A STUDY ON SUSTAINABLE MANAGEMENT OF TANK IRRIGATION SYSTEMS IN INDIA

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ABSTRACT: In India the tank irrigation systems are centuries old. Due to weak property relations and improper maintenance, most of the tanks have over time degraded into open access resources. Privatization, encroachment and government appropriation have been the main outcomes of the failure of local authority system to imbibe and enforce the institutional arrangements under common property resources management regime. Today about 67% of the tanks in the intensive region and about 2% of the tanks in the tank less intensive region have become defunct. Of late a major threat to the very survival of the tanks is the borewells and wells that are supposed to be a security against late season tank water scarcity. More importantly in the short run and the longer run, taxes from the multiple uses of the tanks if collected by a single agency are sufficient to meet the maintenance and operation expenditure of the tanks. The simulation model which focuses and puts forward modernization options indicate that software strategies such as sluice management will have higher pay-off than the hardware strategies such as canal lining and traditional wells. Major policy interventions include physical investments as well as management and legal aspects.

KEYWORDS: Irrigation, Privatization, Resources, Strategies, Policy, Interventions, Management, Tanks.


INTRODUCTION TO TANK IRRIGATION SYSTEMS OF INDIA: Today in many parts of South and Southeast Asia, tank irrigation contributes significantly to agricultural production. Many currently used tanks were constructed in the past few centuries and tank irrigation has a long history, especially in South India and Sri Lanka. Since time immemorial the tanks have existed in India and also have been an important source of irrigation, especially in Southern India. Tanks also account for more than one-third of the total irrigated area in Tamilnadu, Karnataka and Andra Pradesh.

Tank irrigation systems always have a special significance to the small scale farmers and marginal farmers and small scale farmers who make a very large number, essentially depending on tank irrigation as these systems are regarded as less capital-intensive and also have a wider geographical distribution than large projects (Palanisami, 2000). A small reservoir which is constructed across the slope of a valley to catch hold of water and store water during rainy season is called as an irrigation tank. Many low-income communities in India and in other developing countries continue to be bereft of safe drinking water despite investments in water and sanitation infrastructure regardless of the initial water quality, widespread unhygienic practices during water collection, consumption and storage. Tank irrigation systems also necessarily act as an alternative to pump projects, especially where energy availability, ground water supplies or energy cost are constraints for pumping.

In some areas the distribution of tanks are quite dense, but over the years the performance of the tanks has necessarily been declining.

In India among the three major sources of irrigation tank is the only source, where the irrigated area has been declining continuously since early seventies and also many argue that the area under tank irrigation slowly started declining only after the introduction of the green revolution.

Among many of the states in India, the area under tank irrigation has been declined more drastically in those states where tank irrigated area accounts for relatively a larger share in the net irrigated area and also it has increased marginally in certain areas where it accounts for very low share in the net irrigated area.

As the farmers belonging to marginal and small size group are mostly poor, they are naturally not in a position to afford for cost-intensive irrigation sources like groundwater as in the case of large scale and medium scaled farmers and still tank irrigation continues to play a very crucial role among the small and marginal farmers even today. This to a certain extent is also true across different states where tank irrigation has considerable presence even today (Narayananmoorthy, 2004).

MAJOR OBJECTIVES OF THE STUDY:
1. To study the management of tanks in Ancient India.
2. To study the performance of tanks over the years.
3. To highlight the multi uses from tanks.
4. To know the warning signals to the Government and local community on the declining tank irrigation in India.
5. To study the major policies for improving tank systems.

MANAGEMENT OF TANKS: Tanks were considered to be the property of rulers in ancient days in India. A portion of the produce was paid to the ruler by the farmers. Farmers also were in charge of supply channels and maintenance of the tanks.
The proper maintenance of the tanks and supply channels were ensured by the zamindars, since they reaped the benefits of farming in large areas. However, when the ryotwari system was introduced by British in 1886, tanks with an ayacut of 40ha. and above were necessarily brought under the control of the Public Works Department (PWD) and the smaller tanks were vested with the villagers themselves or under the direct administrative control of local bodies.

