Irrigation is crucial to China’s agricultural productivity. Though less than 40 percent of the cultivated land is irrigated, those lands yield two-thirds of the nation’s produce. The Chinese government and farmers have thus invested heavily in irrigation. The economic reforms that China began in the 1980s revealed several problems with its irrigation systems: low system capacity, slow and spotty water delivery, massive water waste, and low productivity relative to the water used. These problems stem as much from poor operation and management as they do from any lack of funds for maintaining and fixing the systems. For decades, many irrigation systems began falling apart as soon as they were built.

Under the old command economy, irrigation-system management was dispersed among different levels of government administration, rather than concentrated in more efficient hydraulic units. Water was priced below cost, or not charged at all. As a result, each new irrigation system became another burden on government administration, which lacked funds for the operation and maintenance (O&M) of any of them. There were widespread “gray water charges,” fees nominally collected for water but used for other purposes. Moreover, the water charges that the farmers actually did pay were calculated by land area irrigated rather than by volume of water used (volumetrically); farmers thus had no incentive to use water efficiently.

Since the government administered the irrigation systems, farmers had no say in their operation even though they had invested much labor and capital in them. The farmers therefore cared little about system maintenance and instead worried about getting enough water delivered on time. Lack of feeling of ownership and inadequate farmer participation thus contributes to the problems mentioned above. In the peak irrigation season, farmers would conspire against one another to get better access to water. As these examples suggest, China’s irrigation problems required institutional as well as physical change. As part of its 1990 rural reform strategy, the Chinese government proposed to rehabilitate the irrigation sector. The Bank’s assistance in this period proved crucial.

The first Bank-supported water project to propose both physical rehabilitation and management reform was the Yangtze River Basin Water Resources Project (“the Yangtze project”), in the early 1990s. The project involved building two new, large-scale irrigation systems in Hunan Province and improving four large-scale systems in Hubei Province, where the “vicious cycle” of poor performance followed by system deterioration was fully evident. Detailed field preparation work indicated that, although the design and upkeep of the physical systems contributed to irrigation inefficiency, irrigation management was more important. The Bank task team and its Chinese counterparts decided to prepare a project that would address institutional reform alongside physical rehabilitation, to make the new systems sustainable.

Local and international experience has shown that participatory irrigation management by farmers (PIM) contributes to institutional improvement. In Hubei, the task team discovered some participatory incentives that were already in place and were improving management at the user-end of the irrigation system. For some years, farmers...
had operated several experimental “water user groups” that had responsibility for the local irrigation networks. These groups had delivered water and maintained the lateral canals quite well, suggesting that farmer-group management at the distribution-network level might work. The groups had two main weaknesses, though. First, they had to be re-established each year. Second, they could not elect their own leaders; local officials appointed them. Despite these drawbacks, the farmers saw these groups as their own and jumped at the chance to manage their own local irrigation networks. With elections and formal legal recognition, these groups could become permanent, farmer-managed water user associations.

The team found a model for managing the other end of the irrigation system in Hunan Province. The reformed Tieshan Water Supply Corporation in Tieshan Irrigation District was designed to gather the irrigation-management authority that had been dispersed among different levels of government into a single body responsible for a defined hydraulic unit. The Yangtze project combined these two innovations to create “self-financing irrigation and drainage districts,” or SIDs, which would maintain a “virtuous cycle” of timely water delivery and efficient O&M. A SID has two main parts: a water-supply corporation (WSC) or organization (WSO) that supplies water from the main headwork, and water-user associations (WUAs) that take care of the distribution networks. The two parts act like sellers and buyers of water. Neither the WSC nor the WUA is a for-profit entity, though; both act as a non-profit social/ productive service for farmers. The SID approach thus involved two meaningful transfers, one economic and one social: it transferred the irrigation system from a command economy to a market one, and it transferred management of the local irrigation systems from the government to the farmers themselves.

The first WUA was established in June 1995 at Hongmiao branch canal* in Zhanghe No. 3 Main Canal Irrigation District, in Hubei Province. Twelve more WUA pilots were established in this district alone in following years; the approach also spread to other project districts in Hubei and Hunan. Intensive preparation work—including socioeconomic surveys, village meetings and household interviews—was done for each WUA initiative. The teams disseminated project information, consulted farmers, and mapped local water and land resources, so as to contrast proposed hydraulic boundaries with existing township and village irrigation management.

Farmers warmly welcomed the project’s incentives for improving the canal system and its management. As their first step, the farmers established water-user groups (WUGs) on each lateral canal. Each of these groups then elected a head (larger groups might elect two) to represent them at a branch-level water users’ conference to establish a WUA. In their groups, farmers discussed local irrigation needs and their expectations for change, and reviewed and amended the WUA charter and regulations produced by the conference. In accordance with that charter, the representatives to the conference elected a WUA executive committee. The committee proposed a one-year plan to the conference for discussion and approval; once approved, the WUA was formally established. This process, begun in the Yangtze project, has since been repeated in several Bank-supported projects in dozens of provinces, with the enthusiastic cooperation of local farmers.

