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Water pricing and sustainable surface irrigation management

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Abstract

This paper deals with the benefits of irrigation water pricing in general. Moreover it is intended to analyse the scope of surface water irrigation, especially tank water irrigation in the state of Tamil Nadu, India, by fixing an appropriate price which will help conservation as well as optimum use of the scarce resource. The differences in water rates in different states are also dealt with.

Keywords: Water pricing, irrigation, tank, surface water, farmer, India, Tamil Nadu, agriculture

Introduction

Water is one of the crucial inputs to enhance agricultural production. Crop yields depend critically on the amount of water available to crops at different stages of their growth. Rainfall alone is an inadequate and undependable source of moisture to sustain high productivity of agriculture in India. In India, greater part of the year is practically dry. The available rainfall during the monsoon is often inadequate and highly viable in its distribution. While some regions have excess rainfall often resulting in floods, others suffer drought. These are among the principal reasons for the low level of yields in Indian agriculture. Under these conditions irrigation plays a crucial role in supplementing rainfall.

For ensuring food security, irrigation system has to be made more effective. However, growing water scarcity is likely to pose a serious challenge to the needed expansion in food production. Economical use of water by effective and efficient water management in irrigation sector is imperative to cope up with the increasing population and developing agriculture technology. It is well understood that the water crisis emerging in India is not the result of natural factors, but has been caused by improper water resources management. It is argued that 50 per cent of India's new water demand can be met by improving effectiveness of irrigation. There is growing concern that the area under irrigation has actually declined in recent years, and may continue to do so. Since agriculture is by far the largest user of water, efficient irrigation management will undoubtedly be a major conservation option for the future (Asit K. Biswas, 1982).

The rate of return from irrigation projects has registered a progressive decline after independence. Instead of profit, there has been increasing losses, and this has imposed a growing burden on the revenues of the states. The Vaidyanathan Committee report (1992) pointed out that the irrigation commission did prescribe optimum levels of charges for use of water for irrigation as a percentage of gross income estimated to be around 5 per cent for food crops, and 12 per cent for cash crops. But the actual receipts vary from less than 1 per cent to a maximum of 2.9 per cent for all India. In fact for the state of Tamil Nadu, the percentage is as low as 0.1 per cent. While fuller utilisation of the irrigation potential and optimum irrigation from available supplies through good water management practices would make some improvement to the situation, the real and effective remedy seems to lie in the revision of the rates at which water is being supplied for irrigation purposes in India (Kartar Singh, 1978).

Significance and Scope of the Study

Tamil Nadu is one of the water starving states of India not endowed with adequate water resources for irrigation and drinking. It is one of the states with low per capita availability of water with 0.03m.cft as against 0.09m.cft in the country. In Tamil Nadu the ultimate irrigation potential of major and medium irrigation system is already exhausted. Balance to be tapped is only with regard to minor irrigation (only 2.4 lakh hectares). Minor irrigation comprises of small projects which irrigate only up to 2000 hectares. This sector employs tubes, tanks, tubewells, traditional lift irrigation etc. Since the scope for the new major, medium and minor irrigation projects is limited, agricultural productivity of Tamil Nadu largely depends upon the rainfall. To mitigate the adverse effects, serious attention is required to rehabilitate the existing irrigation structures to make them functionally more effective, conserve and utilise the water for optimum use.

Tanks play a major role in irrigation and Tamil Nadu is one of the states in India where tank irrigation is prominent. Minor irrigation tanks contribute about 31 percent of irrigation lands in Tamil Nadu. Given the importance of tanks in the state, the government has started the rehabilitation works of existing minor irrigation tanks; but the amount allotted is insufficient for the proper maintenance of the irrigation system.

Moreover, in the present context of Globalisation, 'market forces' has an important role for the sustenance of any public utility system. The maintenance of tanks left to market forces will yield sustainability. In the absence of pricing, maintenance of tank will be a subject of public good facing the problem of free-riders.

