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**Operation and Maintenance
Costs of Canal Irrigation
and Their Recovery in India**

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NCAER-IFPRI COLLABORATIVE PROJECT



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Foreword

During the eighties decade, there has been a growing realisation about the deteriorating financial performance of the irrigation sector in India. Irrigation being one of the basic inputs in the agricultural development of India, the sub-optimal performance, both physical and financial, has given rise to a lot of concern. Aggravating the situation is the fact that benefits from surface irrigation schemes are not commensurate with the massive amounts of capital that have gone into the development of this huge network of canals. Potential creation is considerably low and potential utilised is even lower. One of the main reasons behind sub-optimal performance of canal network in India is considered to be the poor operation and maintenance of the system. This, in turn, has been, at least partially, caused by the paucity of adequate funds available for O&M purposes.

This paper studies the working expenditure and the cost recovery aspect of the major and medium surface irrigation schemes in India, with its regional and state level dimensions. The analysis indicates that the recovery ratio (gross receipts as a percentage of the working expenses) have been low and declining, with the situation becoming particularly serious in the eighties decade. At the end, the paper suggests the need for some institutional changes, besides water rates, etc., in order to bring about better maintenance and operate the systems at optimal levels.

This paper is a part of a larger collaborative study between National Council of Applied Economic Research (NCAER) and International Food Policy Research Institute (IFPRI), with the directors being Ashok Gulati from NCAER and Mark Svendsen from IFPRI. S.C. Agarwal and Munish Duggal were also involved in the initial stages of this part of the project.

June 1994

S. L. Rao
Director General

Operation and Maintenance Costs of Canal Irrigation and Their Recovery in India

During British Rule in India, the construction of many important major and medium irrigation projects was taken up, especially in the north-western parts. The deciding factor behind these constructions was the need to have social security from the periodic famines and droughts. The gradual reduction in the severity of the famines and droughts allowed attention to veer towards more productive use of these irrigation projects. Accordingly, some of the later irrigation projects during this period, were taken up keeping in mind their financial viability. But with independence, irrigation came to be regarded as a critical input for initiating agricultural growth in India, reducing poverty and insuring against fluctuations of monsoon. With this new perspective, attention moved away from financial considerations to speedy development of irrigation facilities.

This concentrated effort at irrigation development in India has led to one of the largest canal networks in the world which has created an irrigation potential of almost 31 million hectares, by 1990. However, only about 85 per cent of this vast created potential, is currently being utilised. Moreover, the gap between the created potential and its utilisation has been steadily increasing and has been a matter of serious concern during the 1980s.

Effective operation and maintenance (O&M) of the existing irrigation systems is generally presumed to be one of the important determinants of the degree of utilisation of the created potential. In the present Indian scenario, this O&M aspect is often neglected due to paucity of funds, and at the margin, this results in significantly reduced efficiency of the systems. The provision of adequate funds for proper O&M of these systems, therefore, becomes critically important. The present paper attempts to analyse various aspects of O&M expenses

with a view to examine the hypothesis that the returns to proper O&M can be very high, at the margin.

In Section I, we present an overview of the government policy, past and present, with regard to O&M of canal networks, along with some conceptual clarifications on the definition of O&M expenses. This is followed, in section II, by a review of some of the literature on this subject, especially those which have focussed on financial aspects of O&M of different canal networks in the country. In section III, we discuss the cost recovery performance of surface irrigation in India, both at all India and regional levels. Some light is also thrown on the structure and behaviour of O&M costs as incurred by different regions and states on their canal networks as well as for India as a whole. Finally, in section IV, some concluding remarks are presented in the light of discussions in previous sections.

I. An Overview of Government Policy

The O&M expenses or the working expenses, include expenditure under various heads such as Direction & Administration, Machinery & Equipments, Extension & Improvement, and Maintenance & Repairs. Irrespective of its size, an irrigation project requires maintenance at different points of the system¹. Ideally, separate funds should be earmarked for each of the components of the total working expenses, in order to maintain a certain prescribed efficiency level. But unfortunately, the ground situation is far from ideal. Irrigation in India is considered the responsibility of the State Governments which in the context of O&M of the systems means that the State Governments have varying practices in this regard. They do not follow any strict norm for allocating the working expenses that may have been prescribed by any of the Committees or Commissions which have looked into this question. This also creates problems with regard to uniform availability of information for different components of O&M expenses. In addition, treatment and content of individual components of O&M expenses differ from state to state.

As mentioned, the norms for allocating funds for O&M vary from state to state and even for different projects in the same state. The general practice is to fix a certain rate per hectare of area irrigated². Regardless of the norm on which the allocation of funds for O&M is

based, the main problem is lack of funds resulting from low levels of water rates that are prevalent almost all over the country. The result of this artificially low rate is that the Irrigation Departments now find themselves without sufficient funds for proper upkeep of the system. Given the poor fiscal status of the government, cost recovery through appropriately structured water rates, appears to be the only viable solution.

Various Committees and Commissions have recommended that water rates should be such as to cover at least the cost of O&M of irrigation systems plus a part of the capital cost. For instance, Irrigation Commission of 1972 opined that so long as the main beneficiaries of irrigation projects can be identified, it cannot be regarded as a pure public good. In view of this, it would be inappropriate to keep water rate too low and expect the general tax payer or the dry-land farmer to make up for the shortfalls experienced in this sector. It, therefore, recommended that irrigation schemes should generate enough annual income to equal the annual cost of O&M at least and a part of the capital cost. To meet the rising costs of O&M, the Commission suggested that water rates should be revised every five years and should lie within the range of 5 to 12 per cent of the gross revenue of farmers in the canal command areas, depending on whether the farmer is producing foodgrain or cash crop. A Committee of Ministers reporting, in 1973, on the 'Under- utilisation of Created Irrigation Potential' observed that O&M of irrigation and drainage systems is often a neglected field and is an important factor leading to under-utilisation of created potential. It was also of the opinion that the grants given for O&M of irrigation projects are inadequate to allow the system to be operated with reasonable efficiency.