The WUAs could mobilize farmers so easily because farmers saw the obvious advantages in the system. Their mobilization in turn gave new impetus to local village works. Villages were rarely and coincidently set up on hydraulic boundaries, and they were happy to let the WUA help deal with irrigation matters and distribution-network maintenance. In many cases, villages volunteered resources to help establish the WUA, either lending it offices or providing the workspace with some furniter. Villages also often helped mobilize the community for both the WUA conference and the executive-committee election. In most cases, WUAs and villages serve different purposes in rural life, and they can thus cooperate without intruding on one another’s authority. In fact, they normally serve the same interests of the local population. Such clear allotment of institutional responsibilities and authority has helped farmer participation and WUA operation.

The WUAs were established to take over the branch system O&M, but first their irrigation-management skills had to be strengthened. The project authorities and local water bureaus held repeated training programs for farmers on water delivery, facility maintenance and financial management. Each year the WUA committee presented the water users’ conference with its plans regarding the amount of water needed, the irrigation schedule, any facility construction or repairs, and the related labor and finance arrangements. It then signed a contract with the water supplier and coordinated with it during the irrigation season to deliver, measure and submit charges for water.

WUAs coordinate water delivery among the lower, middle and upper reaches of the branch canal and organize water guards from the WUGs to monitor water-taking. The amount of water sold to the WUA was calculated volumetrically at the branch in-take; wherever possible, WUA internal water delivery to the WUGs along the lateral canals was also calculated volumetrically. Within the WUGs, farmers usually calculated water use according to the farm area of individual households (farmers are rarely able to measure the volume of water delivered to each farm). In turn, the WUA collects water charges based on the use by household, group and association, and then pays the water supplier according to the contract. This is very different from before. Previously water charges were

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* A branch canal can usually irrigate 5,000-10,000 mu of farmland (6.07 mu=1acre), covering 500-1,000 households (note that there is not a direct positive correlation between these two figures). Lateral canals feed off of branch canals and cover 50-300 households. Both irrigation and plot size obviously vary, depending on the terrain, rainfall, and availability of ground and surface water.
collected from the village or township, even though the village or township’s farms might draw water from several different lateral or branch canals. The charges flowed into the administration alongside agricultural taxes and other fees. It was difficult to tell which monies were actually spent on water—hence the room for “gray charges.” To remove this ambiguity, the SIDD approach involved only two entities in water charges: the water supplier (WSC/WSO) and the water user (WUA).

The institutional reforms had their desired effects: timely delivery, efficient water use, and better O&M. Take the Zhanghe No. 3 Main Canal and Dongfeng Irrigation Districts—two of the major subproject areas in Hubei. Water-delivery efficiency and capacity through branch and lateral canals was raised 50 to 100 percent in Zhanghe and 30 to 50 percent in Dongfeng. Since water delivery was now calculated and charged volumetrically, farmers began to use water more efficiently. Each WUA saved about 1.18 million cubic meters of water per year.

The SIDD approach also needed less labor. Because the WUA ensured orderly water delivery, far fewer water guards were needed during the irrigation season. On an average, a WUA saved about 1,548 labor days per year. This amounts to ¥120,000 in labor costs, no small sum for poor farmers.

To keep the costs down, the WUAs had to keep the physical system in good shape. Most WUAs make annual plans for canal and facility maintenance, and organize labor and capital inputs in accordance with their priorities and needs. Like unified water delivery, the WUA system promotes unified maintenance. The physical system has thus improved under WUA management, which in turn keeps costs down.

Agricultural production has risen in the SIDDs. An independent investigation team from the Chinese Academy of Agricultural Science found that, because enough water was delivered when farmers needed it, WUAs raised paddy yields in particular and agricultural outputs in general. More concretely, the yield per mu had risen from 722.1 kg before the WUA to 764 kg after; about a 6 percent increase, of which about 35 percent was due to improved irrigation. Moreover, since yield per unit rose while irrigation water per unit fell, the average grain output value per cubic meter of water rose from ¥0.47 to ¥1.7.† Irrigation improvement contributed more than 40 percent of the increase.

The improvements in management and O&M allowed more land to be irrigated. The Zhanghe sub-project, for example, expanded its irrigated land by 15 percent. Furthermore, because of the better canal system and management, individual households in Zhanghe district could rely more upon canal water rather than pump water from local ponds or rivers. Since pumping is much more expensive, such a switch had been a major goal for many of the WUGs.

The SIDD approach has several pro-poor impacts. Several SIDDs are located in impoverished areas, like Liuduzhai in Hunan and Hetian, Kashi and Kerkzi in Xinjiang. The improved water service means that farmers can secure their harvests each year regardless of the weather. This contributes greatly to local poverty alleviation. The poorer and weaker households have some extra benefits. One major cause of poverty in such households is the lack of able-bodied male laborers, which made it hard to compete for scarce irrigation water in the old system. The WUA eliminated such competition, both by increasing the total amount of water available and assuring such households some say in its allocation through their participation in the WUGs.