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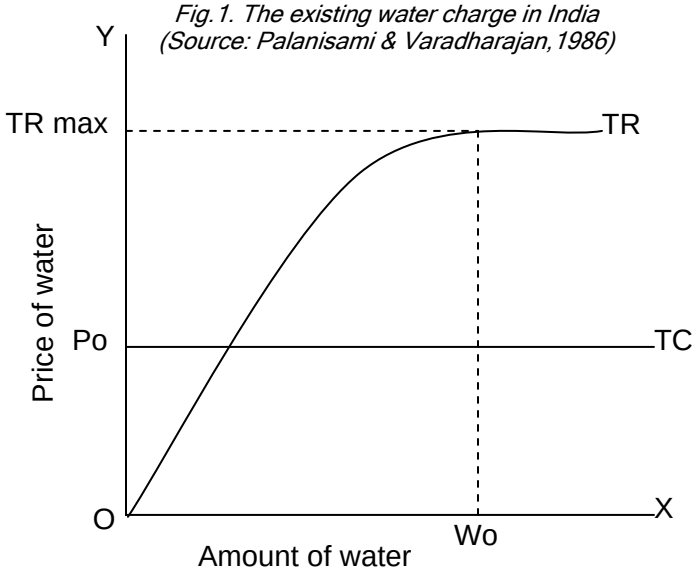
Existing water pricing method in India

The water pricing policy in India is such that it does not even cover the cost of Operation and Maintenance (O&M) of the irrigation systems, let alone the full capital cost including O&M. This leads to severe financial pressure on the state since it has to absorb the subsidies.

The water charge in India is based on per acre basis and does not vary with the volume of water actually used. This is indicated by Po in Fig.1.

Fig.1. The existing water charge in India (Source: Palanisami & Varadharajan,1986)



Since the total cost of water to the farmer is fixed per unit area, the TC curve is drawn as a horizontal line. The curve TR represents the total revenue realized from successive inputs of water, net of the variable costs of production, e.g., fertilizer, plant protection etc. A rational farmer maximizing his net return from water uses water as long as MVP>MC=0. Since the MC of water to the farmer is zero, he will apply water until he attains the maximum TR; i.e., where MVP is zero. This condition holds if he uses W0 of water per unit area for which he pays the price P0, which ultimately results in wastage of water (Palanisami & Varadharajan, 1986).

According to the Constitution of India, irrigation is a subject under the State list. Irrigation projects are planned, executed, owned and operated by State Governments. Irrigation projects are financed as a part of the National Development Programmes. These projects are financed by the State Governments out of their own revenues, market borrowings and loans and grants made available by the Central Government as a part of overall assistance for financing their plans. The State Governments have to repay the capital and interest charges for the loans taken by them from the Central government and the open market borrowings.

There is also no uniformity as regards to principle considerations adopted by the states in fixing of water rates. Some of the important factors which are generally taken into consideration are Crop Water requirement, assuredness of supply of water, paying capacity of the farmers based on net or gross value of agricultural produce, cost of supply of water, recommendation of Irrigation Commission etc. But there is no uniformity or consistency as to how these factors are employed in fixation of rates by different States or Union Territories. This can be depicted with the help of the Table 1 which shows canal water rates for irrigation of major states of India.

The table gives the water rates for canal irrigation in different states as reported in the CWC Publication "Pricing of Water in Public Systems in India". As can be noted from Table 1, there is great deal of variation in water rates from state to state which is presumably due to irrigation services in terms of its dependability and continuity. Pricing of canal waters is a state subject (like power) and hence tends to differ widely across states.

With regard to the irrigation projects in the public sector, sale of water for irrigation constitutes the major portion of Gross Receipts for them. The various committees and Groups constituted for suggesting ways and means to improve financial performance of projects have recommended for restructuring of irrigation water rates.

There is considerable difference in the levying of water rates by different States and Union Territories. For example, no water rate is levied for agricultural purposes in most of the North-East States except for Manipur. In Orissa a flat basic compulsory water rate is charged for the staple crop Paddy in respect of lands coming under the command of Major and Medium Irrigation Projects. Except in Assam and the North Eastern States, all States charge, directly and indirectly for the use of irrigation

Table 1. Canal water rates for irrigation in major States

States	Rate (Rs./ha)		Few crops specific rates (Rs./ha)			Year in which rates revised last
	Minimum	Maximum	Paddy	Wheat	Sugarcane	
Andhra Pradesh	99	370	222	-	370	1986
Bihar	30	158	89	51	158	1983
Gujarat	40	830	110	110	830	1981
Haryana	20	99	74	62	99	1975
Karnataka	37	556	99	54	556	1985
Maharashtra	100	1750	100	200	1750	1990
Madhya pradesh	99	741	198	24	741	1992
Orissa	6	185	40	32	100	1981
Punjab	14	82	49	29	82	1874
Rajasthan	20	180	99	74	143	1982
Tamil Nadu	6	64	49	-	49	1962
Uttar Pradesh	15	410	143	143	237	1983
West Bengal	37	134	37	49	124	1977

Source: Central Water Commission, Government of India

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water from public sources.

