

Institutional Arrangements for Irrigation Management in Pakistan

*Waqar Jehangir
and
Intizar Hussain*

The term “institutions” is vague and means different things to different people. In sociology, the concept of institutions is defined as “an organized, established procedure” (Bandaragoda 2000). In institutional economics, the term “institutions” is defined as “the rules of the game in a society or more formally the humanly devised constraints that shape human actions (North 1990). In that sense, institutions are frameworks within which human interactions take place. The institutions set the ground rules for resource use and establish the incentives, information and compulsions that guide economic outcomes. The main purpose for the creation of institutions is to reduce uncertainty in the society by establishing stable structures for human interactions. Generally, institutions may be considered as combinations of policies and objectives, laws and regulations, organizations and their core values, operational plans and procedures, incentive mechanisms, accountability mechanisms, norms, traditions, practices and customs (Bandaragoda 2000). The main irrigation-related institutions include legal, social, political, economic and organizational components and can be divided into three categories, i.e., formal rules, informal rules and organizational structures. This paper will focus on the institutions that influence irrigation management at the primary, secondary and tertiary levels.

Formal Laws and Rules

The irrigation-related formal laws and rules in Pakistan were devised to allocate and distribute water on an equitable basis to irrigated areas with a minimum maintenance burden. The first irrigation and drainage law, The Canal Irrigation and Drainage Act, was enacted in 1873 and was amended and extended occasionally to meet the emerging needs. Derived from the provisions of this law, various management procedures were devised to operate and maintain canals, allocate and distribute water and resolve the conflicts. According to this law, the provincial government was the owner and manager of the canal water and drainage infrastructure at the primary and secondary level. The farmers were considered as “beneficiaries” and had responsibilities of distributing and using water supplies at the farm level. The management at the tertiary level was the responsibility of the farmers and the state could only intervene if asked to do so.

The Canal and Drainage Act of 1873 is the main legislation relating to the irrigation and drainage system at the provincial level. Under this Act almost the entire irrigation network is entrusted to the provincial government through the officials of the irrigation and revenue departments and the judicial officers. Several amendments to the 1873 Act have been made to deal with the specific requirements but the Act remained the major law throughout the irrigation history of Pakistan. Subsidiary legislation provided room for various operating rules, manuals of procedure and water rates. These manuals form the second component of the formal rules. Under the law, the management of the system is centralized, with no user involvement. The multiplicity and complexity of the formal procedures makes their implementation in the field quite difficult and impractical. The system of detailed record keeping provides several opportunities to the lower staff to indulge in rent-seeking practices. Therefore, the law has lost its relevance with the changed sociopolitical and water scarcity conditions.

For groundwater management, the Punjab Soil Reclamation Act was enacted in 1952. The objective of the law was speedy reclamation and improvement of waterlogged and saline areas and to prevent further damage to maximize agricultural production.

The Punjab Water User's Association Ordinance was promulgated in 1981. The Ordinance provides room for the involvement of irrigators in water management at watercourse level through the WUAs. Under the law, the field officer, i.e., the Director, On-Farm Water Management (OFWM), has control over the WUAs. He has the authority to register or refuse to register WUAs. Under the Ordinance, more than 50 percent of the water users of a watercourse may form an association and apply to the field officer for registration. The WUA does not have any management powers related to canal water. The field officer may entrust the maintenance of a watercourse to the association but this must be carried out to the satisfaction of the field officer. Under the law, WUAs are subsidy-oriented entities. There is no provision for continuous maintenance of infrastructure and resolution of disputes. Since the field officer is given the power to form WUAs basically to carry out maintenance work, the WUA members remain unable to internalize the essence of collective action for water management. As a result, most WUAs formed are defunct now.

The Punjab Irrigation and Drainage Authority Act (1997)

The Government of Pakistan is in the process of implementing the institutional reforms in its irrigation and drainage sector. In 1997, the Provincial Assemblies passed the Provincial Irrigation and Drainage Authority (PIDA) bills in all the four provinces. The reforms aim at decentralizing the irrigation management system through public and private partnership, farmer's participation and resource governance. The new institutional framework consists of three entities with restructured roles: Provincial Irrigation and Drainage Authority (PIDA), Area Water Boards (AWBs) at the canal command level, and Farmer Organizations (FOs) at the distributary level. The framework is to be tested in one pilot canal command initially. The PIDA has defined the functions of the AWB and FOs, though these are only meant for managing surface water. The rules, which regulate formation and functioning of the FOs, are listed below.

