IIMI

(5) June 1986 No. 1

Management Brief

The International Irrigation Management Institute

MANAGING MAIN SYSTEM WATER DISTRIBUTION

P.S. Rao and A. Sundar

MAIN SYSTEM

The term "main system" refers to a canal system. From the headworks of a storage reservoir or diversion structure, water is conveyed and distributed from main canals to branch (secondary) canals, and then down the line of supply to minors (tertiary canals) and outlets, where it is delivered to the fields. Canal system operations are governed by a set of rules for allocating and distributing water. Normally, the irrigation bureaucracy is responsible for properly maintaining and operating the system, and for delivering water to a group of farmers at the outlets.

In South and Southeast Asia, policy makers, planners, and administrators are concerned over poorly performing irrigation systems. Problems include delays in using irrigation potential; relatively low average crop yields; waterlogging, salinity, and alkalinity; and poorly organized and managed systems.

Although, initially people thought that the best way to improve the performance of irrigation systems was to develop the farms below the outlet, it soon became clear that better and more equitable water distribution was the prerequisite for increasing the productivity of irrigated agriculture. Thus, attention shifted to identifying changes in the main system that would improve the performance of the water delivery system.

The objective of the water distribution system should be to encourage efficient use of scarce water and to deliver fair, reliable, and predictable supplies at the outlet. Supplying adequate water to meet the optimal crop-water requirements for each farmer below the outlet may appear desirable, but it is not always feasible.

Managing water distribution from the main system is very difficult. Typically, systems are large and made up of many structures, controls, and people. There are complex and dynamic interactions among the physical nature of the resource and the elements of the system, and between these and the environment. These interactions are further influenced by the personnel from the irrigation bureaucracy and the farmers, who make both formal and informal decisions at various levels. People are often uncertain about how much water is available, which generates competition in sharing it. This can lead to conflicts and, sometimes, to corruption.

METHODS OF DISTRIBUTING WATER

Several types of distribution systems have evolved through practical experience or have been designed to meet specific physical and social requirements.

The *rotational* water distribution system, or "warabandi" of northwest India and Pakistan, is used when water supply is insufficient to provide irrigation to all the land served by the system, and rationing is necessary. It ensures a high degree of equity in distributing water, and increased efficiency, by imposing scarcity on every user. Each farmer gets his share of the available water based on how much land he holds and according to a roster that specifies the day, time, and duration of his turn. He is free to decide how best to use the water for his crops.

In the *intermittent flow* or "shejpali" system in western India, delivery of water is fixed according to the area served and the type of crops grown. The farmers submit applications which state the crop they wish to grow and the area to be cropped, and these are taken into account when water is allocated. If the demand exceeds the available supply, farmers' allocations are reduced in proportion to the amount of land they have. A schedule is prepared for each crop rotation giving advance notice of the dates when the different farmers may use water from a particular outlet for sanctioned crop areas. The system works smoothly as long as farmers can be allowed to irrigate their full sanctioned areas.

Canal systems run continuously for the time that the crop is in the field and serve individual command areas. The systems are designed on the concept of "duty," which is the area that can be irrigated by a unit discharge flowing continuously for the duration of the crop (the base period). In all continuous-flow systems, it is difficult to ensure that water distribution will be equitable, both at the head and tail-ends.

With *demand-based* systems, water is delivered to a farmer according to indents he submits. If crop, soil, and climate data are provided, computer programs can be used to determine the water requirements of a crop at different times during the growth cycle. The computer can then, in theory, plan an individual watering schedule for each farmer. However, in practice this may not be cost-effective for large public irrigation systems.

ASSESSING PROBLEMS

Conflict in objectives. The objectives of a public irrigation system often conflict with the wishes of the farmers who are to receive its water. For example, irrigation system managers try to maximize the yield per unit of water because water is normally a scarce resource. However, farmers try to maximize the net benefit for a unit of land because, for them, land is the scarce resource. Water may not be a scarce resource unless it is rationed.

P.S. Rao is Systems Scientist at IIMI-Sri Lanka, and A. Sundar is Chairman and Executive Director, Irrigation Research Academy, 35/4, 38-A Cross Road 8th Block, Jayanagar, Bangalore 560082, India.

Deficiencies in planning and design. Systems are seldom tested to determine if they are functioning as designed. For example, although designers often assume that the government can enforce cropping patterns, such control has rarely been demonstrated. Other design deficiencies are: assuming that irrigation continues day and night, providing larger outlets than are needed, not locating outlets properly, providing direct sluices or outlets from the distributary instead of from a minor, assuming that "duties" are the same at the heads of all distributaries irrespective of their lengths, assuming that seepage and operational losses are much less than in reality, and not providing for drainage even where it is obviously necessary.

Timing phases in construction. When reservoirs are completed too early during system construction, excessive water is often delivered to the head reaches of finished canals, causing over-irrigation and consequent adjustments to cropping strategies. When the entire canal system is completed, these cropping strategies remain, causing a shortage of water for the tail-enders.

Communication in operation and maintenance. There are often no operating or maintenance manuals for the systems. Flow measurements and communications are often inadequate for effective monitoring and management. Maintenance grants are insufficient. The operating personnel are often subject to considerable pressure from local influences.

PRIORITIES

Priorities for research and development are:

1. Generating awareness and commitment among governments to improve system performance.

2. Preparing clear objectives in collaboration with system operators and putting into practice operational plans for specific projects. This procedure will also enable managers to determine if the system is performing as designed and indicate the improvements needed.

3. Monitoring performance, with emphasis on effective measurements in the field, especially water budgeting. Performance monitoring requires a good communication system which, in turn leads to the development of a good information system for management.

4. Evaluating system performance, with emphasis on developing criteria and indicators of performance, and on maintenance standards.

5. Training both irrigation department personnel and farmers, and developing institutional structures that lead to effective coordination within irrigation departments and between them and farmers.

REFERENCES

Bottrall, Anthony F. 1981. Comparative study of the management and organization of irrigation. Washington, DC: World Bank Staff Working Paper 458.

Malhotra, S.P. 1982. The Warabandi system and its infrastructure. New Delhi, India: Central Board of Irrigation and Power pub. April.

Rao, P.S. and A. Sundar. 1985. Managing main system water distribution. *Wamana* 5(4):1-23.

Singh, K.K. (ed.). 1983. Utilization of canal water: A multi-disciplinary perspective on irrigation. New Delhi, India: Central Board of Irrigation and Power pub. April.

The International Irrigation Management Institute (IIMI) is an autonomous non-profit international organization chartered in Sri Lanka in 1984 to conduct research, provide opportunities for professional development, and communicate information about irrigation management. Through collaboration, IIMI seeks ways to strengthen independent national capacity to improve the management and performance of irrigation systems in developing countries.

For further information or publications, write:
Communication & Publication Office, IIMI, Digana Village via Kandy, Sri Lanka.
Tel: (08) 74274, 74334, and 74251. Telex: 22318 IIMI HQ CE.

The International Irrigation Management Institute
Digana Village via Kandy
Sri Lanka

AIR MAIL