In West Bengal water is supplied only on pre-payment basis as far as Minor Irrigation Schemes are concerned. In the Southern States of Andhra Pradesh, Karnataka, Tamil Nadu and Union Territory of Pondicherry where water rate and land revenue are inseparable. In these States lands are classified as 'Wet' and 'Dry' depending upon their getting or not getting water from a recognised public source. Wet and Dry lands are assessed differently for land revenue. Wet assessment is higher as 'compared to the Dry assessment and difference between the two is attributed to water rates.

In the States which charge water rate for agricultural purposes, rates are in general levied on the basis of area irrigated except for the Tube well irrigation. But there is no uniformity as to how these two important factors are taken into account by States in fixing water rates. In some States special purpose cesses are also levied on irrigated area or crop over and above water rates. This system is in practice in States of Andhra Pradesh, Haryana, Karnataka, Kerala, Maharashtra, Tamil Nadu etc.

Surface Irrigation in Tamil Nadu

Tamil Nadu is the seventh largest state in the Indian union in terms of population and the ninth largest in terms of area. The Western Ghats run along its western boundary and the Eastern Ghats is its east coast. Hence much of the area of the state comes between the two Ghats constituting a dry plain. The frequent failure of monsoons – as has happened in 1982 is one of the important causes of water shortage. The coastal districts and some of the interior districts are fed by the few big rivers that the state has and all of them flow into the Bay of Bengal in the east. The water shortage is to a very large extent compensated by tanks.

Tanks have been a major source of irrigation in the area now covered by Tamil Nadu for several centuries. From the research done by David Ludden (Ludden David, 1979), it transpires that tanks multiplied steadily during the dynasties of the Madurai Pandyas and Chola Kings (C750 to 1300 A.D). Tank irrigation in Tamil Nadu constitutes the most important component of minor irrigation. This mode of irrigation has been prominent in Tamilnadu, which accounts for 17% of all tanks in the country, coming next only to Andhra Pradesh with 27% tanks. The estimated potential is about 1.1 million hectares. There are about 39,200 tanks in the state, with a high concentration in the northern and southern regions of the state. Some tanks may be natural depressions, but most of them are believed to have been formed or improved by human means, reflecting a high degree of skill in using the river and rain water, taking advantage of the natural gradients and heavy coastal rainfall, which would have otherwise gone waste.

Irrigation management assumes great significance in the state, in view of the fact that agricultural production in Tamilnadu depends on the erractic N.E monsoon unlike the rest of the country. About 50% of the total cropped area is under rainfed cultivation and there is very little scope for expansion of net sown area. Rice accounts for about 39 percent of the net cropped area and about 82 percent of the state's food grain production. Since rice needs about 10,000 to 12,000 m^3 per ha of water for the season, any amount below that will reduce the yield (Palanisami & Easter, 2000). It is therefore imperative that acceleration in the growth of agricultural production is made possible through intensive cultivation. It is in this context that irrigation, a vital complementary input, plays a greater role and development of irrigation potential and utilization is assigned top priority in the five year plans

There has been a distinct shift in the contribution by different sources of irrigation over time. Canals and tanks that have been contributing around 34 to 35 % each to net area irrigated during 1970-71 gave way to well irrigation (Table 2).

Table. 2. Percentage Distribution of Different Sources of Irrigation in Tamilnadu

Sources of irrigation	Net area irrigated (share in %)			
	1970-71	1991-92	2000-01	2008-09
Canals	34.2	2.4	28.8	26.1
Tanks	34.6	22.2	20.4	18.4
Wells	29.8	44.8	50.2	55.1
Others	1.4	0.6	0.6	0.4
Total	100.0	100.0	100.0	100.0

Source: Season & Crops Reports, Department of Economics & Statistics, Chennai, 2009

The share of well irrigation which was less than 30% in 1970-71 rose to 45% in 1991-92 and further to 55% in 2008-09. The declining share of tanks is indicative of the fast depleting water holding capacity of tanks, a large proportion of which suffer inadequate maintenance and requires periodical desilting, strengthening of bunds etc (Sivasubramaniyan, 2006).