- Punjab Irrigation and Drainage Authority Pilot Farmers' Organizations Rules, 1999
- Punjab Irrigation and Drainage Authority Farmers' Organizations Registration Regulation, 1999
- Punjab Irrigation and Drainage Authority Pilot Farmers' Organizations Election Regulations 1999
- Punjab Irrigation and Drainage Authority Pilot Farmers' Organizations Financial Regulations
- Farmers Organizations Conduct of Business Regulation 1999
- Irrigation Management Transfer Agreement
- Scheme for Transfer of Irrigation Management: Farmer Organizations in Punjab

Informal Rules

In irrigated areas of Pakistan, the informal norms, values and practices form a strong institutional basis for organizational and social behavior at the grassroots level. The *biradri* (caste and kinship systems), landholding and farm sizes, tenancy, etc., determine the rural power structures, which influence water management at the tertiary level. Occasionally, these variables also influence the management of canals at the secondary level. The level of collective action for effective water management depends on the relative power structure, and the caste considerations. The informal rules of the society and the irrigation management go hand in hand in terms of various forms of *warabandi*¹ at the tertiary level of the irrigation system in the canal command areas. Various forms of water distribution practices adopted about a century ago with the common understanding of the irrigators have evolved in today's *warabandi* System.

Evolution of Warabandi

Water distribution at the tertiary level was primarily the responsibility of farmer beneficiaries at the watercourse level. Irrigation communities experienced social organization processes and established their own water distribution arrangements among users. Water distribution took place through *warabandi* or an irrigation roster, primarily determined by the amount of irrigated land owned by each member. The farmer-managed *warabandi* was called *kachcha* (flexible, informal) *warabandi*. Later, the government had to intervene due to the increasing number of water disputes, or when farmers requested additional water for increased intensities, particularly to nurture their fruit orchards in arable land.

¹Warabandi refers to the irrigation roster, a system of fixed water turns proportionate to the area of each user. For a comprehensive account, see Bandaragoda and Rehman 1995.

State intervention increased when farmers were exposed to new opportunities to acquire more water. Special allowances for orchards and other nontraditional needs were often misused. Sometimes, when a special allowance had been sanctioned, farmers exceeded the limit several times over to get more water. At other times, farmers obtained special allowances without actually owning an orchard. This flexibility was often the result of an alliance between lower cadre staff of the ID and more influential farmers. Invariably, such instances were unacceptable to the other, less-privileged water users. Disgruntled farmers either approached higher officials for some redress, or sought mitigation of these disputes through the judicial system. Successful settlement of disputes through this process encouraged more farmers to lodge complaints with the authorities.

Apart from these allocation-related disputes, farmer-managed water distribution at the watercourse level often resulted in conflicts among farmers, which sometimes culminated in violence. The main origins of these disputes were two interrelated social factors. The first was the existence of a number of heterogeneous groups in terms of caste, baradari, or kinship, political affiliation, etc., along the same watercourse command. The coalition and conflict of interests of various subgroups in the community fostered inequity in water distribution. The second was the *kachcha* practice, which became prone to manipulation by the more influential water users.

Confronted with growing problems of disputes, and inequity in water distribution caused by *kachcha warabandi*, some aggrieved water users expressed their preference for a fixed irrigation roster. Leading petitioners in such cases were mostly from the tail or middle reaches of the watercourses (Mirza 1975) who were more affected by actions of upstream users. Other affected water users usually agreed to sign the petition to formalize the irrigation roster.

In the Punjab province, the ID's interventions in water distribution, by fixing formal water schedules (*pakka warabandi*), started somewhere during the 1960s. By now, most of the watercourses in the area have switched over to *pakka warabandi*, and have discarded the flexible form of *kachcha warabandi*. This widespread phenomenon of switching over from the *kachcha* to *pakka warabandi* reflects the limited formation of social capital among the farming communities in Pakistan.

