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Decentralizing Water Resource Management

Economic Incentives, Accountability, and Assurance

K. William Easter
Robert R. Hearne

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Summary findings

Private sector involvement and user participation in water resource management are not new, say Easter and Hearne. They give examples that demonstrate how willing users and the private sector are able to improve water use and play a larger role in water resources management.

User participation and private sector involvement, if properly structured, can provide the incentives needed to stabilize and improve the efficiency of irrigation and water supply systems. They can add flexibility, transparency, and accountability and can reduce the state's administrative and financial burden. A 1989 World Bank review of 21 impact evaluations of irrigation projects, for example, found cost recovery to be excellent in those projects in which water management and operations and maintenance had been entrusted to water users.

Greater private sector and user participation can effectively increase user responsibility for managing and financing water projects while freeing governments to focus on broader water resource management concerns.

Easter and Hearne provide examples of decentralized water management in developing country water supply and irrigation systems. Governments should:

- More actively regulate private sector exploitation of groundwater, especially for irrigation.
- Take measures to encourage price competition among private suppliers of water for both domestic and agricultural uses.
- Play an active role in organizing water user associations, especially for irrigation and rural water supply systems, and in giving them technical assistance.

As numerous examples highlight, such activities should be designed to reduce the transaction costs of organizing and to establish a sense of assurance and accountability within the water user community. Once this is done, the community can deal with problems associated with excludability and unwillingness to pay.

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DECENTRALIZING WATER RESOURCES MANAGEMENT:

ECONOMIC INCENTIVES, ACCOUNTABILITY AND ASSURANCE

by

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Decentralizing Water Resources Management: Economic Incentives, Accountability and Assurance[1]

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Central governments and community groups have provided for and delivered water services throughout the world. Indeed, both central control and community control have long histories. State development of irrigation systems was important in ancient Mesopotamia, Egypt, and the Roman Empire (Said, 1981). The Nile delta was an important source of food from the time of the Pharaohs to the Roman Empire. And the role of the imperial government in spreading information concerning the Nile floods and in developing irrigation infrastructure was considered crucial for secure food supplies.

Communal irrigation systems have existed for generations in countries such as Thailand, India, Sri Lanka, Bali, Indonesia, the Philippines, and Nepal (Easter, 1986). In the Philippines, the "zangjera" system of cooperative irrigation management dates back to the 1600's (Lewis, 1980). Water User Organizations (WUAs) have existed in Tunisia for most of the 20th century, with the French Colonial government establishing their legal basis in 1913. In Sri Lanka, British rulers undermined community irrigation systems by abolishing forced labor in 1832 and later by establishing minor courts that impeded the authority of village headman (Roberts, 1980). Later, when the irrigation system failed, traditional authority was strengthened in a policy reversal.

In pre-Columbian Latin America, the native empires maintained central control over complex irrigation systems. Many of these physical structures survived colonial rule but the Spanish imposed a system based on individual water rights that they inherited from their Moorish tradition (Lee, 1990).

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This decentralized water management lasted into the twentieth century when national governments reinstated central authority over water.

This post-colonial nationalism was replicated in other areas of the developing world. With it came a trend toward governmental activism in economic affairs. It was believed that only the state was capable of handling the large investments and operations necessary in irrigation and water supply systems and that the crucial role of water justifies government control. Furthermore, international lending institutions, such as The World Bank, maintained policies requiring governmental involvement in the development loans that financed water delivery infrastructure.

The fiscal crisis in the developing world beginning in the early 1980s, however, demonstrated the weaknesses of government delivery of water services. The deterioration of irrigation systems and the continued inadequacy of water supply infrastructure throughout the developing world has exposed the serious institutional deficiencies and resulting government failure in many water resources agencies. This includes lack of motivation and accountability of agency staff, high levels of politic interference and rent seeking, as well as inadequate concern for the needs of users. Consequently, without some assurance that water resources agencies will provide the desired levels of services, users are not willing to share in the investment, operations, and maintenance costs (Easter, 1993).

Although, user and private sector participation in water management is not new, the idea has often been resisted by vested bureaucratic interests and rejected due to lack of confidence in the capacity and incentives of the private sector. Yet, the continued decline in irrigated agricultural performance and the inadequacy of water supply systems has brought this top-down approach under greater scrutiny. This paper discusses the transition from central government control to a more decentralized approach to the delivery of water services. The first section reviews the economics of public goods and market failures and provides the conceptual framework for considering the relative roles of government, the private sector, and user groups in water resources management. This is

followed by an assesment of a number of initiatives promoting private sector and community involvement in irrigation and water supply management with examples from Latin America, Africa, and Asia. All of the examples demonstrate the link between participation or ownership, and the improved performance and sustainability of the water system. The paper concludes that governments have an important but changing role in water management.