Since the duties of the ayacutdars were not clearly mentioned and the local bodies did not have qualified engineers, the system of the farmers themselves taking up maintenance work which was famously known as kudimaramathu works also declined slowly. Supply and distribution channels choked and the tanks were silted up. At least since the middle of the nineteenth century, the deterioration of the tank irrigation system has been a subject of considerable discussion. The public works commission report of 1852 reported that in all districts, labour was more or less forced to work and it also stated that there was not much of voluntary community labour involved in tank maintenance.

In view of the above, an act was passed namely the Madras Compulsory Labour Act of 1858, (which was also known as Kudimaramath Act) with a view to penalize the non-performance of Kudimaramath labour and also with a view to legalise compulsory labour for certain aspects of maintenance. The entire administration of the act of collection of fines and levying was left with the irrigation Panchayats. The deteriorating conditions of tanks were brought to light quite forcefully by the famine commission of 1878 and it also advocated a systematic policy of maintenance. At present the local village level is necessarily responsible for water management and distribution of tanks with a command area of below 40ha.

**PERFORMANCE OF TANKS OVER THE YEARS:** According to Palanisami, normally in a 10-year period, three years the tanks get normal supply, five years they get deficit supply and two years they fail completely. The tank performance is seen declining over years given the rainfall uncertainties. Poorly maintained structures such as bunds, surplus weirs are some of the major problems for efficient management of tanks. There is a huge mismanagement of the catchment and forest land, which is adjacent to the catchment is already converted for human settlement by the Government. In the tank foreshores, there are severe encroachments. There is a huge reduction in the water storage capacity ranging from just 20 to 30 percent because of the siltation of the tankbed.

In the case of below outlet problems, maintenance of the channels are not done properly and they are broken resulting in heavy water losses. Tank irrigation has been dominated by the well irrigation in several cases where the increase in the number of wells in the tank command had been signaling the inactiveness of the tank systems for providing the much needed reliable water supply. As a matter of fact it has been found that large number of tanks has become defunct in less tank intensive districts (i.e., about 76% of Panchayats union tanks and 64% of Public Works Department tanks have become defunct as well) compared to tank intensive regions, where necessarily the percentage of defunct tanks is less.

Also the negligence shown on tank management has meant that most farmers receive inadequate quantities of water from tanks and to offset the decline in tank water supplies, the farmers have also resorted to supplemental well irrigation to avoid crop damage and losses (Palanisami and Easter, 1987, 1991). As only about 15% of the farmers in the tank command area own wells and there is also a growing demand for well water; in most cases the well owners act like local monopolists who are also able to charge high prices for well water.

However, a serious threat to the very survival of the tanks is often posed by profit making through privately owned water source (i.e., wells) within the hydrological boundary of the common property resource (Tanks) and also because of the declining interest among well-owners in proper upkeep of tank structures. Even though the tank performance has been influenced by several factors, the level of their influences keeps on varying across locations.

The major factors influencing the tank location are adjusted tank performance, well density, resource mobilization, encroachment of water spread area and farmers participation. The negative influence of the tank performance was influenced by well density. It was also rightly observed that higher the well density lesser was the tank performance. The better performance of the tanks without the well supplementation in the tank season clearly indicated the availability of adequate tank water supplies.

**MULTI-USES FROM TANKS:** Since times immemorial, even though tanks were originally serving irrigation and other village needs such as livestock, domestic, food production, due to major change in the village profile over years, tanks are mostly serving the irrigation needs only. However, irrigation alone cannot be a major component in judging the tank performance as it will not reflect the true performance of the tank benefiting the village in several ways. Hence for arriving at the tank performance, the multi-uses of the tank must be considered. If such uses are in reasonable proportion, then proper rethinking tank management in terms of multi-use performance and other uses of the same may be warranted. Also by using the multiple benefits approach the magnitude of the receipts from all the uses can be effectively used for tank maintenance. In absolute terms most revenue is raised by social forestry (Averaging Rs. 170/ha), followed by irrigation (Rs 88/ha) and fisheries (Rs 15/ha). Social forestry collects the highest revenue (100%) as a proportion of total value of output, but on the outset irrigation pays a relatively small proportion of the value of output (3.2%) in various fees. Social forestry appears well in relative revenue realization at the tank level. Collecting revenue from the tank users is performed by the State Revenue Department; Panchayats, Social Forestry Department, Mines Department and informal organizations in the village community are all involved.

