Pricing of Irrigation Water in Cauvery Basin

Case of Kabini Command

There has been an almost fivefold increase in gross irrigation potential in the country since the 1950s. But there has been a staggering difference between expenditure incurred on irrigation and revenue recovered. This study examines the feasibility of differentially pricing irrigation water in normal and problematic (saline and waterlogged) soils of the command area of the Kabini project in the Cauvery basin in Karnataka.

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There has been phenomenal expansion in irrigation development in India involving a massive investment of Rs 23,187 crore. This has resulted in an increase in gross irrigation potential from 22.6 million hectare in 1951 to about 95 million hectare by the end of the year 1999-2000 [Dutt and Sundaram 2002]. Almost a fivefold increase in gross irrigation potential was created. But, in terms of the direct cost recovery from these irrigational schemes it has been abysmally low. This staggering difference between expenditure incurred and revenue recovered is largely responsible for the dismal performance of the irrigation sector. This can be attributed to defective pricing structure for irrigation water, which is highly subsidised not reflecting true supply cost. This has resulted in gross inefficiency in the use of water. Further, the inefficiency is exacerbated by poorly defined property rights for the use of surface water.

The irrigation sector is beset with twofold problems. On the one hand, irrigation water is highly subsidised not reflecting the scarcity value of water and the revenue generation from water rates has been extremely poor. On the other, underpricing of water induced unscrupulous use leading to environmental problems like salinity, alkalinity and waterlogging in the irrigated commands.

Many studies indicated that the prevailing irrigation water rate for different crops in India neither promotes use efficiency nor cost recovery reflecting poor performance (National Water Policy 2002; Vaidyanathan 1994 and Sangal 1991). The water rates are not based on volume of water consumed but are area based and vary across states depending on the type of crop. Water rates have not been revised often in many states. Even now, lower and outdated water rates have been continuing and as a result there has been a drop in the revenue from water charges. Therefore, there is a need for pricing of water such that they reflect the supply cost. This study examines the feasibility of pricing of irrigation water in normal and problematic (saline and waterlogged) soils of command area.

This study is confined to Kabini project in Cauvery basin of Karnataka. Currently, this project provides irrigation to an area of over 41,085 hectares in Mysore and Chamarajnagar districts of Karnataka. The predominant crops in the command area are paddy, sugar cane and other semidry crops. The construction of dam across Kabini river was started in 1957 and completed in the Ninth Five-Year Plan. It is a multipurpose project, ensuring irrigation facilities in Mysore and Chamarajnagar districts and supply water for power generation at Shimsha in Mandya district.

Vaidyanathan (1994) opined that the cost of providing irrigation consists of three main elements, namely, operation and maintenance expenses (O and M), depreciation and interest on capital invested. In this study, to compute the annual cost of irrigation, temporal data pertaining to historical investments on dam construction and development of field channels (for the period 1967-2002) and operation and maintenance expenses for last five years (1996-2001) were collected, compiled and the same was used for computations. Collectable revenue from irrigated crops like paddy, sugar cane and semi dry crops was estimated and compared with the annual irrigation cost incurred in providing water.

Amortisation

Amortised cost of dam construction represents the annual fixed cost of irrigation. The amortised cost of dam construction depends on the historical investments, year of construction, average life of dam and interest rate chosen. Here investment incurred on dam construction and development of field channels during different years was considered and compounded at 2 per cent to get the real investment at present. The total compounded cost was amortised at 2 per cent for 100 years in order to get the annual share of the irrigation cost.[1] The average life of the project is assumed to be 100 years. The amortisation formula used is:

Amortised cost of dam construction = [(Compounded cost of dam construction) $\times (1+i)^n \times i] \div [(1+i)^n - 1]$

where

n = The life of project (100 years)

i = interest rate (2 per cent)

Compounded cost of dam construction = Periodic investment on dam $\times (1+i)^{2002-\text{year of construction}}$

where

i = interest rate (2 per cent)

Average of O and M expenses of last 5 years was taken as the variable cost.

Annual Cost of Irrigation

The annualised cost of irrigation is estimated by amortising the capital cost invested on construction of dam and development of field channels. The average annual operation and maintenance cost is added to the annualised cost to get the total cost of irrigation. The cost of irrigation represents the cost involved in providing irrigation for an acre of land per annum.