The first conference of State Ministers of Irrigation was held in July 1975. It recommended setting up of a Central Water Utilisation Team to study the irrigation systems with a view to suggest measures of optimising their operational efficiency. The team visited various irrigation systems in the country during the period 1975-77 and found that for most projects studied, the annual funds allotted for O&M expenses was abysmally low (Table 1) and entirely inadequate for proper O&M of the systems.

**Table 1: O&M Expenses on Selected Projects (1975-77)--
Findings of Central Water Utilisation Team**

<i>State</i>	<i>Project</i>	<i>O&M Expenses (Rs/ha)</i>
Bihar	Sone Canal System	8.75
U.P.	Lower Ganga Canal	5.00
U.P.	Upper Ganga Canal	7.93
Kerala	Peechi Project	18.25
Maharashtra	Purna Project	17.50

Source: GOI (1978).

During the 1970s, the World Bank also prepared an appraisal report on selected projects in India. These reports looked at the O&M aspects of irrigation systems and laid emphasis on the importance of availability of sufficient funds, in order to maintain the systems in accordance with sound engineering principles. Their recommendations for O&M expenses for some projects are given in Table 2.

**Table 2: Recommended O&M Costs of Selected Projects
(World Bank Study)**

<i>Project</i>	<i>State</i>	<i>Year of Appraisal</i>	<i>O&M Cost (Rs/ha)</i>
Kadana	Gujarat	June, 1970	20
Chambal	Rajasthan	May, 1974	32
Chambal	M.P.	June, 1975	48
Nagarjunasagar	A.P.	April, 1976	45
Periyar-Vaigai	Tamil Nadu	May, 1977	50
Jayakwadi Purna	Maharashtra	June, 1977	75
Medium Projects	Orissa	July, 1977	50

Source: GOI (1978).

It may be noted from a comparison of Tables 1 & 2 that the allocated funds for O&M, for approximately the same years, was far below the recommended levels of the same. One of the reasons behind this vast difference between recommended O&M levels and actual ones was the general failure of canal systems to generate sufficient funds due to their abysmally low water rates.

Later Committees like the Public Accounts Committee of 1983 reiterated the stand that irrigation authorities need to generate sufficient revenue to pay for the maintenance, operation and depreciation charges, as also to yield some interest on capital invested in the irrigation schemes. In 1986, the National Conference of Ministers of Irrigation and Water Resources, felt that the water rates should be increased gradually keeping in mind the rising cost of irrigation projects, both with regard to capital and O&M costs. According to them, the rates should be such as to provide correct signals to the beneficiaries about the scarcity value of water supplies.³

Finance Commissions, appointed to look into the question of devolution of finance between Centre and the States have also considered the question of maintenance of capital assets such as canal networks. The Fifth Finance Commission (1969) felt that receipts from irrigation should yield the annual costs on O&M plus 2.5 per cent of the capital cost. All the successive Finance Commissions reiterated this stand on recovery of O&M costs, although the interest on capital charges, to be recovered was stated differently by the different FCs. For instance, the Sixth (1973) and the Seventh FC (1978) brought this percentage rate down to 1 per cent while the Eighth (1984) and the Ninth FC (1988) have brought this rate further down to zero.⁴

The National Water Policy, in 1987, had laid down certain directives with regard to pricing of canal waters. It had felt that water rates should provide adequate signals to convey the scarcity value of the resource to the users and to encourage the farmers to practise economy in its use. It was also felt that the receipts should be adequate to cover the annual maintenance and operation charges as well as a part of the fixed costs. The National Water Policy also recommended that while striving to reach this ideal state over a period of time, assured and timely supply of irrigation water should be ensured and care should be taken to safeguard the interests of small and marginal farmers.

No concrete effort to achieve this ideal has been undertaken in the ensuing years. In fact, the Working Group on Major and Medium Irrigation Programme, set up to formulate programmes for the Eighth Plan period, observed that not only are the existing norms low, states also often fail to make provisions for O&M even at the prevailing rates. Increase in norms itself, therefore, cannot ensure proper maintenance unless means are found for providing the required funds. The Working Group also felt that the present system of fixing flat rates per hectare of irrigated area for O&M, without considering the nature and type of project, is not rational as need for maintenance differs between varying types of projects like dams or diversion canals, etc. Moreover, O&M expenses are also likely to be different for ongoing and completed projects. Since, for maintenance of irrigation systems below the headworks, expenses will vary from place to place depending on topographical and meteorological factors, the Group felt that norms should be suggested by state after detailed studies in different regions. The Working Group also recommended a change in the funding pattern due to the fact that a major part of the allotted money is actually spent on staff payments. As a result, essential repair and maintenance works are not carried out and the system deteriorates. The Group proposed provision of funds at the rate of Rs. 150 per hectare for special repairs necessary for maintaining the system, which the states will be free to carry out without obtaining clearance of the Centre.

It is thus found that requirement of funds for proper O&M of major and medium projects has been rising over the years. Although successively higher norms have been recommended by the Finance Commissions and various Committees set up to look into this question, actual increases in allocated expenditure have been relatively small. Most states do not have sufficient resources to provide funds even on the basis of the existing low norms. The canal network and other irrigation assets are thus fast deteriorating, and urgent steps are required to arrest this fall. For this, funds need to be generated by suitably revising water rates and ensuring timely delivery of water. In fact, the long term sustainability of irrigation development in India is constrained by the economic viability of the system. This fact has also been stressed by various research studies reviewed in the next section.