A. Public Goods and Market Failures

There are four types of market failures that are important in the public provision of water services. They are: nonexcludability, nonsubtractibility, externalities, and natural monopolies. Nonexcludability refers to the difficulty involved in preventing a non-paying consumer from using a good or service. Private firms do not sufficiently provide nonexcludable services because it is difficult to prevent non-paying consumers from using the service. Village wells and large gravity-flow irrigation systems are in many instances nonexcludable. Nonsubtractibility occurs when the use of a good or service by one individual does not subtract from its value to another. This occurs when capital equipment such as dams, water and sewer pipes, and irrigation canals are not used to full capacity. When there is little or no cost to society from added utilization, then expanded use leads to an increase in total economic welfare.

Excludability and subtractibility can be used as a means of classifying between public and private goods and services. Goods and services that are both excludable and subtractible are easily rationed by price and are classified as private goods. Public goods, in contrast, are characterized by nonexcludability and nonsubtractibility in consumption and are difficult to allocate with market mechanism. Flood control and instream uses of water are examples of public goods. Resources such as groundwater that face subtractability in use and nonexcludability are generally called open access resources.

Externalities are the unintended effects of one party's activities on third parties. Delivery of good quality water is generally characterized by positive health externalities for society. Because of this, the market system will tend to underprovide this service. For instance, since these public health externalities are not incorporated into an individual's decision to pay for water delivery, the sum of individual willingness-to-pay is less than society's value for potable water.

The construction of water systems generally requires large, lumpy investments. But once the investments are made, the marginal costs of providing service to an additional patron are quite small. Because of these economies of scale, the delivery of water services is in many cases a natural monopoly. As a result of this market power the organizations that supply water can prevent competitors from entering the market by charging low prices and then after the competition is eliminated, much higher prices can be charged. Thus, governments have become involved in providing and regulating these service in order to protect citizens from non-competitive pricing and excessive monopoly rents.

These market failures imply that competitively determined prices may not efficiently ration water. Thus public intervention into the market may be needed, and can be realized by various types of institutions. While governments - as stewards of the public trust - are usually considered to be the most likely candidates to deliver water services, other institutions - such as independently chartered associations, public utilities, and community groups - can fulfill this role. Once members establish the mutual assurance that fellow users will cooperate and contribute to system success, less formal users groups can also function in this capacity.

However, the sources of market failure do not occur equally in all parts of a water system (see table 1). Certain aspects of water systems can be organized so that market failures are minimized. Thus separate institutions or organizations can be responsible for different parts of a water system (Kessides, 1992). For example, a government can provide for irrigation systems by

establishing a suitable legal structure for irrigation development. It can also provide the capital and then contract out the construction of the irrigation infrastructure to private firms. Once the water system is completed, water users associations, or local communities can operate the system and deliver the water. This can introduce appropriate incentives, improve accountability, increase efficiency, and lower the financial burden on governments. Similarly, management by private firms or financially autonomous entities can introduce many of the same benefits and incentives.

B. Decentralized Irrigation Management

In many developing countries, the state has provided for, constructed, and operated irrigation systems according to its needs, with little or no consultation with those who are to be served by the system. This approach has resulted in poor service and irrigation systems that are not sustainable over the long term. Too often, irrigation agencies have concentrated on new irrigation development at the expense of system maintenance. Once built, many agencies are not capable of performing the necessary O&M and farmers are usually unwilling to accept the responsibility for maintaining the system when they were not involved in system planning and development. Those agencies that levy a water charge to pay for O&M have difficulty collecting it, because farmers are unwilling to pay for poor service. Subsequent government subsidies to pay for O&M are often diverted to pay for new construction.

The inclusion of farmers in irrigation management and even ownership is seen as a way to stabilize, if not improve, most irrigation systems. One approach has been to increase user participation in operation of irrigation services. This improves the flow of information, reduces monitoring costs, establishes a sense of ownership in the farmers, and increases transparency and accountability in decisionmaking. Examples show, that when the knowledge and experience of farmers is included in the planning and management of irrigation system, its performance improves

and they are willing to participate in system maintenance. The participation of farmers in project planning and management provides them with some assurance that the system will supply them with an effective level of service.

