action among community members is not automatic.

How effectively, if at all, community members work together to manage the system depends partly on existing social capital in the community. The empirical evidence indicates that the existence of other, non-water related, networks and associations in a community aides collective action for water delivery. In those instances, households are accustomed to working together and formal and informal ties among people constrain free-riding and provide incentives for households to participate in system management as designed. Also, evidence indicates that the existence of social capital in this form aides the crafting and enforcement of operational rules that govern the use, operation, and maintenance of the water system in the community.

Existence of social capital may promote collective action and coordination within the community, but it does not ensure that the water system performs well. Social capital is only one of several factors that influence the effectiveness of community management and performance of water systems. For example, since community-based water services are typically joint efforts of the government and community, effectiveness of community management and system performance depends also on actions of the government and coordination of communal and governmental tasks. Also, collective action is fruitless if users do not possess the skills to

operate and maintain the system. Finally, all actions may be perfectly coordinated and users possess the needed skills to manage the system, but without appropriate technology and access to spare parts, even the best-organized and trained community management efforts will fail.

## SOCIAL CAPITAL AND URBAN SANITATION

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Inadequate sanitation is one of the major environmental health problems facing poor urban residents of developing countries. Despite heavy investments in the sector in the 1980s, the number of urban people without access to sanitation increased by about 70 million during that decade (Serageldin 1995). In total, about 37 percent of the urban population in developing countries still lack access to adequate sanitation (Wright 1997). The majority of these people are poor and live in squatter settlements, illegal subdivisions, and working class neighborhoods. Government agencies that work in urban water and sanitation tend to concentrate their activities to large cities and focus primarily on middle and upper income neighborhoods, leaving the poor neighborhoods unserved (Watson and Jagannathan 1995). As a result, the poor resort to disposing wastes into gullies along footpaths or digging pit latrines that quickly fill and contaminate the groundwater. These practices obviously pose a major public health hazard.

One reason why poor neighborhoods often do not have public sanitation is that conventional urban sanitation systems with high design standards are typically prohibitively expensive and technically difficult to implement in most poor neighborhoods. These neighborhoods are commonly located on the worst urban land far away from sewer trunk lines and have narrow streets and irregular layouts. All these factors, by raising the cost of construction, dampen government's interest to make the work in poor neighborhoods a priority. When conventional systems have been built in poor neighborhoods, they have often suffered from a number of problems which include low connection rates, poor construction work, poor operation and maintenance, and poor financial sustainability (Watson 1995).

However, in some countries, low-cost urban sanitation systems that require participation of users in system management have been introduced in the past two decades. In these countries, the number of housing units connected to the low-cost sanitation systems has been growing steadily throughout the 1980s (Watson 1995). The best-known of these systems are the condominium system in Brazil and the Orangi Pilot Project in Pakistan.

In the early 1980's Brazilian engineers developed a condominium system — a low-cost water-borne sanitation system — that addresses many of the technical and financial barriers to urban sanitation in poor neighborhoods. It is called a condominium system because it resembles a system that might be designed for a co-owned apartment building. Mejia (1996, p. 32) has described the underlying rationale of the system as follows:

At the bottom of it was the understanding that the water company could not deal directly with each family in a “helter-skelter” community...Instead, families had to band together to negotiate and commit to operate and maintain the service to a group of some twenty to fifty barracos (homes). This way of generating and supporting communal inter-dependence helped work out affordable solutions: people could afford what they wanted and the water company would recover its capital and operating costs....

The condominium system differs from the conventional sanitation system in two ways: first, it uses innovative low-cost engineering designs, and second, it requires participation of residents in system management. The low cost designs, while making the systems affordable to the poor, demand more maintenance. This is one of the reasons why participation of users is sought in management.

Instead of designing all sanitation systems with cast-iron pipes sunk deep under urban streets at high per household cost, condominium systems typically use feeder lines with much smaller pipes that can run through urban blocks either in the backyards, front yards, or sidewalks of those being served. By placing these feeder lines away from heavy traffic, the costs of constructing the feeder section are between 50 to 80 percent less than that of conventional designs (Watson 1995). The feeder lines are then connected to larger trunk lines that are constructed according to the regular engineering standards, located under urban streets, and lead to treatment plants (Ostrom 1996).

Condominial systems also involve residents in the planning and management of systems. At the start, the project staff organizes a series of neighborhood meetings where an overview of the process, and benefits and costs of a condominium system are presented. After that, meetings are held in each block of the neighborhood. At least half of the residents of the block need to be present for a meeting to be held. In these meetings, the choices that residents will have to make and the implications of these decisions to the cost and maintenance of the system are discussed in detail. In general, residents are expected to maintain the feeder lines as a group, while the government takes care of the trunk line and treatment facilities.

Residents collectively make decisions regarding the system and its maintenance. A condominium system is built only if residents as a group decide they want it. This ensures that the system matches user demand and that the connection rate is high. If they agree to have a system, residents collectively need to decide about the layout of feeder lines at the block level — whether they will be located in the backyard, front yard, or sidewalk — given that different layouts have a different cost per household. Also, all residents together need to develop a plan for constructing the feeder lines: whether they will dig the feeder lines themselves or hire a private contractor for the work. Finally, before construction begins, all residents need to sign a formal petition requesting a condominium system and committing themselves to the payment of the fee agreed upon during negotiations. Thus, residents are expected to cooperate and jointly manage the system once it has been constructed.

Usually, the first few blocks that construct a condominium system serve as demonstration projects in the neighborhood: other blocks can see the results in practice and compare the functioning of different layouts. Typically, once the first few blocks have been completed, the construction of systems rapidly spreads to other blocks.

