Tank Irrigation – Causes for Deterioration and Remedy for sustainability

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Abstract

Improving irrigation system performance is now perceived as a more pressing need than developing new irrigated areas, after large budgetary allocations have gone for decades into expanding irrigated acreage. In most developing countries, investment in irrigation has not produced the expected results. The actual irrigated area turns out to be much smaller and crop yield and cropping intensity fails to increase appreciably. Whether to further invest while hoping for the best has become questioned. Instead, planners have started to give priority to the improvement of existing irrigation systems.

Among different irrigation systems, Tank irrigation, formerly a source of relative stability, has become a source of instability for agricultural production in many parts of India. Important factors for the decline in tank irrigation are environmental degradation such as deforestation, soil erosion, siltation, tankbed cultivation, and lack of administrative setup to provide timely repair and maintenance of tanks, and to ensure proper water control and tank management.

Simulation results show that with improved water control and by keeping sluices closed on rainy days, a 20% larger command area can be irrigated. A Tank Irrigation authority is proposed for better water control and management. Another concept proposed is Composite Watershed Management involving a system of runoff- and erosion controlling land management for enhanced groundwater recharge and sustained well irrigation.

Key words – Tank irrigation, decline, Remedial measures

Introduction

The preface of the *1998 India Water Resources Management Irrigation Sector Report* by Arun Kumar, Secretary-in-charge at the Ministry of Water Resources of the Government of India, states that "what is needed is a total revolution in irrigation agriculture with much more focus on the improvement of the *performance* of existing irrigation facilities and provision of a *client-focused irrigation service*". This statement is optimistic because it assumes that performances can be dramatically improved. Once one arrives at this level of understanding that the present performance is low and that it is indeed possible to make positive changes. The same preface also calls for a "paradigm shift in emphasis toward improving the performance of existing irrigation agriculture" and stresses that "A Second Revolution in Irrigation Agriculture is required now."(FAO report, 1999)

Irrigation is vital to the Indian economy as it helps to relieve agriculture from its dependence on the monsoon rains. Farmers with access to irrigation can stabilize and increase farm production; risks of crop failure can be reduced and opportunities increased for making full use of improved seed and fertilizer.

Irrigation systems in India are categorized for administrative purposes into major, medium, and minor irrigation works. Each of these three types of irrigation sources evolved at different times in history to meet man's changing requirements for irrigated land and as technologies developed for storing, transporting, and lifting water. While irrigation from tanks and dug wells is a comparatively old technology, canal and bore well irrigation with electric or diesel -powered pumps are relatively recent innovations

Small water reservoirs behind earthen dams are called tanks in India. Tanks supply many villages with drinking water, but their primary purpose is irrigation.

In India, the monsoon rains fall erratically during a few months of the year, and irrigation tanks serve to store and regulate water flow for agricultural use. In southern India tanks are used primarily for rice cultivation. Thus tank irrigation provides continuous flow of water with low mineral content and permits uninterrupted rice cultivation year after year , without ever exhausting or salinifying the soil.

However, despite these advantages the tank irrigated area in India over the past two decades has tended to stagnate and fall. From a source of relative stability, tank irrigation has become more and more unreliable. In many areas tank irrigation now is a source of increasing instability in agricultural production.

In this paper i have tried to explore the physical and administrative factors affecting the performance of irrigation tanks and propose ways to improve tank irrigation or alternative watershed-management systems in India.

Tank Irrigation as a Source of Instability

Hanumantha Rao (1968) found that variability of agricultural production was affected significantly by tank and well irrigation, the higher the proportion of irrigated area the lower the variability, but the larger the share of irrigation from tanks and wells the higher is the variability in productivity. At the all India level, tank irrigation expanded till the early 1960s; subsequently generate higher profits. Land values under tank irrigation are about 2.5 to 4 times those of dry lands. The direct benefits of tank irrigation for the nation are additional food production and employment. There are also environmental benefits such as rise in ground water table.

The increase in the variability of tank - irrigated area is probably a function of physical as well as institutional variables, which are directly and indirectly related to population pressure (erosion, encroachment), and also attributable to changes in the institutional environment .

After the abolition of the zamindari system, tank management, organization, maintenance, repair, water control, etc., ceased in most cases to be under private control and became the responsibility of different bodies of public administration.

Reasons for Decline in Tank Irrigation

The important reasons for the decline in extent and reliability of tank irrigation in the southern states are:

- Encroachment, siltation, soaking of supply channels resulting in poorer / no-inflow of water, pollution of tank water by tannery and dying factory influence (Coimbatore, Erode, Salem Districts)
- Tank chains almost disappear and their hydrologically interlinking, any improvement could revive the tank will have benefit of exploiting full tank irrigation through appropriate or selective moderanisation benefit
- Lack of soil conservation and afforestation in the catchment areas leading to flash runoff and increase in tank -bed siltation.
- Inadequate maintenance of bunds , waste weirs, and draft channels;

- Unauthorized cultivation , tank - bed cultivation , and foreshore encroachments;
- Increase in population densities
- Owing to vagaries of man, only 50-60 % of supply is realized by crop diversification.(TNAU agriportal)

Remedial Action for the Improvement of Tank Irrigation

Tank irrigation in parts of India is decreasing in extent and reliability although it has the potential to be socially and economically beneficial. The concern is to ensure that the existing capital of irrigation tanks is preserved, better utilized, and possibly expanded.

In the light of the information available, it is clear that the performance of tank irrigation technology depends not only upon the farmers on whose land the run off to fill the tank is being generated and on those whose land is being irrigated, but also upon the government agencies which are largely responsible for the administration of tanks. This includes water distribution, maintenance, and collection of water fees. Generally, the smaller tanks are governed by individual farmers' decisions while larger tanks depend upon government agencies operating the system.