The annual irrigation cost is calculated as:

Annual irrigation cost =

[The amortised cost of dam construction + annual operation and maintenance cost] ÷ Total irrigated area.

Considering the expenditure for the last five years on operation and maintenance by Command Area Development Authority (CADA), on an average it works out to be around Rs 64.8 lakh for the entire irrigated command (Table 1). Upon dividing the total operation and maintenance by net irrigated area, variable cost per acre was arrived and it was around Rs 62.9 per acre. The O and M expenditure

represents a partial amount, as it has included the establishment cost of the field staff and not the administrative staff who cater their service to the Kabini command along with other commands in the basin.

The overhead component (historical investments) incurred during different years was compounded to get the real investment at present. The compounded cost was amortised in order to get the annual share of the irrigation cost. Construction of reservoir and development of field channels entailed a sum of Rs 376.38 crore from 1967 to 2002. This amount was compounded at 2 per cent interest rate. The total compounded value of historical investment constituted around Rs 487 crore (Table 1). Further, the compounded value was amortised for100 years at an interest rate of 2 per cent to get annual share of fixed cost of irrigation (considering the life of the dam as 100 years). Thus, the estimated annual fixed cost of irrigation is Rs 9.73 crore for the entire command. Presently, the net irrigated area of the command is 1.03 lakh acres. Accordingly, by dividing the total overheads by net irrigated area, average fixed cost per acre was arrived and it was around Rs 944.7 per acre. Thus, the total cost of irrigation works out to be Rs 1,007 per acre of irrigated command and Rs 12 per acre-inch of water delivered. The actual water rate fixed by the government is Rs 100 for paddy; Rs 400 per acre of sugar cane and Rs 35 for semi dry crops rarely reflect the scarcity value of water. The water rate paid by the farmer forms just 17 per cent of the actual cost of water supplied in case of paddy, 33 per cent in case of sugar cane and 25 per cent in semi dry crops. Thus, surface irrigation water is highly subsidised by the government not reflecting the true supply cost of water leading to gross inefficiency in water use. Lack of appropriate pricing for irrigation water induced mismanagement of the resource. This has led to environmental problems such as salinity and waterlogging imposing additional cost on the users. The irrigation authorities are incurring substantial cost in providing irrigation facilities to the farmers. But, it is paradoxical to note that farmers are not willing to pay the irrigation cost based on 'user pay' principle as compared to groundwater-irrigated farmers. In case of well-irrigated farms, the irrigation cost was Rs 3,930 per acre and this was fully borne by the farmers (Yatheesha 2002).

Table 1: Irrigation Cost in Kabini Project at 2 Per Cent Discount Rate

(Lakh rupees)

Particulars	Compounded at 2 Per Cent Discount Rate
Total compounded value	48,702.53
Amortised value for 100 years	973.05
Average O and M expenses	64.8
Annual total cost (for entire command)	1,037.85
Gross irrigated area (lakh acres)	1.03
Annual cost (Rs/acre)	1,007

Source: CADA, Mysore, 2002.

Expected Revenue in Kabini Command

As evident from Table 2, paddy occupies the lion's share in the total irrigated area (83 per cent) and other crops only a miniscule. The water rate charged towards irrigating paddy is Rs 100 per acre; accordingly the total revenue expected was Rs 108 lakh for 1.08 lakh acres. The estimated irrigation cost forms around Rs 600 per acre, while the actual water rate forms only 17 per cent of the estimated cost. Similarly, the total irrigated area under sugar cane was 4,862 acres and water rate charged is Rs 400 per acre, yielding revenue of Rs 19.5 lakh. The expected revenue from semi dry crops was Rs 5.75 lakh at a water rate of Rs 35 per acre for 16,440 acres. Thus, overall expected revenue from all the three categories of crops was Rs 134 lakh.

Table 2: Total Expected Revenue from Water Rates in Kabini Command (2000-2001)

Crops / Season	Kharif (Acres)	Summer (Acres)	Total Irrigated Area (Acres)	Water Rate (Rs/acre/crop	Total Revenue (Rs Lakh)
Paddy	93,750	15,037	1,08,787(83.6)	100	108.78
Sugar cane	4,862	–	4,862(3.7)	400	19.44
Semi dry crops	14,365	2,075	16,440(12.7)	35	5.75
Total	1,12,977	17,112	1,30,089(100)	–	133.97

Note: Figures in the parenthesis are percentage to the total.
Source: CADA, Mysore, 2001.