II. Review of Research Studies

Pawar (1985) studied the O&M aspect of a selected sample of irrigation projects in *Maharashtra* and found that in 1982-83, about 65 per cent of potential created in these sample projects, remained unutilised. One of the contributing factors towards this poor utilisation scenario was poor O&M of the irrigation systems. It was found that in Maharashtra, there was no separate agency for O&M of irrigation projects. The O&M was looked after by the Management Wing of the Irrigation Department, which was already reeling under a myriad of duties. Thus, very little attention was paid to the actual maintenance of the systems. During the five year period of 1979-80 to 1983-84, an examination of the recovery position of the selected irrigation projects in Maharashtra showed that, on an average, working expenses were about 91 per cent of the revenue receipts.

A study of irrigation systems in Bihar and Haryana, with the prime focus on their financial performance, was carried out by Bhatia (1989). The study revealed that for all irrigation projects in *Bihar*, net revenue (i.e. net of cost of collection) was only one-third of the working expenses on these projects, in 1984-85, in terms of both total and per hectare of area irrigated. Further detailed study for the four major projects of Sone, Kosi, Badua and Chandan, for the period 1980-84, revealed that the cost of establishment (i.e. mainly salaries and wages) had gone up sharply by over 173 per cent and the 'Works' component, i.e. the component indicative of the actual maintenance and repair works undertaken, declined by 23 per cent *in real terms*. The share of establishment costs in the O&M expenses on a per hectare basis, for the four projects together, increased from 12 per cent in 1980-81 to 23 per cent in 1984-85, while the expense on revenue establishment (i.e. cost incurred in collection of revenue) increased from about 23 per cent of the O&M expenses to about 44 per cent in the same period (Bhatia, 1989).⁵

Revenue establishment thus appears to account for a major share of total current expenditure on O&M in Bihar. Part of the reason is the large number of small farms in Bihar, with almost 76 per cent of the total farms having area less than 1 ha. As a result, the cost of collection as well as the number of people engaged on this job goes up. Besides, due to high population density, strong political pressures exist to

provide employment in Irrigation Department, resulting in over-staffing.

A study of *Haryana*, carried out by the same author showed that the share of gross receipts to working expenses decreased dramatically from 116 per cent in 1976-77 to only 52 per cent in 1981-82. Another interesting fact, brought out by this study is that in real terms the working expenses per hectare of irrigated area remained constant at around Rs 68. Also, unlike Bihar, the cost of revenue establishment in this state has been fairly low at about 17 per cent for multipurpose projects and 10 per cent for other irrigation projects in 1984-85. The 'Extension & Improvement, Maintenance' component has been reasonably high at 50-60 per cent of total expenses (Bhatia, 1989). However, these expenses include the wages of workers and technical personnel at lower levels and hence do not really reflect the amount being spent on the actual maintenance of the irrigation system.

Patel (1989) studied four irrigation projects (Kakrapar, Mahi, Dantiwada and Shetrunjee) in *Gujarat*. A critical review of their financial performances showed that of these four projects, only in Kakrapar project revenue exceeded expenditure by about 46 per cent on an average, over the period 1982-83 to 1986-87. For all the other projects, working expenses were in surplus when compared to revenue.* The reasons contributing to this shortfall in revenue were low utilisation of potential created as well as low rate of collection. The uncollected demand (about 40 per cent) accumulating over time adversely affects the financial viability of the project.

Although there were substantial fluctuations in the per ha O&M expenses, it could be observed that the share of establishment cost in the total O&M cost had been rising, signifying that maintenance and repairs was being neglected.** Patel's study indicated that such high shares of establishment costs led to poor quality of irrigation service resulting in widespread dissatisfaction among the farmers. It was suggested by him that in order to improve the situation, maintenance

* O&M expenses exceeded revenue by 6%, 23% and 77% for Mahi, Dantiwada and Shetrunjee respectively.

** For the period 1982-83 to 1985-86, the share of establishment costs in O&M costs was 47%, 52%, 47% and 36% for Kakrapur, Mahi, Dantiwada and Shetrunjee respectively.

and repairs should be provided for separately while special repairs should also be treated as a segregated category.

Similar findings were obtained from the study on the Chambal Irrigation Project, in *Madhya Pradesh*, undertaken by Sisodia (1992). It was found that revenue from irrigation in this project, fails to cover the working expenses and falls short by about 73 per cent. At current prices, while working expenses have shown an increase of 448 per cent during the period 1980-92, irrigation receipts have increased only by 153 per cent. This is because, while the recurrent expenditure has been increasing sharply, water charges have failed to keep pace with it and have in fact declined in real terms. Poor collection rate of irrigation revenue adds to the general malaise which is due to both poor assessment and outdated collection procedures. Inadequate improvement in the income of the farmers caused by poor irrigation service, was pointed out as another factor leading to poor recovery of irrigation charges by this study.

To sum up, the above review of literature on this subject suggests that maintenance and repair of irrigation system is treated in a faulty manner. Such works are undertaken out of residual funds left after meeting other commitments like establishment cost as is evident from the ever increasing share of this component in total O&M expenses. Thus, a separate provision needs to be made for establishment and maintenance and repair, if any worthwhile effort is to be made to maintain the created structures in any meaningful way.