Another approach is to establish a legal and economic climate that encourages farmers to develop irrigation privately. Both communal systems and private wells have contributed significantly to irrigation development. In both cases, the users own the system, receive most of the benefits, and have to pay most of the costs. This establishes incentives for efficient water use and farmer monitoring of performance that does not exist in many government operated systems.[2]

1. Water User Associations

Modeled somewhat after communal irrigation systems, governments have helped establish WUAs in government operated irrigation systems and in some cases transferred ownership to WUAs. Two factors have been important in these efforts by governments to establish sustainable WUAs. First, the benefits to farmers from cooperation must be sizeable, well understood, and considered by the community to be fairly distributed. Second, the responsibility and accountability for system management and decision making including project finances must be transparent and clearly established. The second condition provides water users assurance that other users will perform their duties and make contributions to the system's operation and maintenance. Once established, effective WUAs reduce the transactions costs of monitoring, eliminate the asymmetry of information associated with the principal-agent problem, lessen the uncertainty in water deliveries, and improve the link between farmers' efforts and the benefits they receive.

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[2] This paper terms all groups that manage irrigation systems as water associations. Some countries, however, refer to them as Irrigation Associations (Philippines) or Farmer Irrigation Associations (Nepal).

In the Philippine the National Irrigation Administration (NIA) has been a leader both in establishing WUAs and in turning over irrigation systems to them. In the mid-1970s NIA began a unique participatory approach. The process was designed around the introduction of an irrigation community organizer into a community in order to reduce the transaction costs associated with organizing the cooperation needed in providing O&M. The organizer acts as a catalyst, showing farmers how they can benefit from cooperation, helping them establish responsibility and accountability for O&M, and developing the mutual assurance that other users will contribute their fair share. Once farmers agree to organize, a legally recognized WUA is established. In systems with effective WUAs, the NIA has started a three-stage process of contracting with the WUAs to perform various levels of O&M. In the first stage, the NIA contracts the WUA to carry out O&M under NIA supervision. The second stage involves the WUA in the collection of irrigation service fees, with incentives provided to achieve target collection rates. The final stage involves the transfer of responsibility to the WUAs of all but the main storage, diversion, and conveyance works. As of 1989, 581 formal contracts covering 140,000 hectares had been signed with WUAs for main system O&M and irrigation service fee collection (World Bank, 1991a). Only thirty-five contracts for full transfer of responsibility for O&M had been signed. Overall, results have been favorable with the majority of WUAs fulfilling their contracts. The one apparent key to the process is the initial introduction of a catalyst to start the process and thereby reduce the transaction costs of organizing and helping farmers recognize the benefits from taking responsibility for O&M.

In the early 1980s, Sri Lanka with the help of a USAID funded Water Management Project used the Philippine model of community organizers to rehabilitate the Left Bank of the Gal Oya. To gain the trust of the farmers, the organizers began with groups of farmers along the distribution channels (Uphoff, et al., 1990) These groups discussed amongst themselves their problems and communicated with the irrigation department staff. This process has greatly improved communications

between farmers and government irrigation officials which has increased the farmers assurance that irrigation officials will deliver the promised level of service. Conflict among farmers has declined substantially while system improvement have provided greater water supplies for tailenders. Careful to separate their organizations from party politics, the farmers have also eased ethnic tensions. In one area, cooperating farmers cleared a canal allowing the dry season cultivation of 1,000 hectares which had previously been left fallow. This benefitted over 300 families and demonstrated that participation and cooperation can provide substantial benefits and that the farmers have a strong concern for fairness.

Much like Sri Lanka and the Philippines, the government of Indonesia has instituted a policy to turnover small-scale irrigation systems of under 500 hectares to WUAs. This was supported by the World Bank funded Irrigation Sub-Sector Project (ISSP). The WUAs were granted formal legal status to enable them to take on management responsibilities. The government carefully prepared the turnover process by bringing in the farmers for discussions about rehabilitation and redesign so as to provide farmers with a sense of ownership and responsibility. The International Irrigation Management Institute studied two pilot turnover projects under the ISSP and found that, overall, the maintenance performed was more or less what was required with no long-term threat to deterioration of the canals (Burns and Atmanto, 1992). By the middle of 1991, the government had transferred over 400 irrigation systems covering 34,000 hectares to WUAs. Success for the program relies on early inclusion of farmers in the design and construction phase with flexibility in the formation of WUAs.

In Nepal a somewhat different approach was used to establish accountability and responsibility in irrigation system management. Farmer-managed irrigation schemes have been a long tradition in Nepal, with 70 percent of all irrigation under farmer control. However, more recently, the government has been heavily involved in managing new irrigation systems with poor results.

Consequently, the government shifted its approach and promoted farmer management as a way to improve irrigation performance and to reduce the financial burden to the government for irrigation development and operations. To support the new approach, the World Bank financed the Irrigation Line of Credit (ILC) Pilot Project with resources totaling close to US$20 million (Reidinger and Gautam, 1992). The ILC pilot project funded small- and medium-sized surface and groundwater schemes to be owned, operated, and maintained by legally recognized WUAs. The WUA must request the irrigation investment, contribute to capital costs, and accept full responsibility for O&M upon completion of construction.