Among the various agencies will collect revenue Panchayats, unions receive the maximum realised revenue (64.96%), Social Forestry Department (24.84%), Village community (5.18%) and the Revenue Department (4.67%). But after generating so much income from the tank users, why are the Panchayats not investing more in attending to the maintenance of the tanks? The Panchayats of respective
villages feel that it is the responsibility of the respective State Governments to pay for the maintenance and therefore they do not put their own resources and invest money into tank maintenance. It is still not yet clear as to what effect the Panchayats Raj Amendment has had on this situation, but it is very essential to explore what will happen if the responsibility for tank maintenance as well as the entire revenue collection authority is vested upon and given to a single institution such as water users association or local Panchayats, thus making the system more decentralized. Tanks themselves can generate more resources for maintenance instead on receiving heavy small allotments from the Government.

Tanks suffer from lack of maintenance funds, which are one of the major reasons for poor conditions of the tanks and the present practices do not seem to be even exploiting the full potential of tapping all the uses of tanks for revenue to support them. However, further analysis is needed to essentially determine whether revenue generation will be uniform across tanks and how different combinations of uses which may be complimentary and competitive in nature.

**WARNING SIGNALS:**

**Following are some of the major warning signals to the local community and Government on the declining tank irrigation in India at present:**

- It is reported that tanks are functioning only in excess and normal rainfall years and not so in the poor and low rainfall years. The major consequences are that many farmers have necessarily started abandoning the tank agriculture, mainly because of its continuous uncertainties in water supplies and also those moving to the nearby towns for other jobs and only the older people who are aged are staying back in the tank villages. Prosopis trees are growing freely in the cultivated lands as the lands are not maintained properly thus making the lands unsuitable for cultivation during years when the tank has adequate water. The upkeep of the tank structures is a cost affair for the farmers when they really want to use the tank for irrigation purposes during normal supply periods due to the declining commitment on the maintenance of the tank structures.

- The livelihood options in the village are eroded by the lack of livestock support activities, which are also completely gone in the village eco-system. Bullock carts were used by the farmers to take the silt and after the introduction of the social forestry scheme in the year 1980’s, especially in the water spread areas, silt removal from the tanks was prevented thus making the bullock operations limited. But in the recent years, rural women are managing the families with livestock and credit integration with the concept of microfinance. Arrangements should also be made for livestock as they need adequate fodder. Hence, the entire tank-ecosystem based rural economy will be completely collapsed if the tanks are not at all properly managed.

- It will be very difficult to sustain the tanks if the social forestry is allowed to continue as the impact of the social forestry is already felt in terms of increasing silt accumulation in the tank water spread area. But at the same time, even without the social forestry in the

forbidden tanks there are always possibilities that Prosopis trees will be spreading very fast and it will always have severe impact than the social forestry with acacia trees which have market value for the timbers.

- Due to the intensification of watershed development programs by the Government, it is seen in several locations today that several structures such as percolation ponds and small check dams are developed in the upstream of the tanks thus affecting the inflows into the tanks. Hence, a clear demarcation should be done between the tank improvement programs and watershed programs.

- Today the disappearance of the supply channels is very common. Due to the population increase house construction works and village development activities such as schools, buildings, roads are concentrated in the Government lands, which are the main sources of inflows to the tanks as well as interlinking the tanks in the chain. Even though the rainfall is normal, this is one of the major reasons as to why tanks are not getting adequate storages.

- Traditional Village Institutions like Jalaspandana, Needkatti or Madayan Thotti who looked after the tank structures and tank catchments and facilitated the inflows into the tanks regularly during rainy seasons also disappeared as they were not paid by the farmers due to frequent tank failures.

- Castes and politics were the growing nexus among the younger generation in the village which also played their vital role in making the traditional leaders in the village who necessarily looked after the tank management inactive. Voting percentage is higher in the villages since several regional political parties are coming up, these parties concentrate on the rural villages for their benefits and also in the process, the households are divided among the caste and political related groups.

- Tank management is also made a difficult task by the growing self-interest and non-cooperation by the well owners in the routine tank maintenance. The reason for these is that in several villages well owners feel that the tanks will not be much useful as in most of the periods they are dry. On the outset the reliability of the tanks for recharging the wells has also gone down due to encroachment and siltation.