In Zhanghe, a disabled married couple with two school-age children had to pay ¥200 for a water guard during the irrigation season. The increase in available water under the WUA reduced the incentive to steal. The WUA also appointed guards for the entire system, thus saving the family the special fee. Another poor family in Hubei’s Yindan district could previously use only the water left after others had finished their irrigation. With the WUA’s help, they now cultivate three mu of paddy, from which they earn ¥800 per year. The SIDD system thus extends the opportunities to benefit from irrigation to previously excluded groups, even as it lowers the costs for prior beneficiaries.

The SIDD approach’s impacts on improving irrigation and alleviating poverty are encouraging. It gives farmers a sense of ownership, increases system efficiency and transparency, encourages social inclusion and equity, reduces costs and enhances productivity. By the time the Yangtze project was completed in 2002, WUAs covered most of the irrigation/drainage districts in Hubei and Hunan. Meanwhile, about 500 WUAs (and 40 WSCs/WSOs) had been established under other Bank-assisted agricultural-development projects. The Ministry of Water Resources (MWR) disseminated the WUA approach as a good practice throughout the country. A SIDD Training Textbook, co-edited by the Office of Comprehensive Agricultural Development, the MWR, and the Ministry of Finance’s State Office of Comprehensive Agricultural Development, was published in 2001. With Bank help, a series of SIDD/WUA training programs have been carried out nationwide. These have included numerous field visits to the pilot areas and experience exchanges among WUA practitioners: government officials, line agencies and WUA chairmen. By 2002, when the MWR hosted the Sixth INPIM

* In the late 1990s, the cost for a man-day of rural labor on public works was ¥20, up from about ¥15 in the early 1990s; ¥8.26= $1. This rate is much higher than a farmer’s normal daily earnings from agriculture. In the Yangtze project areas, a farmer’s average net annual income was ¥2,000-¥2,200 per person, about half of which came from crop production. A household normally has 4-5 members. In poor areas like the Liuduzhai Irrigation District, income would be closer to ¥1,000-¥1,200.

† ¥1.70 would buy 1.70 kg of grain in China in 2000. This output is comparable to the 1.60-2.00 kg of grain produced per cubic meter of irrigation water in the United States in the same year.
International Conference in Beijing, China had some 2,000 WUAs spread through most of the provinces.

The experience of WUA development in China also identified some constraints and challenges for deepening and expanding the reform. More attention and effort are needed for four things. First, most SIDDs were established with project support and thus had favorable policies and funds. Not all irrigation and drainage districts will have this advantage. There needs to be overall policy support at the national and provincial levels, including funds for initial system rehabilitation.

Second, support from governments, especially from local township authorities, proved crucial to success. Because the reform threatens some of their vested interests, however, some township authorities might oppose a WUA. Such attitudes have indeed hampered the development of some WUA pilots. Efforts are still needed to sell the idea of participatory management to township staff. Meanwhile, substantial policy support from higher levels of government and demonstration of results by the WUA will help build township support.

Third, for decades, many local water authorities and irrigation districts have had a top-down, command approach to managing water delivery and system maintenance. Such authorities often try to apply the same approach to SIDD/WUA. This behavior retards the bottom-up concept of the SIDD/WUA approach and distorts its participatory nature. As a similar case study* urged, the traditional entrenched interests must be dislodged by replacing the conventional “patronage with participation” with a new paradigm of “partnership with empowerment.” To this end, four key principles of WUA have to be emphasized:

a) A WUA is the farmers’ own organization; farmers elect, farmers manage, farmers make decisions
b) A WUA is organized hydraulically, not on existing administrative divisions
c) A WUA measures and charges for water volumetrically
d) A WUA has the right and capability to collect water charges and submit them to the water supplier, to pay for water and for its own self-financing and management

Fourth, water charges must be revisited. The SIDD/WUA approach changes how charges are levied and collected, but the price of water in many areas is still set far below real costs. On the one hand, although the State Development Planning Commission (SDPC) and the MWR encouraged water price reform to meet the full water costs, most provincial governments continue to impose price ceilings on irrigation water, in order to “protect agriculture and farmers from too high production costs.” On the other hand, farmers also oppose raising water prices, because they already suffer under the heavy burdens of taxes, fees and compulsory labor. Water will not become a freely traded commodity overnight. Still, with the SIDD reforms, the government has agreed to separate water charges from other fees and taxes. This is an important step toward fair and transparent prices, and it makes self-management and self-financing easier for farmers. In fact, based on the cost-recovery studies of WUAs carried out during the SIDD training program, most WUAs were able to raise water charges 5-10 percent to meet their own operation expenses, as discussed and agreed at the WUA conferences. This action reflects the WUAs’ innovative attitude toward constraints and gives hope for their future performance.

In 2002, a combined SDPC/MWR research investigation of water prices in one hundred large- and medium-sized irrigation and drainage districts reviewed the roles of the established WUAs. It recommended formally regularizing the WUA’s status and functions in irrigation management. It further recommended mobilizing farmers and strengthening the coordination between the local water sector and township authorities, so as to expand the WUA approach. It also recognized that water prices are a bottleneck to further reform. These recommendations show that the government agrees that WUAs can both improve the lives of farmers and contribute to China’s ongoing agricultural reforms.