In the first two years of operation, forty-three ILC surface subprojects were completed out of a total of sixty-one subprojects processed and approved for implementation, and eighty-one tubewells were drilled. Altogether, these subprojects serve an area of some 3,400 hectares and about 4,500 households in eight districts. Initial success of the project was due to the enthusiastic cooperation of the farmers and the substantial benefits they derive from reliable irrigation water. The WUA ownership and oversight improved the quality of construction, adding a much needed element of transparency and assurance concerning the use of governmental resources. The WUAs created accountability and assurance through strong organizations with good cost recovery and penalties on members who fail to abide by the rules (Reidinger and Gautam, 1992). However, motivated by the fear of future loses in rents, the government has now withdrawn its support for this approach which has resulted in its demise.

The Argentina experience in forming large WUAs highlights a further potential benefit from WUAs. The traditional irrigation in Mendoza were 100 to 500 ha. in size and were not able to take advantage of some of the economies of scale associated with large systems. This situation changed when the WUAs were able to merge into large ones of 5,000 to 15,000 ha. which allowed them to take advantage of economies of scale and utilize professional management to manage

water delivery, cost recovery, and system maintenance. The administrative costs are now lower and conveyance efficiency has been increased by 10 percent through more efficient water distribution. Twenty-one new organizations have been formed covering over 200,000 ha. Each organization is autonomous, raises its own budget and issues its own regulations in accordance with the recently enacted water law (Chambouleyon, 1989). The WUA's autonomy and direct hiring of professional management have provided the necessary accountability and assurance concerning operations of the irrigation systems while also producing significant cost savings.

Colombia provides another example of effective large WUAs. The management of two irrigation districts, the Coello (27,187 hectares) and the Saldana (13,985 hectares), was transferred to the WUAs. The WUAs maintain detailed and comprehensive rules, with elected officials and active participation by farmers. A 1989 evaluation by World Bank staff of the Coello district found the system well-equipped and managed with sophisticated technology. Operation and maintenance is covered through both fixed and volumetric charges, with the fixed rates covering 50 percent of O&M costs (Plusquellec, 1989). Fixed and volumetric charges cover nearly 85 percent of expenses, with the remainder coming from equipment rentals, bank interest, and other charges. The success of the system is due to a dynamic farming sector, a high level of farmer training, continuity and accountability of staff, simplified and transparent operations, and regular maintenance. This provides the farmers with the needed assurances and sizeable irrigation benefits.

2. Well Irrigation

In many areas groundwater is the major source for irrigation water supplies. Possibly the most extensive use of groundwater resources is in South Asia, particularly in India, Pakistan, and Bangladesh. Here, the nation often was the initial investor in tubewell development. But it was unable to provide the appropriate O&M for the tubewells, causing them to fall into disrepair and disuse.

Farmers invested in tubewells in spite of the nation, with greater success. Major concerns with this private well development include the possibility of aquifer depletion, because of the open access nature of the groundwater resource, local monopoly pricing, and the inability of private owners to integrate surface and groundwater management. Farmers with the larger holdings and access to capital have been the typical owners of tubewells. However, water markets have become common in areas with private tubewells, and poor farmers are willing to buy water, often paying high prices, rather than rely on state tubewells. Examples from Bangladesh and Pakistan illustrate how governments can change their emphasis on public sector irrigation and effectively promote private sector development. In addition, an example of private groundwater development in the Deccan Plateau of India shows how unregulated open access to groundwater can create serious problems.

Public investment in tubewells has a long history in Pakistan. The Salinity Control and Reclamation Project (SCARP), begun in the 1950s, was designed to reduce waterlogging and salinity problems. Over time, problems of poor maintenance, inefficient installation and management began to emerge. The pumping capacity of SCARP tubewells declined an average of 4 percent annually, with 205 percent of the tubewells not operating at any one time (World Bank, 1984). SCARP tubewells account for about 10 percent of irrigation water supplies, yet require 55 percent of the total O&M expenditures in the irrigation sector.

The inadequacies of the SCARP tubewells, along with the demonstrated benefits of tubewell investment, provided incentives for private sector investment. Originally, private sector involvement came with no encouragement by the government. Slowly, beginning in the 1960s, the government began to liberalize imports of the necessary equipment. Over the following two decades, while continuing SCARP investment, the government also encouraged more private investment through increased credit availability, fuel subsidies, and an extension of the electrical grid. Between 1964 and

1976, private tubewell use grew by around 38 percent annually. By 1990, over 250,000 private tubewells had been installed in the country, as opposed to approximately 13,000 SCARP tubewells.