Types of Warabandi

The term *warabandi* is derived from two local words *wahr* and *bandi*, meaning "turn" and "fixed," respectively (Bandaragoda and Rehman 1995). Thus, this term translates into fixation of irrigation turns for the landowners along a particular watercourse. Essentially, *warabandi* is a rotational method to equitably distribute available water supplies in an irrigation system. Turns are fixed according to a predetermined schedule specifying the day, time and duration of supply to each irrigator, in proportion to the size of his landholding in the outlet command (Singh 1981; Malhotra 1982). In consideration of "fixing" water turns, this definition seems to apply only to the officially sanctioned *pakka warabandi* schedule, which is determined and "fixed" by the ID.

Pakka Warabandi

A pakka warabandi generally follows a cycle of one week, or 10 1/2 days. Furthermore, the 12-hour pakka warabandi rotation is alternated every year, generally after the annual canal closure in December-January, so that farmers who had been irrigating at night during the previous year will irrigate during daytime hours during the next year. This warabandi is sanctioned by respective Executive Engineers of the ID, and also serves as proof of water rights for shareholders along the watercourse (Bandaragoda and Rehman 1995).

Kachcha Warabandi

Unlike pakka warabandi, farmers distribute water entering their watercourse by following an agreed irrigation roster without the formal involvement of the governmental agency. This type of warabandi is generally referred to as kachcha (ordinary, unregulated, informal) warabandi (Bandaragoda and Rehman 1995). This type of warabandi provides turns that are generally fixed and predetermined, but the day and timing of each turn is flexible and depends on the availability of water in the watercourse.

Water Management Organizations

There are several agencies involved in managing the irrigation supplies and drainage in the irrigated areas of Pakistan. These include:

- Water and Power Development Authority (WAPDA).
- Punjab Irrigation Department (PID).
- On-Farm Water Management Directorate (OFWMD).
- Salinity Control and Reclamation Projects (SCARP) staff.
- Punjab Private Sector Ground Water Project (PPSGWP).
- Agricultural Development Bank (ADBP), etc.

Water and Power Development Authority (WAPDA)

WAPDA, linked with the Federal Ministry of Water and Power, was created in 1958 as an autonomous agency to supervise the construction of large-scale infrastructure in the Indus Basin Project. It remains as an agency responsible for the dams and interprovincial link canals, and operates these facilities with the consultation of PIDs according to water rights and the seasonal allocation of the provinces. In the irrigated areas of Pakistan, WAPDA was

responsible for the planning and installation of tube wells for the SCARP and for the tile drainage projects.

The Provincial Irrigation and Drainage Authorities (PIDAs)

The PIDAs, transformed from the PIDs are autonomous bodies responsible for policy formulation, legal enactment and overseeing the overall management of the irrigation and drainage systems in the respective provinces. The PIDAs are responsible for the O&M of the irrigation systems extending from the headworks to the main canals, distributaries, to the outlets in the watercourses in the provinces. The role of a PIDA is defined in the already-mentioned different Acts, rules and manuals.

Currently the PIDA is in transitional stage and, ultimately, it will be a financially autonomous body with independent revenue collection and spending authority with proper accountability. Below PIDA in each province, financially self-accounting AWBs are to be created on an experimental basis. And below AWB, FOs will be formed, again on a pilot basis, along the distributary level (secondary level). The AWB will receive water from PIDA and deliver it to FOs and the latter operate and maintain the distribution channel with financial autonomy and management. An FO is formed and owned by the farmers of the command area of the distributary.

PIDA manages primary and secondary network of canals, drains, and public tube wells through its irrigation circles, divisions and subdivisions. The main responsibility of O&M lies with the Executive Engineers, Subdivisional Officers, and the Subengineers. Most of the maintenance is undertaken through contracts. The revenue assessment is carried out through *Patwaris* and *Zilladars*. The collection is the responsibility of the Revenue Department that collects the water charges through village-based *Lumberdards*. The revenue and spending on irrigation and drainage are not linked to each other.

