TANK IRRIGATION SCHEMES

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Irrigation schemes in the developing countries often fail to generate expected levels of crop production and farm income. Causes of poor performance in existing irrigation projects include shortcomings in overall project management and in procedures for allocating water to individual farmers. The problem often is exacerbated by misallocation of investments in irrigation.

These are issues being addressed by the "Water Resources Economics" project funded by the Office of Agriculture in AID's Bureau for Science and Technology. The project supported studies of various aspects of these issues[1] in Egypt, India, Pakistan and Thailand. The study of tank irrigation in India, conducted by Tamil Nadu Agricultural University and the University of Minnesota[2], is the focus of this article.

Tank irrigation systems in South India account for about one-third of the irrigated area. Although tank irrigation has existed in India for thousands of years, most of the tanks were built only about 100 years ago to store and regulate the erratic monsoon rainfall. The water is used primarily for crop irrigation, although livestock and fish production are important secondary users.

1 A review of literature dealing with these issues is found in Easter, K. William and Delane E. Welsch, "Socioeconomic Issues in Irrigation Development and Distribution," Economic Report ER83-5, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, April 1983.

2 This summary is based on Palanisami, K. and K. William Easter, "The Tanks of South India, "Economic Report ER83-4, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, June 1983. < PN-AAN-638

A typical irrigation tank is a small reservoir constructed across the slope of a valley. Generally, the tanks are no more than 15 ft. deep, although some may go as deep as 30 feet. Medium-sized tanks have a capacity up to 100 million cu. ft. with an average depth of 8-10 feet. Many tanks form parts of a system of tanks and receive surplus water of tanks above, discharge surplus water into tanks below, or both.

To study the management of tank irrigation systems and identify investment opportunities, the Tamil Nadu Agricultural University and University of Minnesota researchers conducted a study of 10 tanks in Ramanathapuram district of Tamil Nadu, and selected a random sample of 200 farmers. Data were collected for the crop season, November-December 1981 to February-March 1982.

The study indicated that 50-70% of the time, 7 out of the 10 tanks had inadequate water supplies. Farmers depended heavily on groundwater for supplementing tank water supplies; about one-third of their total water supplies came from wells. Most of the farmers served by tanks grow only one paddy crop.

Cultivation of crops in the foreshore lands, the area immediately above the tank water spread area — the area flooded when the tank fills — is a serious problem limiting crop production in 6 of the 10 tanks. About 30-50% of the water spread area of the tanks is encroached on for cultivation, resulting in about 30-40% reduction in tank storage capacity. In addition, the encroachers illegally release tank water to avoid flooding of their crops. The penalty system to discourage encroachment is not effective and there are acute conflicts between the command area farmers and the encroachers, resulting in poor management of many tanks. Revised legal sanctions and better enforcement may help solve this perennial problem.

All the tanks have upper and lower sluices to irrigate different portions of the command area. Due to poor maintenance, silt has accumulated in the tanks and seriously restricted water availability, particularly for the upper sluices. In several tanks, the upper sluices are functioning with less than 50% of their original water storage capacity. Hence, there is a large disparity between farms irrigated from upper sluices as compared to lower sluices. The farms irrigated by the lower sluices received about 30 days more of irrigation for the crop season. Desilting of tanks by involving farmers and restructuring the sluices at appropriate places to serve more farmers are alternatives to be considered. In addition, a program of watershed management could be adopted to help reduce future siltation.

Water users' organizations only exist in tanks with continuing water shortage problems. The organization may be formal (sanctioned by the government) or informal. The tank operation and water distribution are more efficient in tanks with a water users' organization. The maintenance of the tanks and channel structures also is better.

The main purpose of some water users' organizations is to bring additional supplies to the tank from other sources. Since the water is more equally distributed with users' organizations, conflicts are reduced among farmers. The water distribution is not uniform in tanks without an organization, although the tanks may have adequate water for the crop season. Establishing farmers groups (formal or informal) is thus a prerequisite for effective tank water allocation as well as tank maintenance.

An important public policy question is whether to invest in new tanks or in the rehabilitation of old ones. The economic feasibility of new tanks constructed in the last decade was justified by high benefit-cost ratios.

However, after construction, most of the tanks did not provide water to the full comanded area. At least 40-80 % of the lands in the command areas was not irrigated. The major reason was the location of one or more sluices at a level lower than the fields to be irrigated.

Under such conditions, it is difficult to irrigate the entire command area without pumping the water. Consequently, the return from the tank investment is likely to be much lower than estimated and may not justify construction. In addition, the best sites for tanks have already been used. This means that the expansion of new tanks will be constrained both by physical and economic factors. Thus, the researchers recommend that a very careful engineering and economic study be made of all new tank proposals in Tamil Nadu and none built unless they pass the economic feasibility test.

Possible rehabilitation measures include a wide range of investments. The Tamil Nadu Irrigation Department is concentrating on measures, such as channel lining and community wells, to supplement tank water. Normally the water saving is about 20 percent from lining, while one community or tube well irrigates 40-50 acres. The study's findings suggest channel lining will have a higher payoff for large tanks, while community wells appear better suited for small tanks. Investment priorities need to be set by individual location and tank.

The study indicates that relaxing the different tank management constraints along with the appropriate rehabilitation investments can provide a high rate of return. However, it is important to identify the tanks to be improved and to select the appropriate mix of management changes and rehabilitation investments. Simple criteria are needed to identify tanks that would show the highest returns. To develop such criteria, a wider survey is now underway to check the findings from the ten tank study. It appears that the criteria should include cost of investment, time required to complete the investment, farmers' willingness to cooperate, domestic water supply, fishery benefits, and the recharge of wells, as well as the level and variability of crop production.

Additional research is needed on methods to improve tank performance. For example, should tanks, particularly with substantial encroachment, be deepended by 20 or 30 feet? This would reestablish the lost tank capacity while not causing a conflict with encroachers. In addition, the deeper tank would have less evaporation losses. However, the pumping and deepening costs may be quite high amd must be compared to potential benefits to determine if this is a reasonanle alternative.

Another possible improvement that should be studied is the rotation of tank irrigation among sluice outlets. The idea would be to coordinate private pumping and tank water releases and thus extend the period of tank irrigation. When a sluice was closed, pumps would be used in that area. While there is water in the tank, the water table is higher. Therefore, maintaining water in the tank longer would reduce pumping costs. It would also allow a fuller irrigation of the command area.

In a number of tanks the wells are not adequate to irrigate the whole command area. When the tank water is used up a number of fields cannot be irrigated. If the tank releases and private pumping were better coordinated, a larger area could receive an adequate irrigation.

A careful analysis is needed of forestry development in the tank waterspread areas. There appears to be potential benefits from reduced erosion, increased wood supply, and greater fodder supplies. Yet, if the forests use up irrigation water in the tanks and prevent farmers from desilting tanks, then there will also be negative impacts. The ownership and distribution of the forestry products is also an important issue. Are farmers involved in deciding where best to plant the trees and who should get the benefits? What land uses are they displacing with the forests? These and other questions should be asked before investing in forestry development.