The performance of private tubewells has been far superior to SCARP tubewells. About 90 percent of the private tubewells are operating at any one time, with a shorter down time because the beneficiaries (farmers) now have responsibility for all O&M and as a result there has been a growth in small repair shops and availability of spare parts. Most are shallow tubewells, which are more appropriate for the individual farmer. These tubewells allow farmers better control over the timing and use of supplemental irrigation water. Private tubewell development has replaced public investment at both a savings to society and a benefit to farmers.

Similarly in Bangladesh, up until the mid-seventies, tubewell development was mostly performed by the public sector through the Bangladesh Agricultural Development Corporation (BADC). BADC rented, at heavily subsidized prices, deep tubewells, shallow tubewells (STWs), and low-lift pumps (LLPs). The supply system, however, was limited and inefficient with the equipment neglected due to a shortage of parts and qualified maintenance personnel. As the system deteriorated, the World Bank encouraged the Government of Bangladesh (GOB) to allow private sector investment in the irrigation sector.

Beginning in the late 1970s and early 1980s, GOB began to eliminate many of the subsidies and import restrictions on agricultural inputs and minor irrigation equipment. This enabled the private sector to compete with the BADC. Sales of STWs rose from 4,485 in 1980 to over 39,000 in 1983 (World Bank, 1990b). Hand-operated tubewell sales rose dramatically from 763 in 1980 to over 90,000 in 1984. All sales decreased with the reimposition of import and setting restriction in 1985, but rebounded when the government loosened all restrictions after the floods in 1988. Between 1988 and 1989 there was a 22 percent rise in the use of STWs and LLPs. By the end of the eighties, the private sector had virtually taken over the STW and LLP market.

As in Pakistan, the majority of the ow ers of STWs are medium to large landholders. Yet the substantial growth in STWs has benefitted the small landholder through a more active water market. In one World Bank funded project area it was found that for each STW owner, there were about fourteen water purchasers. A Bank study found that for each hectare irrigated by an STW owner, water purchasers irrigated another 2 hectares. At present, Bangladesh apparently has ample quantities of groundwater to supply a continuing growth in tubewells.

Private wells development has also become increasingly popular in India and has been strongly encouraged by government policies. The government has provided low interest loans, through the National Bank for Agriculture and Rural Development (NABARD), for the purchase of pumps. In addition, a flat rate for electricity use was introduced in 1982. The result was rapid exploitation of the available water with electric pumps. Since farmers with electric pumps do not face a marginal cost for the open access groundwater that they pump, there is no incentive to conserve water. Furthermore, farmers can sell pumped water to neighbors who do not own their own pumps at prices below the marginal social cost. The result has been a rapid decline in the water table in a number of areas. For example ,in parts of the states of Tamil Nadu and Karnataka the average water table level dropped from only 25 to over 160 feet below the surface (Chandrakanth and Romm, 1990). These declining water tables greatly increase the cost of pumping, cause the failure of many shallow wells, and result in an ecological imbalance in environmentally sensitive areas. Thus unrestricted private tubewell development can have a significant negative effects overtime. This could be corrected by establishing tradeable groundwater rights or by effectively regulating well installation and withdrawal rates.

C. Decentralized Delivery of Water Supply

In many developing countries the performance of the water supply delivery organizations is poor, with maintenance a chronic problem. Many water supply systems are plagued by high levels of

unaccounted-for-water (UFW) due to leaks, old pipes, illegal connections, and a lack of meters. In industrialized countries, UFW values are about 10 to 15 percent of net production while a World Bank study found UFW losses in most Latin American cities ranging from 20 to 50 percent of net production (Yepes, 1992). The revenue losses resulting from these high UFW losses represent an important potential source of funds to improve O&M. In Bogota, the revenue losses have been estimated to be equivalent to 25 percent of total billings. "If captured, these financial resources would have been more than adequate to meet all debt service obligations (US$195 million) during this period." In Mexico City, the authorities have no "credible plan to meter consumption, maintain meters, and reduce the number of illegal connections. The magnitude of this neglect, coupled with low rates, requires a federal subsidy in excess of US$1 billion a year (0.6 percent of GDP), an equivalent to the annual sector investment needed to supply the total population of Mexico with adequate water and sanitation services by the end of this century" (Yepes, 1992 p.v.).

As noted in the introduction, establishing institutional and regulatory arrangements that foster efficient water supply systems is complicated by the potential for natural monopolies in the collection, purification, and delivery of water. In addition, large numbers of households, many poor, still lack access to decent water supplies, although they have a substantial willingness to pay for a domestic water supply as shown by what they pay private water vendor (World Bank, 1992). One way governments can improve and extend water supplies is through a program in which the government provides capital for and regulates water supply services while construction is done by private firms and private entities or user groups operate the facilities. In this way, urban and rural communities can reduce government failure while limiting market failures.