The improvement of tank irrigation efficiency for all tank sizes would require a more balanced integration of farmers ' involvement, and government commitment and participation in activities such as control of water distribution , maintenance and repair, revenue collection, and management of the tank and tank bed as well as of the catchment areas.

Control of Water Distribution

The water use efficiency (WUE) of a tank depends largely upon water management judicious water use and distribution during the two growing seasons would result in larger areas being served from a particular tank. Even a high water consumptive crop such as paddy covering the entire tank command area does not require the same amount of water every day. Instead, the water required varies with the crop growth stage and with weather and wind conditions. Theoretical calculations show that tank command area can increase significantly when a tank controller allocates water optimally by taking these variables into account.

Naturally, if crops that require less water are grown groundnut, sorghum, cotton, etc. the WUE can be further increased. It is not likely that radical shifts away from paddy can be achieved easily, because of these relatively high physical and institutional investments. Instead, water allocation by a tank controller, and a system of fixing water charges according to actual water use might allow less extreme and therefore more feasible solutions, i.e., a change in land-use patterns, where perhaps the outer fringes of a command area would be planted to irrigated dry crops while the areas near the tank are cultivated to paddy.

Depending upon water availability from year to year, farmers could be induced to shift towards irrigated dry crops so as to achieve better water and land use.

A cost efficient solution has to be found for maximizing productivity through improved water management. However, an optimal point, where marginal costs of improved water management are equal to *its* marginal benefits, is difficult to determine as it varies from year to year.

Modelling using 70 years' daily rainfall data to simulate a water - storage system have shown that for an average tank, a simple rule of keeping the sluice closed on rainy days would permit a 20% increase in the irrigated area and reduce by about half the number of years that the tank runs dry during the cropping season (Von Oppen, Subba Rao and Engelhardt, 1983). It should be possible to implement this type of a simple control function by a public authority at relatively low cost.

Regular Maintenance and Repair

Any tank constitutes an artificial obstacle to a natural water way and is permanently subject to destructive forces which would eventually lead to its breaching and washing away, unless it is continuously repaired and well maintained . Thus tanks, as old as some of them may be, cannot be regarded as permanent and stable features perse. The amount of money available to the PWD for tank repairs has always been claimed to be insufficient for proper maintenance. (Von Oppen and Subba Rao, 1987)

A gradual erosion of the capital of irrigation tanks is the consequence of inadequate maintenance. Tank construction today is regarded as a welfare activity , and in the field of minor irrigation , public decision makers as well as farmers and private entrepreneurs often pay more attention to the expansion of pump irrigation than to maintenance (not to mention expansion) of irrigation tanks.

Maintenance of irrigation tanks requires annual inspection and regular repair work. The amounts spent for repair have to be kept at levels sufficiently high to preserve the capital value of a newly constructed tank.

Revenue Collection and Tank Management

Water rates levied for the tanks are very minimum. These water charges are collected by the Revenue Department as a tax on people who own irrigated land. Repair work by the PWD (in five-year cycles) is financed out of the water charges previously collected.

In the past zamindars , collected up to 50 % of the production under tanks, are likely to have spent a much higher amount on construction as well as on maintenance and repairs than is spent now by government agencies. Also, the provision that the same person, i.e., the zamindar or his equivalent, was responsible for maintenance as well as revenue collection allowed for more direct attention to urgently needed repairs than is possible in the present system in which two separate Government departments are responsible for revenue collection and maintenance. (Von Oppen and Subba Rao, 1987)

Avoiding Tank bed Cultivation

Tank beds should be kept free from cultivation so that desiltation is not inhibited; they could be used for grazing or to grow trees in the upper fringes. Tank bed cultivation and the subsequent acquisition of ownership rights by individuals is likely to reduce storage levels of tanks.

Desiltation of Tank Beds

Though controlled erosion minimizes tank bed siltation, it does not entirely eliminate it, and over time, the accumulated silt will reduce the effective storage capacity of the tank. Regular desiltation of existing tanks should be the responsibility of a public body. The fertile silt can be dug up and redistributed on the uplands from where it originated, thereby upgrading the value of these uplands. At the same time, the storage capacity of the tank would be restored.

Lining of Irrigation Channels and Farmer Cooperation

A previous study clearly indicates the importance of farmer cooperation for efficient management of tank irrigation. The government departments should encourage such organizations and help in identifying a strong local leadership. Investments in lining irrigation channels and the installation of community wells below the tank out lets lead to a good internal rate of return (Palani sami and Easter 1984).

Measures for rehabilitating irrigation tanks are required. Wherever irrigation tanks are operative under good management, they show high levels of productivity and considerable

economic benefits. It is worthwhile to maintain this capital, with relatively small investments for rehabilitation.

Summary

- Tank irrigation, formerly a source of relative stability, has become more and more unreliable. It is now a source of instability for agricultural production in many parts of India.
- Major factors causing the deterioration of tank irrigation include: environmental degradation such as deforestation, over grazing, soil erosion, siltation, etc. All of which are related to increases in population density; lack of administrative structures for tank maintenance and repair, and to provide proper water control and general tank management.
- Remedial measures for improvement of existing tanks include: increase inefficiency of water use by control of water distribution and management, regular and timely maintenance and repair, regular desiltation of tank beds (beneficiaries should share the responsibility), avoidance of tank-bed cultivation, creation of an agency responsible for revenue collection and tank management, soil conservation and afforestation measures to control erosion, lining of field channels to avoid transit losses, and farmers cooperatives at the tank level for efficient water management .

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