The Area Water Board (AWB)

The pilot AWB in the Punjab province is established in the Rechna Doab subbasin on the Lower Chenab Canal (LCC) East. The AWB covers about 0.4 million hectares. The LCC AWB is responsible for the irrigation and drainage management of the primary level and supplies services to around 100 distributaries where FOs are being formed. In 43 canal commands of Pakistan, altogether 43 AWB will be established. The AWB will have functions similar to those of a utility company. The AWB will be in charge of a particular area and will comprise the representatives from FOs, the PIDA, the Agriculture Department, and some technical members. The AWBs will operate through their management board. For the canals where AWBs have yet to be formed, the canals are being managed through irrigation and drainage circles, divisions and subdivisions. The responsibilities of PIDAs in such areas extend up to the head of the watercourses, and dispute resolution within the watercourses. A PIDA also assesses the revenue.

Farmer Organizations (FOs)

The FOs are being established at the distributary canal command level. The FOs will receive water from the AWBs and distribute the same to various watercourse farmers and other users. The FOs will operate and maintain distributary canals and assess and collect revenue. About 40 percent of the collected revenue will be given to FOs for O&M of the channels. The FOs will have to sign an Irrigation Management Transfer (IMT) Agreement with PIDA to take over management. So far, some 20 FOs have been established but the management is yet to be transferred. However, in the southern Punjab, IMT Agreements have taken place between three FOs and the PIDA.

On-Farm Water Management (OFWM)

The OFWM program implemented in 1976 has 20 years of experience. The Agriculture Department is in-charge of the program. Primarily tertiary level construction works such as land leveling and watercourse lining have been undertaken through this program. Farmers' participation is an important element of the program, since farmers can gain a sense of ownership and undertake better quality work. The staff first organizes the water users into a WUA and registers them and undertakes the works. In all OFWM works, farmers contribute 50 percent of the total cost, in both cash and kind. To ensure farmers' participation the department assists in organizing WUAs. After informal activities of WUAs, from 1976 to 1981, the WUA Act was enacted in 1981 and WUA became a formal group. Most of these WUAs became defunct after completion of the construction work. Now, the OFWM is attempting to organize farmers into FOs for distributary management.

Salinity Control and Reclamation Projects (SCARPs)

Waterlogging and salinity have been major problems in Pakistan's irrigated agriculture. In Rechna Doab, waterlogging was first noticed a few years after the opening of the Lower Chenab Canal in 1892. At that time, the water table in other parts of the Doab was fairly deep and irrigation applications were quite adequate for crops and for the leaching requirements of the soil. During the period 1912-52, various institutional arrangements and works were carried out in an attempt to solve the problem. These include the establishment of the following:

- Waterlogging Board, 1912
- Provincial Drainage Board, 1917
- Waterlogging Inquiry Committee, 1925
- Rural Sanitary Board, 1925
- Waterlogging Board, 1928

- Land Reclamation Board, 1940
- Soil Reclamation Board, 1952

The Groundwater Development Organization of the Punjab Irrigation Department, subsequently named as Water and Soils Investigation Division (WASID), was established in 1954. After the establishment of WAPDA in 1958, WASID was transferred to WAPDA. The objective was to investigate the water and soil resources of the Punjab plains to better understand waterlogging and salinity problems, and to provide basic data for reclamation planning (Khan 1978).

To reduce the problem of waterlogging and salinity, the Government of Pakistan also started the vertical drainage scheme as SCARP projects during the 1960s. The basic aim of the salinity control and reclamation program was to reduce the culturable waste areas under waterlogging and salinity. The scheme was thought to be beneficial in two aspects, providing vertical drainage to waterlogged areas and augmenting the water supplies through deep tube wells available for use along with surface supplies.