1. Urban Water Supply

Three types of arrangements for decentralizing water management that are being used in urban areas include: service contracts, lease contracts, and concessionaire contracts. With service contracts, a public water company engages a private firm to produce specific operational services such as meter reading, billing and collections, and operating facilities. Under a lease contract a private firm rents the facilities from a public authority and assumes responsibility for operations and maintenance. The lessee finances working capital and replacement of capital components with a limited economic life, while the public authority is responsible for fixed assets. With concessionaire contracts, a private firm finances fixed asset investments, in addition, to working capital. Assets are owned by the firm for the period of the concession and are transferred back to the public authority at the end of this period (Yepes, 1992). These arrangements are already observed in different developing countries and are designed to use competitive market forces to improve the deliver of water services. Three recent examples highlight these approaches.

In 1977, EMOS, the water utility for Santiago, Chile, began to encourage its employees to leave the company and form private firms that would bid for service contracts. Contracts were awarded for one to two years under competitive bidding for meter reading, maintenance of the pipe network, billing, vehicle leasing, and more. This approach reduced public employment and costs, shortened response time and provided better service. EMOS is now one of the most efficient public water supply companies in the region in terms of number of staff per population served.

Guinea which began to restructure its water supply sector in 1987 has used leasing contracts to supply water to its principal cities. This has improved the financial conditions of the utility responsible for delivering water and collecting charges. Early results are favorable with collections up from 15 percent to 70 percent (World Bank, 1992).

In the past 25 years, the urban water sector in the Cote d 'Ivoire has been operated by a private company, Societe de Distribution d'Eau de Cote d'Ivoire (SODECI), under a mixture of concessions and lease contracts (Briscoe and De Ferranti, 1988). In 1960, SODECI was established as a subsidiary of a large, French water utility, to operate the water supply system of Abidjan under a concession contract. Subsequently, the majority of the equity was acquired by Ivorian shareholders, and the shares are traded on the Abidjan stock exchange. In 1974 SODECI's contract was extended to include three new elements: a lease contract for the O&M of all urban and rural water supply outside the capital; a concession contract for Abidjan including investment in boreholes, as well as the O&M of the system; and a maintenance contract for Abidjan's sewerage and drainage. SODECI collected the approved tariff from consumers, deducted its fees due under the contracts, and transferred the remainder to the two public funds in the water and sanitation sector. Until the arrangements were changed in 1987, SODECI took on limited commercial risk, because it was compensated for any shortfall between actual and projected sales (Triche, 1990a).

By 1989, 72 percent of the urban population had access to safe water, compared with 30 percent in 1974. About 80 percent of the rural population were served by wells equipped with handpumps, compared with 10 percent in 1974 (though many of them were not in working order). There was a high level of operating efficiency in urban areas, with unaccounted-for-water at 12 percent and the collection rate for private consumers at 98 percent.

2. Rural Water Supply

The link between community participation in project development, user responsibility for O&M, and quality of service has been demonstrated by the success of a many rural water supply programs in Africa, Asia, and Latin America. Several donors, including UNDP, have been involved in community-managed rural water supply projects. Programs in Colombia, Malawi, Paraguay, Kenya

and Bangladesh, are examples of community managed systems with limited government support. All five programs have developed mechanisms, such as the community organizers to reduce the transaction cost of organizing. In Kenya and Bangladesh, the organizers made successful special efforts to involve women who are the primary managers of water for domestic uses. To establish accountability and assurance in the communities, each project required a major community commitment for building as well as operating and maintaining their water system. The communities must then deal with any excludability problems or free rider that may arise.

Colombia has the reputation of having the best rural water supply program in Latin America. By 1980, 80% of the rural population in Colombia had access to safe water (Briscoe and De Ferranti, 1988). This is mainly due to a program, developed by the National Institute of Public Health (INS), which encourages community-managed water systems. In each phase of this program the responsibilities of the INS and the community are clearly spelled out and transparent. The INS provides design standards, instruction materials, and technical assistance for maintenance problems. Also, an INS promoter helps the community organize the system's Administrative Committee, and audits the Committees' ledgers to assure that they are the financially accountable. With this restricted government support, the contribution of the local community is quite different from mere "cost recovery". The community participates in project design, elects the Administrative Committee, raises funds through social activities, and provides materials, labor, transport, and cash for construction. The Administrative Committee operates, maintains, and regulates the system.