Table 3: Revenue to Irrigation Cost Details (2000-01)

Particulars	Amount
Revenue expected (crore Rs/per year)	1.34
Irrigation cost (crore Rs/per year)	10.38
Revenue expected to irrigation cost ratio	0.12
Cost incurred per acre-inch of water (Rs)	11.96
Irrigation charges paid per acre-inch of water (paddy) (Rs)	2.00

Note: Irrigation cost was estimated by considering 2 per cent interest rate.
Source: CADA, Mysore.

Expected Revenue to Irrigation Cost

As discernible from Table 3, the expected revenue from the farmers of irrigation command according to the existing water rates is around Rs 1.34 crore and the actual cost incurred is around Rs 10.38 crore leaving a wide gap of Rs 9.0 crore. The ratio of expected revenue to irrigation cost indicated that for every 100 rupee spent on irrigation, the expected revenue from water rates is around Rs 12, which is almost eight times lower. On an average, the estimated cost per acre-inch of water was around Rs 11.9, while the water rent expected in case of paddy is around Rs 2 per acre-inch of water. It is disheartening to note that even at the prevailing low water rates, the revenue actually collected formed less than 50 per cent of the expected revenue. In spite of assured irrigation for cultivating paddy, the payable revenue for water is not realised from the farmers. Even if the irrigation authorities enforce and collect all the revenue according to the existing water rates, it hardly meets the actual irrigation cost. This calls for not only enhancement of water rates but also timely and fully recovering of revenue from water rates.

Estimated and Existing Irrigation Cost

The estimated and prevailing irrigation cost from water users for various crops like paddy, sugar cane and semi dry crops in the command area is presented in Table 4. The sugar cane being a highly water intensive crop consumes approximately 100 acre-inch of water per acre during its growth period in a year. Accordingly, the irrigation cost for sugar cane crop works out to be around Rs 1,200 per acre at the estimated rate of Rs 12 per acre-inch while, the existing water rate is Rs 400 per acre of sugar cane irrigated. Thus, farmers are paying only 33 per cent of the cost incurred by the irrigation authority. Similarly, for paddy, a hydrophilic crop, consuming around 50 acre-inch of water the estimated irrigation cost is around Rs 600 per acre while, the existing water rate paid by the farmers is only Rs 100, which forms only 17 per cent of the actual cost incurred.

Likewise, the prevailing water rate in case of semi dry crops is around Rs 30 per acre as against the estimated irrigation cost of Rs 120 (for 10 acre-inch).

In the Kabini command, over 84 per cent of the area is under paddy, 12.5 per cent of the area is under semi dry crops and the remaining 3.5 per cent is under sugar cane. The existing cropping pattern suggests that paddy is being highly water intensive crop and consumes bulk of the water. Considering the water requirement for paddy 45-50 acre-inches, the estimated irrigation cost forms around Rs 600 per acre, while the actual water rate forms only 17 per cent of the estimated cost.

At the prevailing water rates, the revenue expected from three categories of crops formed Rs 1.34 crore while the annualised irrigation expenditure constituted around Rs 10.38 crore leaving a yawning gap between revenue collected and expenditure incurred. On an average, for every Rs 100 incurred on irrigation development only Rs 12 was collected from the beneficiaries. Even though the recoverable revenue from irrigated crops per acre is not much, nevertheless it is not realised. Thus, the sound norm of financial self-sufficiency is not met.

It is disheartening to note that even at the prevailing low water rates, the revenue actually collected formed less than 50 per cent of the expected revenue. In spite of assured irrigation for cultivating paddy, the payable revenue for water is not realised from the farmers. Even if the irrigation authorities enforce and collect all the revenue according to the existing water rates, it hardly meets the actual irrigation cost. This calls for not only enhancement of water rates, but also timely and fully recovering of revenue from water rates.