III. O&M Expenses and Recovery: Structural & Temporal Behaviour

In this section, we take a look at the cost recovery aspect of O&M expenses for India as a whole as well as for selected states classified into the four regions of north, south, east and west. We also look at the structural and temporal behaviour of O&M expenses.⁶

(The period of study is from 1960-61 to 1986-87.⁷ The major states for which information is available have been grouped as follows: (i) Northern region comprising of Punjab, Haryana and Uttar Pradesh; (ii) Eastern region comprising of Bihar, Orissa and West Bengal; (iii) Southern region comprising of Andhra Pradesh, Karnataka and Tamil Nadu; and (iv) Western region comprising of Gujarat, Maharashtra and

Rajasthan.) The behaviour of Recovery Ratio (RR) and O&M expenses of the included states have been studied through their weighted averages for the regions.⁸ This also helps to discern the regional features underlying the state level data. An analysis of the structure of working expenses is attempted by looking at the relative proportions of the main components namely, Direction and Administration, Maintenance and Repairs, Extension and Improvement, Machinery and Equipment as classified by Combined Finance and Revenue Accounts of Government of India. The analysis from each of these angles is provided in the ensuing paragraphs.

3.1 All India

For the country as a whole, the financial performance of the irrigation sector may be considered somewhat satisfactory up to the middle of the sixties decade, with the Recovery Ratio [= (Gross Receipts/Working Expenses) x 100] remaining above 100. This indicates that receipts from irrigation were greater than the O&M expenses undertaken. But this encouraging situation did not last beyond the end of the third plan period (1960-1965). As seen in Figure 1, during the entire 1960s, the Recovery Ratio (RR) showed a declining trend and from 1966-67, the ratio had fallen below 100 indicating that receipts had fallen below expenses on maintenance of irrigation projects. This downward trend coincided with the rising trend in O&M expenses, as can be seen in Figure 2. The opposing trends in the two relevant figures indicate that during the 1960s, while the O&M expenses continued to rise, the revenue from the irrigation sector remained virtually stagnant leading to the gradual fall in the Recovery Ratio. This downward trend culminated in 1970-71, after which there was a short period during which the RR showed some recovery. This short period of rise in RR again coincides with an opposing trend in O&M expenses. Thus it appears that the rise in RR has been brought about due to the combined effect of a fall in the money spent on O&M of irrigation schemes and a hike in water rates that was carried out in most states of India during the early to mid 1970s. By 1975-76, the irrigation receipts had climbed marginally above the working expenses taking the RR above 100. But from the very next year, there was a downward trend again and the RR remained on this downward trend till the end of the period under study. From 1976-77 till the end of the

Recovery Ratio : All-India (Gross Receipts/Working Expenses)

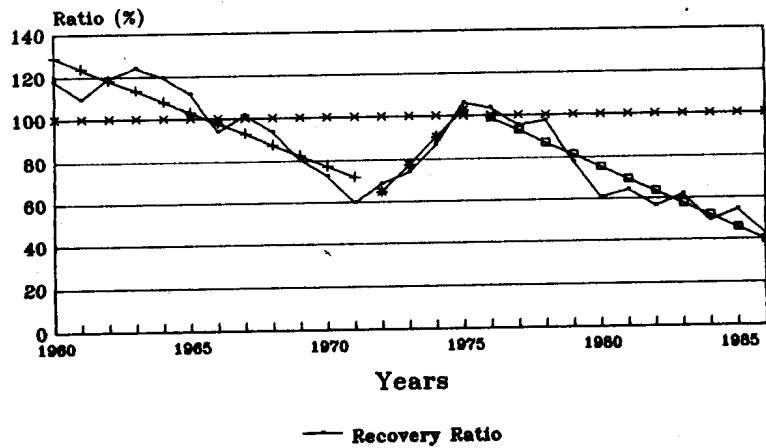


Fig 1

Source: NCAER (1994)

O&M Expenses Per Hectare (All-India) (At 1988-89 Constant prices)

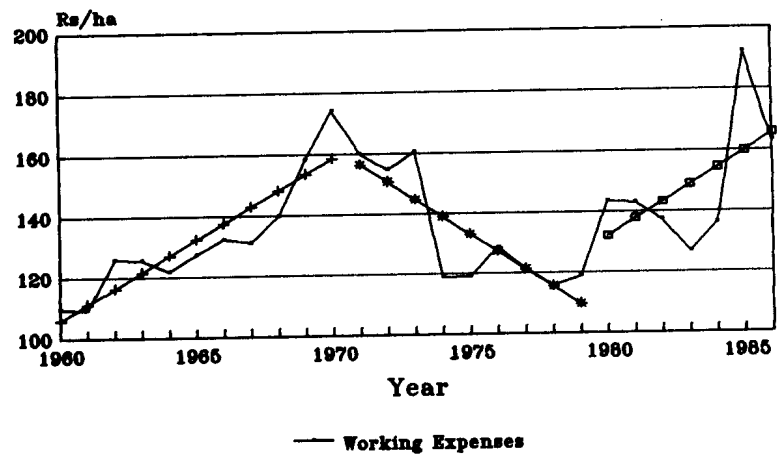


Fig 2

Source: NCAER (1994)

decade, RRs fall even though O&M expenses are also falling. This is happening due to the fact that during this period receipts from irrigation are falling at a rate greater than the rate of fall in the expenses on O&M. From the beginning of the 1980s, O&M expenses at constant prices again show a rising trend which coupled with a gradually falling trend in the revenue from irrigation, result in a marginally sharper fall in the RRs than witnessed during the 1960s.

Over the total relevant period, i.e., 1960-61 to 1986-87 the RR is seen to have fallen at an average rate of 3 per cent. This low rate of decline is essentially due to the initial rise and subsequent fall of gross receipts in the seventies decade. Looking separately at the period from 1975-76 to 1986-87, i.e. the period after the general hike in water rates, the trend rate of decline is found to be much greater at 8 per cent per annum (Table 3).

Direction & Administration and Maintenance & Repairs are found to be the two heads that dominate the working expenses on irrigation projects. The share of Direction & Administration remained generally below 35 per cent for the two decades of the sixties and the seventies. But on entering into the 1980s, the share of these establishment costs in the total working expenses, started increasing and usually lay within the range of 35 to 47 per cent, reaching the peak of 47.4 per cent in 1986-87.