Malawi's program is very similar to that of Colombia. It started in a community of 2,000 people and has been replicated throughout the country. Currently, community owned, maintained, and operated rural water systems provide one million people with safe, reliable, and convenient service. Although ideally suited for small-scale, labor-intensive, gravity systems, this program is now being adapted to serve communities reliant on groundwater supplies. Governmental responsibility includes:

promoting community organization, conducting necessary hydrological and topographic studies, raising external funds, providing the engineering designs and standards, assisting in construction, and contributing technical services for maintenance (Briscoe de Ferranti, 1988). To further reduce the transaction costs of developing water supplies, government staff train community leaders in technical and organizational skills. The villagers organize themselves in order to: participate in project design and planning, contribute data to pre-project studies, provide labor for project construction, and operate and maintain the system.

In 1977 the World Bank approved the first of two loans for rural water supply and sanitation projects in Paraguay. Over the next thirteen years, the two projects have served 98 poor rural communities of between 400 to 4,000 people (over 250,000 in total) (World Bank, 1991a and 1987). In these projects, the communities are responsible for all O&M and pay a portion of the construction costs. To receive support, a community must form a committee, or junta, and agree to contribute a minimum of 22 percent of investment cost, that is, 10 percent in cash and labor during construction and the remainder as long-term debt (with interest). The fees are set with a concern for fairness since the socioeconomic level of the community is taken into account. But the fee still must cover debt payment and O&M, and also contribute to a fund for major repairs and replacement parts.

While there were delays in implementing the projects, mainly due to weaknesses at the government rural water supply agency, the projects have been an overall successful. The juntas are motivated, function well, and manage the systems satisfactorily. The fee structures appear to be fair and affordable. By 1985, nearly all of the juntas that were formed under the first project had budget surpluses. Results from the second project show total contributions ranging from 18 to 68 percent (weighted average of 50 percent) of investment costs.

In the southern coastal area of Kenya, the World Bank teamed up with UNDP and its affiliate agency, PROWWESS (the Promotion of the Role of Women in Water Supply and Environment

Sanitation Services) to provide access for the poor to safe water supplies. Beginning in 1983, the project developed and installed hand pumps in rural communities. Early problems prompted the organizers to bring in a local NGO, specializing in developing self-help water systems and focusing on women's participation. Since water management for the household is essentially the responsibility of women, the project recognized that it was important to have women involved in providing the service. This helped improve the link between the beneficiaries of the project and the costs of providing the desired services. Women were trained as extension workers and in community organizing and development. Both men and women were trained for the appropriate maintenance and repair tasks. The local NGO motivated village men and women to organize themselves into water committees, which were responsible for maintenance and repairs. By 1988, 135 village water committees existed, all of which had women in the key position as treasurer. All of the pumps were functioning. The project gave villagers assurance that the community water system would be effectively operated and maintained while it increased the respect and acceptance of women in public decisionmaking. In the project area, between 1985 and 1987, there was a 50 percent decline in diarrhea and a 70 percent decline in skin diseases (Narayan-Parker, 1988). The project also resulted in resource savings for both government and the villages.

In Mirzapur, Bangladesh, a similar PROWWESS program helped to install hand pumps and latrines. Again, the project was designed to be community based, with a strong emphasis on the.inclusion of women. From the beginning, women were involved in selecting project sites and in maintenance of the systems. In the intervention area, 148 Tara hand pumps were installed (1 for every 33 inhabitants) and 754 latrines (Aziz et. al, 1990). Ninety percent of the households used the hand pump for practically all domestic use compared to only 20 percent outside the intervention area. Ninety-eight percent of the adult population said they used the latrines regularly. Within the intervention area, there was a noticeable decline in diarrhea and other water related diseases.

D. Conclusion

Private sector involvement and user participation in water resource management are not new. The examples given demonstrate the willingness of the private sector and users to play a larger role in water resources management and improve water use. User participation and private sector involvement, if properly structured, can provide the necessary incentives for stabilizing and improving the efficiency of irrigation and water supply systems. It can add flexibility, transparency, and accountability as well as lessen the financial and administrative burden on the State. For example, 1989 World Bank review of twenty-one impact evaluations of irrigation projects found cost recovery to be excellent in those projects, in which water management and O&M had been entrusted to water users (World Bank, 1980a). Greater private sector and user participation offers an effective means to increase user responsibility for managing and financing water projects while freeing governments to focus on broader water resource management concerns.

The examples of decentralized water management in developing country water supply and irrigation systems points out several important government activities. First, governments will need to play a more active role in regulating the private sector exploitation of groundwater especially for irrigation. Second, the governments will have to take measures to encourage price competition among private suppliers of water for both domestic and agricultural users. Third, governments should play an active role in organizing WUAs particularly for irrigation and rural water supply systems and in providing technical assistance. As highlighted in numerous examples, such activities should be designed to reduce the transaction costs of organizing and to establish a sense of assurance and accountability within the water user community. Once this is done, the community can deal with problems associated with excludability and unwillingness to pay.