The SCARP was considered effective in eliminating waterlogging, controlling salinity and providing additional irrigation water to increase cropping intensities and yields. However, in the mid-1980s, the following problems were identified, which were resolved through the SCARP transition and improvement projects:

- With the deterioration of the operational efficiency of SCARP tube wells over time and the consequent reduction in pumpage, the water table started showing a rising trend in most parts of the area.
- With increasingly high power tariffs, rapid depreciation of tube wells and low water rate for tube-well supply, the O&M costs of SCARP tube wells were becoming both high and an unsustainable financial burden on the irrigation sector of the O&B budget.
- Replacement of a large number of aging tube wells was needed.
- Farmers were generally dissatisfied with the performance of the SCARPs but accepted the services because of highly subsidized rates of water supply from SCARP tube wells.
- With frequent repairs and fault removals needed by aging tube wells, the ID had limited capacity to manage and operate SCARP tube wells

In the late 1980s, a pilot project for the transition of SCARP tube wells in the Khanqah Dogran scheme of the first SCARP was launched. The basic concept was the involvement of private sector pumping for irrigation from shallow groundwater generally falling within freshwater limits to balance the drainage requirement of the pilot project area where public-sector operation of SCARP tube wells was terminated.

The objectives of transferring fresh groundwater pumpage were to meet irrigation and drainage requirements more effectively and to increase agricultural production and farm incomes through conjunctive use. The objectives were to be achieved by electrification and installation of private tube wells, irrigation/ drainage improvement works (e.g., lining of minors and watercourses) and institutional developments. Under the pilot project, 213 SCARP tube wells were transferred and replaced by 2,100 private tube wells by providing necessary financial incentive and technical guidance to the farmers (ACE-NESPAK-NDC 1997).

The successful implementation and enthusiastic response from the farmers of the SCARP Transition Pilot Project led to the development and execution of the Second SCARP Transition Project. The transition activities were expanded to the remaining schemes of the first SCARP by replacing 1,353 SCARP tube wells through the installation of 4,700, comparatively, shallow private/community tube wells operated by farmers/groups of farmers (ACE-NESPAK-NDC 1997). Included in the project was a hydrogeological study to collect and update data forming a basis for analysis of the long-term sustainability of groundwater withdrawals and its use in the project area without causing any undesirable effects on the hydrogeologic regime and environment. The study concluded that the distribution and pattern of pumping did not indicate significant vertical or lateral movement of groundwater of undesirable quality in future at large scale and recommended to regulate the number and distribution of tube wells in the project area by a public agency.

On the successful culmination and enthusiastic reception by farmers of SCARP transition projects, the Government of the Punjab is executing and cofinancing with the World Bank the Punjab Private Sector Groundwater Development (PPSGD) Project in the province for a 5-year period (1997–2002). The project lies in the fresh groundwater areas of the Second SCARP (including Shahpur), The third SCARP (Rangpur Unit) and remaining SCARPs within Rechna Doab (Fourth-Muridke Mangtanwala and Fifth-Shorkot Kamalia). The PPSGD Project also covers saline groundwater areas of the Second SCARP and saline groundwater pockets within, and at the boundaries of, fresh groundwater areas (PGC 1999). The project envisages disinvestment of 4,230 SCARP tube wells and establishment of 6,360 private tube wells owned by individuals/groups of farmers.

The SCARPs Monitoring Organization (SMO), a subunit of WAPDA is responsible for monitoring the changes in the groundwater. It monitored the results of the vertical drainage strategy adopted by WAPDA. Its mandate is to collect data on the depth to water table through a network of observation wells located in the selected locations in the irrigated areas of Pakistan.

Planning and Scheduling of Water Deliveries in the Irrigation Command Areas

Planning and scheduling of the water deliveries in the main canals and the secondary canals are the PIDA's responsibility. The planning is done for each cropping season (kharif and rabi). The PIDA staff schedules water for a particular subdivision based on the culturable command area and is responsible for delivering the scheduled water to the main canals and to the

secondary canals in that subdivision, subject to the availability of water in the upstream system. The supplies depend on the release of water from the storage reservoirs by WAPDA.

At the tertiary level the farmers manage the distribution of water through the weekly warabandi system. The water users are also responsible for the maintenance of the watercourse and for implementation of warabandi but, if there is some dispute, the PIDA intervenes at the farmers' requests to resolve the problem.