Importance of tank irrigation

In view of huge investment costs, long gestation period, heavy maintenance costs and ecological problems associated with major and medium irrigation projects, the importance of minor irrigation has been realized by all the concerned in the recent past. Among the minor irrigation projects, well irrigation is entirely private, centering on the individual farmers. On the other hand, tank irrigation has been traditionally a common property of a village and has played an important role in agricultural development; particularly in the semi-arid regions of the country. Further, tapping of ground water has become increasingly expensive on account of deeper and receding water table levels due to indiscriminate and unplanned expansion of well irrigation. Thus, there is a need to utilize the existing tanks by undertaking necessary repairs to them and evolving proper management systems. This will facilitate the optimum

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utilisation of the available rainwater for sustainable agricultural development in semi-arid tracts of the country. The success achieved by Japan, and more recently by China which planned their modernization programmes on traditional methods in the field of irrigation suggests the need to give due importance to the development of tank irrigation in our country, especially to the state of Tamilnadu (Sen Gupta N, 1985)

Tank modernization

Tank modernization is the process by which the water in existing tanks is used more efficiently through improved water storage, distribution, and on-farm water use. The aim is to increase food production and rural incomes by achieving higher cropping intensity through improved water management and reduced water losses. Evaluation of Potential Returns from Modernization of Irrigation Tanks by implementing the modernization program, it is expected that more than 25% of the water will be saved. Past experiences from a pilot project (CWR, 1996) shows that by physical (hardware) modernization alone, irrigation efficiency was improved by 32.25% and subsequently yield increased by about 30% as presented in Table 3.

Table 3. Comparison of benefits before and after modernization of an Irrigation tank

Benefit	Before Modernization	After Modernization
Conveyance efficiency (%)	79.2	95.7
Distribution efficiency (%)	50.0	90.0
Application efficiency (%)	69.8	91.0
Irrigation efficiency (%)	27.7	78.4
Water requirement (m3/ha)	12300.0	10250.0
Paddy yield (t/ha)	3.0	3.9
Water Productivity (Rs/m3)	0.2	0.3
Gross Income (Rs./ha)	2962.0	5261.0

Source: CWR, 1996

If such measures are extended to cover all other deteriorated tanks additional cropping area is certainly to be brought under cultivation, which will narrow down the gap between the potential and actual area irrigated by tanks. Catchment treatment in the tank area will not only contribute to increased availability of water supply, but also bring such environmental benefits as reduced sedimentation and increased ground water recharge. Nevertheless, unlike major irrigation structures, modernization of these small-scale irrigation structures will not have any negative impacts on the environment at the same time ensuring the stability and sustainability of crop production in the tank command areas (Atchi Reddy, 1994).

Benefits of water pricing

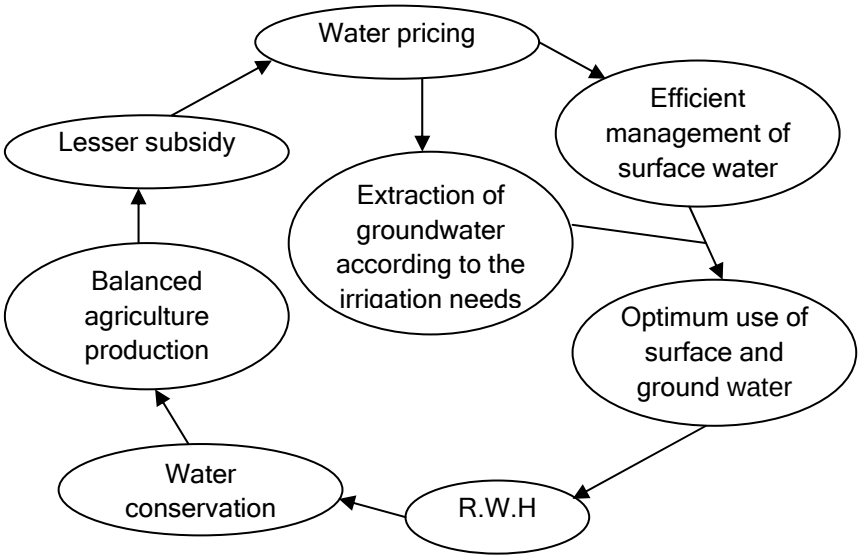
Water pricing for irrigation helps in the proper maintenance of the tanks. This can be shown with the help of the chart 1.