Table 3: Trend Rate of Growth of Recovery Ratios

<i>Region</i>	<i>State</i>	<i>Trend rates over entire period under study (1960-87)</i>	<i>Trend rates after hike in water rates (approximately 1975-87)</i>
ALL INDIA		-3.06	-7.95
Northern Region		-3.16	-7.74
	Punjab	-4.16	-7.25
	Haryana	-5.43	-7.14
	Uttar Pradesh	0.92	-10.56
Eastern Region		-3.29	-6.28
	Bihar	-4.37	-11.31
	West Bengal	-10.74	-18.69
	Orissa	0.21	-2.49
Southern Region		-2.52	-5.69
	Andhra Pradesh	-1.05	-16.90
	Karnataka	-3.46	-15.01
	Tamil Nadu	-4.12	-14.35
Western Region		-5.40	-8.05
	Gujarat	-3.97	-10.55
	Maharashtra	-6.19	-9.49
	Rajasthan	-5.04	

The proportion of working expenses being spent on Maintenance & Repairs was the highest at the beginning of the period under consideration. Thus, during the 1960s, the share of this component lay between 60 to 70 per cent but started falling gradually from the 1970s. The sharpest fall was witnessed in the 1980s decade and in 1985-86, the share of Maintenance & Repairs in the total working expenses had fallen to a mere 27 per cent, rising marginally to 39 per cent in 1986-87.

The share of Machinery & Equipment in the total working expenses was found to be the lowest and stayed below 2.5 per cent for all the years under study. The remaining head of Extension &

Improvement had a slightly lower share and remained less than 15 per cent for most of the relevant period.

Thus, we find that the financial performance of the irrigation sector, at all India level, has deteriorated over time. This deterioration is particularly sharp in the 1980s, and hence of great concern.

3.2 Northern Region

The financial performance of the three states (Punjab, Haryana and Uttar Pradesh) in this region has been steadily declining during the period of analysis. On looking at the trend of RR for the Northern region, we find that the RR has declined at the rate of approximately 3 per cent per annum over 1960-86, and this trend is statistically significant (Table 3). While up to the end of the sixties decade, the RR remained well above 100 (Figure 3a), indicating that dues recovered through gross receipts were more than the expenditure incurred under O&M, the financial performance of the irrigation sector became less than satisfactory from the 1970s with RR dropping to below 100. Till about 1974-75, RR showed a declining trend corresponding to a similar trend in the expenses undertaken for O&M, indicating that during this period, gross receipts from irrigation were declining at a rate higher than the decline in working expenses. In 1974-75, there was a sharper fall in O&M expenses (Figure 4a). The hike in water rates during the same period, leading to an increase in gross receipts, resulted in a temporary recovery of the RR. But within a couple of years it was back on its downward inclining path. During the 1970s, while the percentage of recovery never fell below 80, the picture has become progressively more dismal during the 1980s with receipts falling to only 50 per cent of the working expenses by 1986-87. In fact, after this period, the fall in the RR is much sharper and more definite than in the period before 1974-75. Looking at this later period separately, we find that the RR has declined at a much greater rate of 7.7 per cent per annum as compared to the overall period under study (Table 3).

✓ All the three states in the Northern region display rising share of Direction & Administration and falling share of Maintenance & Repairs in O&M expenses, although the rates of increase or decrease differ in each case.

✓ Uttar Pradesh is the only state in this region where cost recovery

Recovery Ratio : Northern Region (Gross Receipts/Working Expenses)

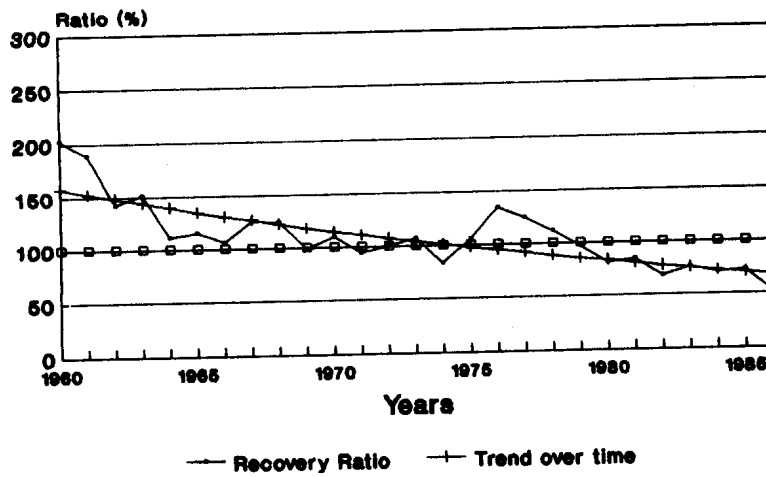


Fig. 3a

Recovery Ratio : Eastern Region (Gross Receipts/Working Expenses)

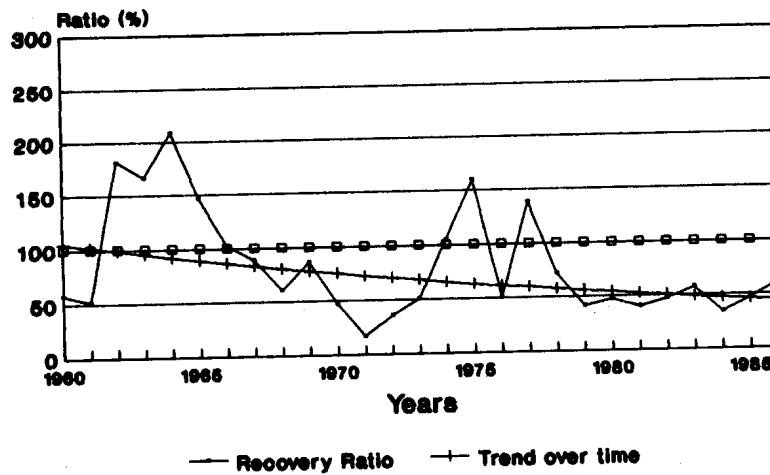


Fig. 3b

O&M Expenses Per Hectare (Nrthrn Region)
 (At 1988-89 Constant prices)