Table 4: Estimated and Existing Irrigation Cost in Kabini Command

Crops	Estimated Irrigation Cost (Rs/Acre/ Crop)	Actual Water Rate (Rs/Acre/ Crop)	Per Cent of Actual Water Rate to Estimated Irrigation Cost
Paddy (50 acre-inch)	600	100	16.7
Sugar cane (100 acre-inch)	1,200	400	33.3
Semi dry crops (10 acre-inch)	120	30	25

Cost and Returns in Paddy Cultivation

Cost and returns from paddy cultivation with and without irrigation cost in different situations is computed and details are given in Table 5. In case of normal soil, the estimated cost of cultivation of paddy was around Rs 6,735 per acre without considering the irrigation cost. If estimated irrigation cost is added, cost of cultivation increases to Rs 7,335. Thus, the share of irrigation cost formed 8.2 per cent of total cost of cultivation. But, the actual irrigation water rate forms only 1.5 per cent of the total cost of cultivation. The net return realised per acre was Rs 5,005 ignoring the irrigation cost, if the irrigation cost is accounted it would fall to Rs 4,405. The existing water rate is Rs 100 per acre of paddy, whereas irrigation cost incurred per acre is Rs 600 yielding a gap of Rs 500. Thus, the prevailing irrigation charges per acre of paddy is almost six times less than the actual cost incurred. In the case of saline-sodic and waterlogged soil, paddy cultivation without considering irrigation cost itself is not economical as farmers incurred a net loss of Rs 1,530 and Rs 40 respectively.

The relative economics of paddy and sugar cane with assured irrigation shows that even after accounting for the estimated irrigation cost in the cost of production, farmers are realising a net surplus of Rs 4,405 in case of paddy and Rs 12,425 in case of sugar cane per acre. However, in the case of saline-sodic and waterlogging soil without inclusion of irrigation cost, farmers are incurring loss and there is no break-even. This clearly indicates that the farmers in normal soil have realised adequate returns and have the ability to pay for the water while the farmers affected with adverse environmental problems of salinity, alkalinity and waterlogging are not able to realise adequate return and hence their ability to pay water rates is also weak. This is a pointer to the policy-makers to charge water rate fully for the farmers with assured irrigation under normal conditions and subsidise the affected farmers in degraded soil.

Table 5: Cost and Returns from Cultivation of Paddy with and without Irrigation Cost in Kabini Command

Particulars/soil category	Normal	Saline-Sodic	W L
Irrigation cost (per acre)	600	600	600
(a) Cost of cultivation of paddy without irrigation cost (Rs/acre)	6,735	7,030	7,180
(b) Irrigation cost (Rs/acre)	600	600	600
(c) Total cost of cultivation of paddy including irrigation cost (Rs)	7,335	7,630	7,780
(d) Per cent of irrigation cost in total cost of cultivation	8.2	7.9	7.7
(a) Net return without irrigation cost (Rs)	5,005	-1,530	-40
(b) Net return with irrigation cost (Rs)	4,405	-2,130	-640
(a) Water rate paid by farmer (Rs/crop/acre)	100	100	100
(b) Cost incurred by CADA (Rs/crop/acre)	600	600	600

Note: WL = waterlogged

Concluding Remarks

In the major irrigated command area, at the prevailing water rate, there has been a yawning gap between revenue collected and expenditure incurred. The water rate paid by the farmer forms just 17 per cent of the actual cost of water supplied in case of paddy, 33 per cent in case of sugar cane and 25 per cent in semi dry crops. Thus, surface irrigation water is highly subsidised by the government not reflecting the true supply cost of water leading to gross inefficiency in water use.

Farmers are realising surplus returns over costs (even after accounting all the costs including the estimated irrigation cost) with assured irrigation in the command area. Estimated irrigation cost forms just one-quintal worth of paddy and 1.2 tonnes worth of sugar cane. The farmer's ability to pay the estimated irrigation cost is fairly adequate. Thus, there is a need for charging of water for promoting efficiency in water use. EPW

Notes

1 In this study an interest rate of 2 per cent is considered for amortisation because the choice of discount rate needs to be reflective of the criterion of sustainability and intra- and inter-generational equity in natural resource economics. For amortisation choice of discount rate above 2 per cent did not yield pragmatic estimates of annual cost. Here higher rates of interest resulted in future values that increased at compound rates unmatched with current rates of inflation.

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