Water pricing is a good policy measure for the optimum use of water resource. Water pricing might influence the quantity of consumption of both surface and groundwater. Pricing of water allows the farmers to extract the quantity of water and power necessary to irrigate their land area. Surface water pricing provide the sufficient fund for the proper maintenance of tanks and percolation ponds. These practices facilitate Rain Water Harvesting (RWH) and the conservation of water. The pricing of water selects the suitable crop for the particular type of land and availability of water. This will strengthen the attitude of farmers towards water pricing because of the fact that the optimum use of water will benefit the farmers by economizing the extraction cost and reliability in supply. This will change the negative attitude of the farmers towards water pricing.

Water pricing policy and tank irrigation system

In the developed countries like USA the exact requirements of water during the various stages of crops are taken into account for designing the necessary supply in the field channels. Information regarding rainfall, humidity, evaporation percolation etc are utilized in arriving at the capacity of various channels in the distribution system. The cropping pattern is fixed to design the channel for the average duty. In all irrigation projects, the ayacuts under the scheme generally lies on either side of the river or main canal. The canals mostly run on contour so as to cover the maximum possible area under them. After calculating the requirements of water for crops, the shutter of the sluice is opened automatically for a specific time for the ayacut below the sluice through remote control by the concerned irrigation Engineer. During that specific time, the required water will flow over the field through branch channels or pipe outlets. The same system will be adopted for the other sluices also.

Chart 1. Benefits of water pricing



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In India screw gearing shutters of the sluices are operated by the village assistants or president of the Water User Association. Thus the farmer has every control to use the precious resource either in a good manner or to waste it. The present practice of fixation of irrigation charges has several weaknesses. For example after the first irrigation is applied to a crop, the farmer has to pay the fixed amount of charges and thereafter, the marginal cost of second irrigation becomes zero. In such a situation the farmer may go on applying water up to the points where the marginal return is equal to zero. This leads farmers to use large quantities of water per hectare of each crop.

Pricing of water helps in reduction of wastage of water. Proper pricing can reduce the burden of the government. Most of the inefficiencies, misuse and environmental damage have their roots in the mispricing of water and electricity. Since the only kind of subsidies so far used is price based input subsidies, they end up distorting the allocative prices, from which the other distortions follow. Under the present practice of free electricity for agricultural purposes, the number of electric pumps tends to be more than the social optimum, resulting not only in the overexploitation of ground water, but also in the decline in collective management. So a revision of the present policy must be seriously considered.

Conclusion

Whatever, the shortcoming at their creation, existing irrigation tanks remain as an asset to the sustainability of paddy cultivation in Tamil Nadu, provided their storage is not reduced and the related irrigation facilities are not deteriorated to serve the purpose. Research results show that if supplemental irrigation were available to crop in the command area of tanks, crop yield would increase by more than 1 ton/ha in tank-irrigated areas. Though high yielding varieties and other modern inputs of farming are widely adopted, in respect of water use and water regulation the farmers in the tank command area still poorly informed and have not paid their attention. In order to sustain agriculture and to achieve the optimum utilization of the available water resources and maximum production per unit of water, these tanks have to be modernized in a comprehensive and holistic way.

Moreover the poor maintenance of the tank is one of the important reasons for the non-availability of water to all farmers on an equity basis. For a healthy maintenance of the tank a suitable pricing policy mechanism is indispensable. It should satisfy the farmers' confidence in getting cheaper and reliable source of water for irrigation.

While all the countries have recognized the need and importance of charging appropriate fees for irrigation water supply, the creation and implementation of policies on irrigation water pricing are facing some problems. In most cases, the willingness and affordability of farmers to pay water charges are found to be very low as they have been receiving irrigation water free of charge. Moreover, national priorities to achieve self-sufficiency of food grains and stable food prices are influencing the political will of many governments in fixing realistic irrigation water prices reflecting their true value. Therefore, greater efforts need to be targeted towards creating farmers' awareness and acceptance of the need to pay for irrigation water if they wish to receive the services on a sustained basis. For this they should be educated about the benefits from water pricing through forums like water users associations.

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