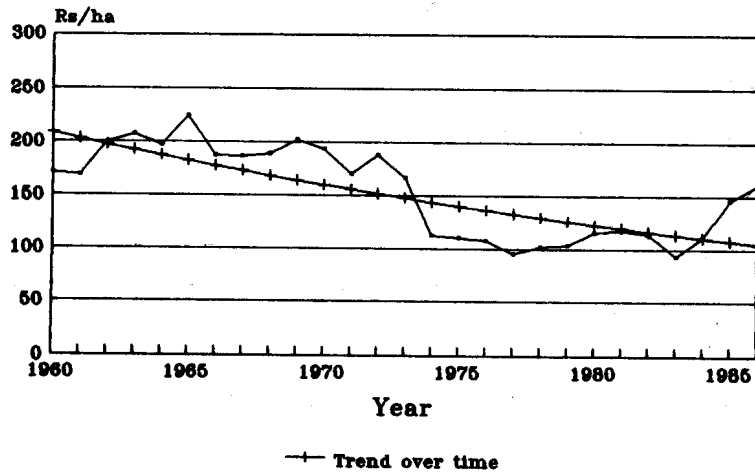


Fig. 4a

O&M Expenses Per Hectare (Estrn Region)
 (At 1988-89 Constant prices)

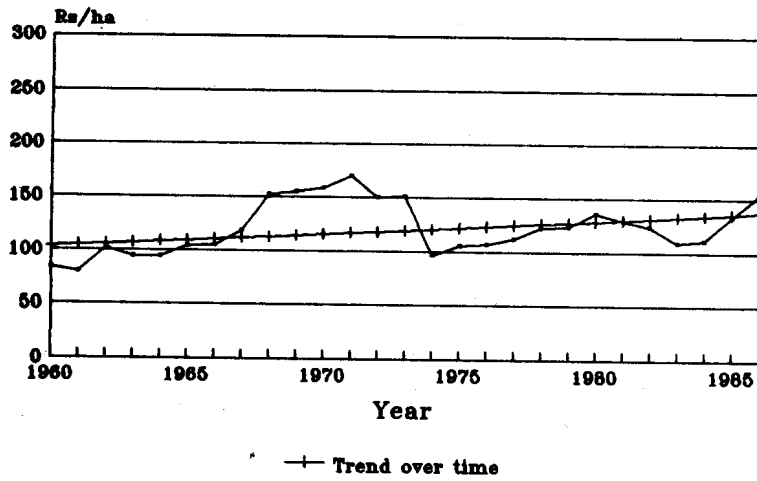


Fig. 4b

has been somewhat better than in the other states. Over the entire period of 1960-61 to 1986-87, RR actually shows a positive trend rate of growth, although it is only marginal at 0.92 per cent. In fact, during the first half of the 1970s the rise in RR was meteoric, touching 240 per cent in 1977-78. But thereafter, the decline in RR was considerable at 10 per cent, indicating that the financial state of Irrigation sector in this state is going the same way as the others.

Thus, even for the northern region, which has displayed the best overall performance, in relation to the other regions, the financial performance of the irrigation sector, especially from the late 1970s onwards, gives rise to a lot of concern regarding the present and continued health of this sector. This concern is re-emphasised by the fact that not only are the expenses incurred for operation and maintenance of the system not being recovered, but that the major part of the funds designated for O&M is being incurred on establishment costs rather than on actual maintenance of the systems.

3.3 Eastern Region

Under Eastern region, the states taken up for study are Bihar, West Bengal and Orissa. Compared to the Northern region, the performance of the states in the Eastern region is quite dismal. Over the entire period under study (i.e., 1960-61 to 1986-87) the RR is seen to decline at the rate of 3.3 per cent per annum which is found to be statistically significant at 5 per cent level of significance (Table 3). In fact, the trend rate of decline would be even more significant if we were to ignore the mid-sixties (1962-63 to 1966-67). During this period the region displays an uncharacteristically high RR which reaches a peak of 208 per cent in 1964-65 (Figure 3b). Thereafter, a sharp fall in RR takes place due to the combined effect of a significant rise in O&M expenses and an even sharper fall in the gross receipts from irrigation. From 1971-72, working expenses start falling, leading to a corresponding increase in the Recovery Ratio. In fact, in 1971-72, receipts as a percentage of O&M expenses had touched rock bottom at 17 per cent, but rose again to 159 per cent in 1975-76. This sharp rise in RR, in the mid-1970s, is aided by the rise in gross receipts which took place as a result of the hike in water rates during this period. But as the O&M expenses increase over the later half of the seventies (Figure 4b), RR falls again and continues on a declining trend over the rest of the

period under study. In fact, looking at the period from 1977-78 separately, the RR was found to be declining at an average rate of 6.3 per cent per annum. Only the state of Orissa shows a mild positive trend rate of growth of RR at 0.21 per cent. But even here, a negative trend rate of -2.49 per cent was witnessed from 1977-78 onwards.