- The village ration shops where the rice is supplied to some extent make the poor farmer households to prolong their livelihood with the dried up tanks. But the issue here is how long the ration shops will sustain the tanks as well as the villages.

- Mainly people now raise the question: Do we really need the tank bund which makes 1:2 or 1:4 water spread: Command area? The 1:2 ratio means (for every one hectare of water spread only two hectares of water are available) is to a certain extent very attractive for making the rainfall tanks into rainfed land as there is no much difference between tank irrigation and rainfed agriculture. This aspect is gaining more importance and priority since in most of the time, tanks are empty and people also think about using the water spread area for the rainfed cultivation due to its fertile silt.
MAJOR POLICIES FOR IMPROVING THE TANK SYSTEMS IN INDIA:

Some of the major policies for improving the tank systems in India are as follows:

Investment: Options that restore the original standards for tank rehabilitation should be given priority out of which desilting is an important option. It was observed however that in a 10 year cycle, only in 3 years the tank gets full storage, 5 years deficit storage and in the remaining 2 years the tank fails. Hence, it is not economical to desilt the tank fully as the benefits due to desilting will be in three years only where the tanks get the full supply. As the fertile silt is found only in the top (0.4 meter) layer the disposal of the entire desilted material is also difficult. The chain system of the tanks has almost broken today and most of the tanks are not getting adequate water supply. Hence, the revival of the tank chains is very urgent through appropriate modernization strategies for improving the supply channels connecting different tanks in the nearby vicinity. The essential need for taking up modernization works at chain level can be highlighted by considering the entire hydrological boundary as a single unit rather than viewing the individual tanks as separate entities for new investment. In the tank water spread area community wells should be installed to provide little supplementary irrigation to the non-well farmers during the most critical periods.

Management: Crop diversification strategy involving groundnut, cotton, pulses and other crops have been already adopted by farmers in few water scarcity tanks and this practice should be extended to tanks whose water storage capacity is 50 to 60 percent. The water which is required to produce one kilogram of rice ranges from 4500-5000 litres when compared to 1500-2000 litres in the case of non-rice crops such as groundnut. The entire area can be covered with non-rice crops using the 50 percent tank storage. Particularly in the wet season marketing support and extension efforts to farmers should be strengthened to introduce crop diversification. Department of Agriculture at the Centre and State should help speed up the process by crop demonstrations in respective states. Tank structures should be repaired for effective water control to complement the above options. Besides creating inequity in distribution between head and tail farms water loses at the canals are about 30 percent. Main canals lining can be followed without disturbing the field boundaries. Sluice rotation which is one of the major tank management strategies will help save the tank water by 20 percent. More importantly sluices can be opened and closed on alternate weeks (rotation of sluices) instead of continuous water withdrawal from tanks.

Legal: In recent years more tanks have become defunct due to encroachment, siltation, choking of supply channels and more importantly pollution from industries. Those tanks which are close to the cities should be protected from environmental pollution and further be made as groundwater recharge structures for domestic purposes. Penalty mechanisms and strict regulations should be necessarily imposed on the encroachers of catchment, supply channel and also foreshore area.

CONCLUSION: Sustainable management of irrigation is very vital to the wellbeing of the people in this world and it also plays a significant role in local, national and international growth as well as development. However, some major problems have also been created by irrigation such as salinization of land and water resources, environmental degradation and damage, adverse socio-economic and cultural effects. It is revealed from the history of irrigation development in India that there is need of revival of traditional and local irrigation management practices along with the major irrigation infrastructure project. Special efforts are indeed needed to revitalize the tank irrigation as tank irrigated area has been declining in recent years. Groundwater irrigated area has been increasing in recent years, but this increase should be done in a more effective and sustainable way. The gap which exists between the created and utilized irrigation potential alarms the necessity of completion of canal network as well as the need of minimizing the losses. Further expansion is very much limited as most of easily possible potential has already been utilized in India.

Many efforts are needed now to find and explore the future development possibilities. Major policy reforms like the change of criteria from rate of return to BC ratio should be explored as well as welcomed for sustainable maintenance and development of tanks. There are many lessons, which we may need to learn from the past. From building of our concrete knowledge and experiences of the past on complex soil-plant-water-tank–environment relationship we can surely maintain irrigated agriculture indefinitely.

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