The Orangi Pilot Project has supported similar efforts with low-cost (shallow and small-bore) sewers and community involvement in system management in Karachi, Pakistan. The project has empowered the users to plan, construct, and maintain their own latrines (Wright 1997).

Overall, the results of condominial systems in Brazil and Pakistan have been impressive in terms of improved sanitation coverage. For example, more than 75,000 condominial connections were built in Brazil in 1980-90, serving about 370,000 residents (Watson 1995). The Orangi Pilot Project in Pakistan has also had a substantial demonstration effect: while it helped only about 15 percent of Karachi residents to build condominial sewers, another 25 percent built later sewers on their own, simply copying what they had learned from their neighbors (Watson 1995). Not surprisingly, other developing countries have also adopted condominial systems. Similar systems have been constructed, for example, in Kenya, Paraguay, and Indonesia (Watson and Jagannathan 1995).

However, the performance of condominial systems has been mixed. Studies of the performance of condominial systems point to difficulties in all stages of the design, construction, and maintenance of these systems. They are plagued by similar difficulties inhibiting community managed irrigation and community-based drinking water projects, namely: (1) sustenance of collective action among residents; (2) actions or inaction of the public agency; and (3) coordination of activities between residents and the public agency (Watson 1995, Ostrom 1996).

Cooperation among residents is a major problem in many condominial systems and, as a result, collective maintenance of feeder lines by residents often fails (Watson 1995). In condominial systems, each household is responsible for removing the blockages in the feeder line on its own property. However, in collective lines, the responsibilities of each household can sometimes be opaque because backyard and front yard lines are shared by all residents connected to them. Since blockage removal is a dirty and unpleasant task, each resident has an incentive not to do the work but wait for others to act. In other words, private interest is commonly stronger than the collective interest, and cooperation among residents fail.

Maintenance of feeder lines may also falter because residents sometimes lack the skills to maintain the system, or because the neighborhood sometimes has a high turnover rate of residents. According to Watson (1995), maintenance training has not been provided in all neighborhoods as part of the project. Further, in neighborhoods that have a high turnover rate of residents, new residents are not always aware of the network's existence or they may not be advised properly about its operation and maintenance. Also, in transitional neighborhoods, shared communal norms and networks that could aide collective action among residents are likely to be weak or missing.

Government officials often shirk their duties as well. They do not always involve residents in the planning. As with conventional systems, they frequently perform inadequate routine maintenance of trunk lines (Watson 1995). This may lead to a complete blockage of feeder lines, as flow velocities in upstream sections slowly decrease and suspended solids settle and build up.

The most common cause of poor performance of condominial systems is the sub-standard quality of construction. The reason for the poor quality is rarely a design flaw, but rather insufficient supervision during construction and a failure to remedy the problem once it is

detected. The problems of monitoring the performance of those who construct the trunk and feeder lines do not disappear even though the length of the trunk lines are substantially reduced.

In sum, the community-based approach that uses low-cost technologies for urban sanitation has produced impressive results. However, like in the case of irrigation and rural drinking water delivery, ensuring cooperation among residents is a major challenge. The same set of factors that influence collective action in rural water delivery are likely to impact the outcome of collective action in urban sanitation, though no studies on these topics seem to have been conducted yet.

## CONCLUSIONS

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This paper has analyzed the role of social capital in community-based irrigation, rural drinking water, and urban sanitation delivery by reviewing the empirical literature on the topic. Existing empirical evidence indicates that community management that builds on social networks, norms, and interaction among users often improves the performance of water and sanitation systems. Several factors, including social capital, have been shown to influence the effectiveness of community management.

How effectively users manage the system as a group has been shown to depend partly on social capital in the community. While the establishment of a functioning user group for water and sanitation management creates social capital, the organization of that group is aided by pre-existing social networks, norms, trust, and interaction among neighbors. Specifically, the empirical evidence indicates that the existence of other (that is, non-water and sanitation related) networks and associations in a community as well as mutual trust among users aide collective action. In those instances users are accustomed to working together and the resulting formal and informal ties among people constrain free-riding and provide incentives for users to participate in system management as designed. Further, economic and social homogeneity of irrigators with respect to caste, kinship, and ethnic and cultural background is shown to promote collective action by increasing the number of norms and social ties that users can draw upon in building cooperation. Also, evidence indicates that existence of social capital in this form aides the crafting and enforcement of operational rules that govern the use, operation, and maintenance of the water or sanitation system in a community.

Existence of social capital may promote collective action and coordination within the community, but social capital alone by no means ensures that the water or sanitation system performs well. Social capital is only one of several factors that influence the effectiveness of community management. Whether collective action of users can be expected to emerge at all depends heavily on factors other than the social structure of the community. For example, the relative degree of water scarcity in a community is shown to affect the expected net returns to, and thus the emergence of, collective action. Since community-based water and sanitation delivery is typically a joint effort of the government and community, both parties contributing complementary inputs into the process, performance of community management depends also on actions of the government and coordination of communal and governmental tasks. Further, community management can only work if users possess the skills and knowledge to operate and maintain the system. Finally, the importance of using appropriate technology and having access to spare parts needs to be stressed: without them even the best-organized and trained community management efforts will fail.

However, several aspects of the role of social capital in water and sanitation delivery remain unexplored. The Social Capital Initiative at the World Bank will attempt to fill in some of these gaps. Specifically, the project on monitoring and measuring the relative impact of social capital on decentralized rural drinking water projects (Garn, Isham, Kähkönen) will attempt the address quantitatively the following unanswered questions on rural drinking water delivery:

- Which aspects of social capital are most critical for the performance of water systems?
- What is the relative importance of social capital and other factors for the performance of water systems?
- Which operational rules governing the use, operation, and maintenance of water systems are most critical for system performance?

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