As far as distribution of the expenditure allocated for O&M is concerned, the Eastern region shows a definite trend of increase in establishment cost as represented by the head 'Direction & Administration' and a corresponding fall in the funds left over for heads like 'Maintenance & Repairs' and 'Extension & Improvement'. It is again in the case of Orissa, that the trend appear to be reversed. In this singular state, the share of Direction & Administration has fallen from 20 per cent of O&M expenses in 1960-61 to about 8 per cent in 1986-87, while the share of Maintenance & Repairs has increased from an already substantial 74 percent to 88 percent during the same period. Thus it appears that in this state, operation and maintenance of the irrigation systems is not a neglected area.

3.4 Southern Region

The Southern region, comprising of Andhra Pradesh, Karnataka and Tamil Nadu, shows the worst performance as far as the cost recovery of the irrigation sector is concerned. Throughout the period under study (1960-61 to 1986-87) at no point does the Recovery Ratio for the southern region rise above 100 per cent, indicating that gross receipts consistently remain below the level of O&M expenses undertaken on surface irrigation schemes in this sector. We see from Figure 4c that the weighted average of the O&M expenses in the states in this region, remain more or less stagnant upto 1967-68 at around Rs 100 per ha, shooting up in the next year. This steep increase in the working expenses in this year is the result of large amount of money being allocated to O&M expenses in the state of Karnataka. Gross receipts from this state also show a steep increase in this period. Consequently the RR is not very greatly influenced by the abnormal behaviour of O&M expenses and receipts of the region in this year. Recovery Ratio had, in fact, shown a relatively sharp increase from 1964-65 onwards and peaks out in 1968-69, the year of the abnormality. Thereafter, RR begins on a declining trend and this decline continues upto the end of the period under study with a marginal

Recovery Ratio : Southern Region (Gross Receipts/Working Expenses)

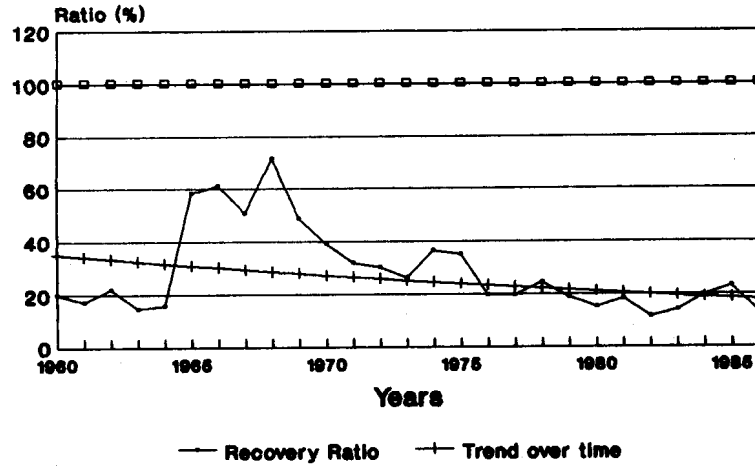


Fig. 3c

Recovery Ratio : Western Region (Gross Receipts/Working Expenses)

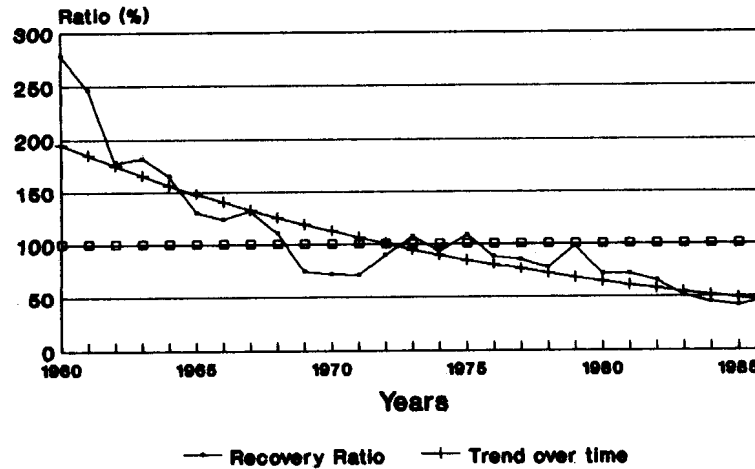
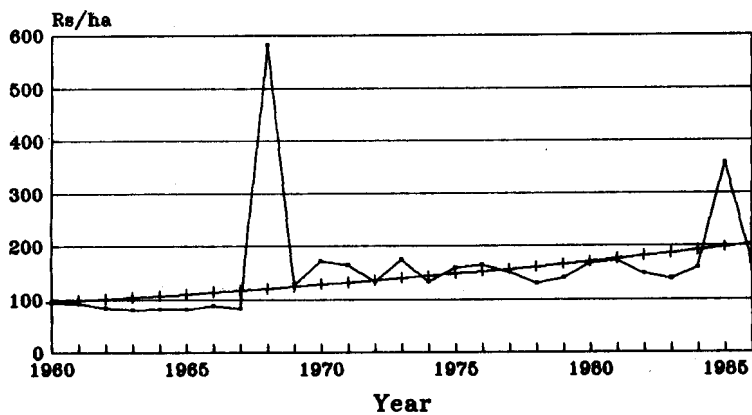


Fig. 3d

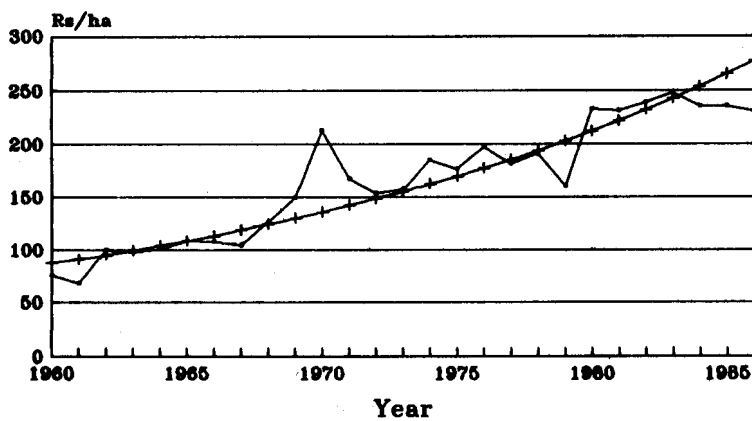
O&M Expenses Per Hectare (Sthrn Region)
 (At 1988-89 Constant prices)