Resolution of Water Disputes

As mentioned earlier, under the Canal and Drainage Act of 1873, there is provision to resolve the disputes among water users. The Subdivisional Canal Officer (SDCO) is responsible for allocating the warabandi and to resolve warabandi-related disputes. He is also responsible for implementing the orders of the Divisional Canal Officer regarding new sanctioned watercourses and to adjust the claims from the joint users. Under the PIDA Act of 1997, there is a built-in mechanism to resolve the disputes. The responsibility for resolving disputes regarding the formation of the association, election of office bearers, framing of bylaws, etc., is entrusted to the FOs. In case of any dispute of this kind an appeal can be made against the decision to the "Appellate Board" of the WUA. In case of disputes relating to the operational aspects of irrigation they are referred to the AWB and PIDA and are settled under the laws relating to irrigation.

Summary

In the canal command areas of Pakistan the irrigation institutions performed well under different irrigation rules till about two decades ago. The increase in demand for grains and the population pressure forced the cropping intensity to increase threefold than the intensity on which this system was designed. It has resulted in a situation where inequities appeared in the system. On the one hand, the farmers were facing problems of acute shortages of irrigation supplies and, on the one hand, they experienced problems of waterlogging and salinity. The problem of waterlogging originated due to seepage from the irrigated canals and to lack of drainage infrastructure to drain out the water seeping out of the irrigation canals.

To rescue the farmers from the waterlogging problem the government introduced the SCARP project in early 1970s. The SCARP achieved some success in solving the problem of waterlogging but it led to the problem of secondary salinization due to poor-quality water of deep tube wells installed under the SCARP project. At a few places, sodicity is also posing a high threat to the irrigated agriculture in the Rechna Doab. The farmers at the tail ends of the systems suffered due to the exploitation by the farmers of the head reach. The huge investments of the SCARPs have also taxed the budget of O&M for the canal system. Most of the maintenance budget is now directed to SCARPs, impinging on the physical health of the canal system.

Farmers complain about the delays in O&M of the system and the PID complains about the scarcity of funds required to undertake the necessary O&M in the irrigation structures. To improve the situation the Provincial Government has passed the PIDA Act of 1997, which is expected to help improve the situation in the canal command areas.

Literature Cited

- ACE-NESPAK-NDC. 1997. *Hydrogeological studies, final report, second SCARP transition project*. Lahore: Irrigation and Power Department, Government of Punjab.
- Bandaragoda, D. J. 2000. *A framework for analysis of institutions for water resources management in a river basin context*. IWMI Working Paper 5. Colombo, Sri Lanka: International Water Management Institute.
- Bandaragoda, D. J.; and G. R. Firdousi. 1992. *Institutional factors affecting irrigation performance in Pakistan: Research and policy priorities*. IIMI-Country Paper. Colombo, Sri Lanka: International Irrigation Management Institute.
- Bandaragoda, D. J.; and S. U. Rehman. 1995. *Warabandi in Pakistan's canal irrigation systems: Widening gap between theory and practice*. Country Paper No. 7. Colombo, Sri Lanka: International Irrigation Management Institute.
- Cernea, M. 1987. Farmer organization and institution building for sustainable development. *Regional Development Dialogue* 8 (2). Nagoya, Japan: United Nations Center for Regional Development.
- Khan, M. A. 1978. *Hydrological data, Rechna Doab, Vol. I, Lithology, mechanical analysis and water quality data of testholes/testwells*. Publication No. 25. Lahore, Pakistan: Project Planning Organization (NZ), Water and Power Development Authority.
- Malhotra, S. P.; S. K. Raheja; and David Seckler. 1984. A performance monitoring study of the warabandi system of irrigation management. In *Productivity and equity in irrigation systems*, ed. Niranjan Pant. Delhi: Ashish Publishing House.
- Mirza, A. H. 1975. *A study of village organizational factors affecting water management decision-making in Pakistan*. Water Management Technical Report No. 34. Fort Collins, USA: Colorado State University.
- North, Douglass C. 1990. *Institutions, institutional change and economic performance*. USA: Cambridge University Press.
- PGC-Punjab Private Sector Groundwater Development Project Consultants. 1999. *Guideline for the modification of STWs as CTWs in PPSGDP*. Technical Report No. 28. Government of Pakistan: Project Management Unit, Planning and Development Department.
- Singh, K. K. ed. 1981. *Warabandi for irrigated agriculture in India*. Publication No. 146. New Delhi: Central Board of Irrigation and Power, India.