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Table 1. Public and Private Goods Market Power and Externalities in Water Systems

	Nature of the Good		Market Power		
	Subtract-ability	Exclud-ability	Contest-ability	Externalities	Comment
I. Water Supply					
A. Piped					
1. Trunk System (intake pumping station)	H[2/]	H	L	PH, GD	PG
2. Distribution System	L	M	L	PH	PUG
3. Terminal Equipment					
a. Common (i.e. handpump)	M	L	H	PH	SF,PUG
b. Individual (i.e. home faucet)	M	H	H	PH	PG
B. Village wells	M	L	H	PH	SF, PUG
C. Vending (tanker trunks etc.)	H	H	H	PH	PG
II. Irrigation					
A. Surface water					
1. Trunk System (dam, main canal)	M[3/]	M	L	WL, E	PUG
2. Distribution System secondary & tertiary canal	M[3/]	M	M	WL, ND	PUG
3. Terminal system (on farm) gravity					
a. Field to field irrigation	H	L	H[1/]	WL, ND, S	OAR
b. Individual farm	H	H	H[1/]	WL, ND, S	PG, HTC
4. Terminal System requiring lift	H	H	H[1/]	WL, ND, S	PG
B. Groundwater					
1. Deep Tubewells					
a. Pumping facilities	H[2/]	H	M	GD	PG, OAR
b. Distribution System	M	M	M	WL, S	PUG
c. Terminal System	H	H	H[1/]	WL, S	PG
2. Shallow tubewells	H[2/]	H	H	WL, S	PG, OAR
C. Run of the River Systems					
1. Headworks	M[3/]	M	M		PUG
2. Distribution System	M[3/]	M	M	WL, S	PUG
3. Terminal System	H	H	H[1/]	WL, S.	PG, HTC
D. Small dams and reservoirs					
1. Headworks	M[3/]	M	M		PUG
2. Distribution System	M[3/]	M	M	WL, S	PUG
3. Terminal System	H	H	H[1/]	WL, S	PG, HTC

H = Public health
WL = Water logging
GD = Groundwater depletion
ND = Introduction of new diseases
SF = Difficult to exclude users due to social factors
PUG = Public Good Characteristics
S = Salinization.
E = Erosion during construction & because of in-migration
L = Low, M = Medium and H = High
HTC = High transaction costs for trades beyond the tertiary canal
OAR = Open Access Resource
PG = Private Good

Source: World Bank Water Resources Management Policy Paper, 1993 and Kessides, 1992.

1/ Function usually performed by private farmers.
2/ The degree of subtractability associated with a given well actually depends on the nature of the aquifer from which the well is drawing. High water resource scarcity is assumed.
3/ The degree of subtractability depends on the scarcity of water and the canal capacity.

Abstract

Decentralizing Water Resources Management: Economic Incentives, Accountability and Assurance

The fiscal crisis beginning in the developing world during the early 1980s has highlighted the weakness of a heavy dependence on government agencies for delivery of all water services. Institutional deficiencies ad government failure now over shadow many of the traditional market failure concerns (externalities, public good characteristics, and monopoly power). The lack of motivation and accountability of agency staff, political interference, rent seeking, and inadequate concern for user demands have created a vicious cycle that starts with consumers receiving poor service for which they are unwilling to pay. As a consequence, water agencies do not receive sufficient funds to maintain the water delivery infrastructure and prevent its deterioration which causes a further decline in service.

Decentralization of service delivery along with increased participation of water users has been adopted by a number of countries as a means to break out of this vicious cycle. Private firms and water user groups have been given control over system management and in some cases, even ownership. Service agreements, long-term leases, and concessionaire contracts have been used to incorporate of private sector efficiency into the management of specific water service activities such as meter reading, fee collection, and water delivery. In agriculture, tubewell development by the private sector has taken over the leadership in irrigation expansion.

The results are encouraging as illustrations from Asia, Latin America, and Africa show that water system performance can be improved by decentralizing service delivery. Farmers have taken charge of irrigation systems from the Ihilippines and Indonesia to Argentina and Columbia. Private tubewell

development has been a major source for expanded food production in many parts of the developing world, especially South Asia. Rural water supply systems in Kenya, developed and managed by villagers, have reduced the diarrhea by 50 percent and skin diseases by 70 percent. Similar water supply systems have significantly reduced diarrhea and other water related diseases in Bangladesh.

These successes in decentralized water delivery are encouraging other countries to make similar changes. This means a change in roles for many government agencies in water resources management to focus on: (1) regulating the private sector over exploitation of critical groundwater areas, (2) fostering price competition among water suppliers, (3) helping water users to organize, (4) regulating land and water use practices that cause water pollution, and (5) providing technical assistance. Yet, for large investments and main system operations government agencies will continue to play a direct role in water development and management.

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