—+— Trend over time

Fig. 4c

O&M Expenses Per Hectare (Wstrn Region)
 (At 1988-89 Constant prices)



—+— Trend over time

Fig. 4d

increase in 1974-75 and 1975-76 which was brought about due to the rise in water rates in the states of Andhra Pradesh and Karnataka. Tamil Nadu, of course, has not witnessed any rise in its water rates for the past 30 years (GOI, 1992). Since the rates increased in only two of the states, the weighted average of the RRs of the three states does not rise to a very great extent as is evident from the trend rates of decline in RR (Figure 3c). Thus, this trend rate of decline was 2.5 per cent per annum (Table 3) for the entire period under study while it is only marginally greater at 5.7 per cent during the period 1974-75 to 1986-87.

All the three states included in this region show an increasing trend in the expenses classified under Direction & Administration. A correspondingly decreasing trend in the expenses under Maintenance & Repairs is seen in the case of Andhra Pradesh and Tamil Nadu. Only in the case of Karnataka, the combined share of Maintenance & Repairs and Extension & Improvement remain more or less constant at between 70 and 87 per cent of the total O&M expenses.

3.5 Western Region

The states studied here under Western region are Gujarat, Maharashtra and Rajasthan. Looking at the weighted average of the three states, we find that the Recovery Ratio for this region, at the beginning of the 1960s is very high at almost 280 per cent. This indicates that gross receipts were almost thrice the amount spent on O&M of the systems. This is largely due to the exceptionally low level of working expenses, in 1960-61, for the states in this region. Thereafter, as O&M expenses start rising (Figure 4d), RRs correspondingly fall (Figure 3d), till about 1971-72. The rate of fall in the RRs is seen to be steeper than the rate of rise in O&M expenses, which is the result of the fact that gross receipts during this period have also been falling. This fall in gross receipts from irrigation is arrested after this period due to the hike in irrigation charges which allowed the RR to climb marginally above 100 per cent in 1973-74, indicating that receipts had increased sufficiently during this period to become more or less equal to the expenses on account of O&M. But from the late 1970s, the RR again commences on its declining trend, the decline becoming more pronounced after entering the 1980s. This fall in RR is both due to the rising trend in O&M expenses as well as the steep fall in gross

receipts towards the end the 1970s and into the 1980s. Over the entire period, Recovery Ratio fell at the trend rate of 5.4 per cent at a very high level of statistical significance (Table 3). Even when the period from 1975-76 is considered separately, i.e. the period after the rise in water rates, the trend rate of fall is only a little higher at 8 per cent per annum.

All the three states of this region, i.e. Gujarat, Maharashtra and Rajasthan which have been included in this study display the same trend of increasing share of Administration expenditure and a declining share of expenses on Maintenance & Repairs. This trend is most pronounced in the case of Gujarat.

IV. Concluding Remarks

The analysis carried out in the above section, based on the detailed data collected on the O&M expenses and gross receipts of surface irrigation projects, indicated that the financial performance of the irrigation sector in India is reason for grave concern. It was also found that the gross receipts in general fall short of the working expenses and it is this widening gap measured which results in the paucity of funds for O&M. It was found that 'recovery ratio' has been deteriorating over the past two decades for all states studied. The highest (negative) trend value has been observed in case of the Western region. The Southern region on the other hand, displayed the smallest rate of decline but also the lowest level of RR throughout the period under study. The level of gross receipts as a percentage of O&M expenses stood at less than 50 for each of the regions as well as for the country as a whole. On the other hand, all regions except the North display a rising trend in O&M expenses per hectare at constant prices. As in the case of RRs, the steepest slope appears to be in case of the states belonging to the Western region, indicating that the weighted average of the working expenses of these states increased at a rate greater than in any of the states belonging to the other regions.

Another point of note is that the predominant portion of the limited O&M expenses available, appears to be going towards paying for the establishment costs as seen by the increasing share of Direction & Administration in all the regions and for the country as a whole. West Bengal, Bihar and Punjab are the worst performers in this respect. This

increasing share of Direction & Administration is at the cost of falling share of Maintenance & Repairs which is indicative of the deteriorating health of the network of major and medium irrigation projects in the country. It is felt that the structure of working expenses over a period of time is explained by, among other things, the vintage of the irrigation projects in different states. A lot of our surface irrigation schemes being fairly old, more and more needs to be spent on their maintenance in order to make them perform at the same level of productivity.

The major and medium irrigation projects and a host of the multi-purpose river valley projects are the major components of the surface irrigation system in India, and are expected to provide sufficient water supply to sustain the expected and current level of agricultural development. In order to supply optimal levels of water, these need to be operated well and maintained regularly. Unfortunately, the performance of this sector has been far from satisfactory and poor O&M of these systems has been one of the factors blamed for this inability to achieve their expected potentials. The poor state of maintenance, in turn, is attributed largely to paucity of funds available with the state governments. What has contributed to this state of penury of the state governments is the exceedingly low water rates levied in states for the use of irrigation water.

Various studies which have looked at this issue with respect to certain specific projects, have brought out the inadequacy of the funds available for O&M purposes. Our study finds that this holds true not just for specific projects or some particular states, but practically for every state as well as the country as a whole. Moreover, most of the funds allocated for O&M are, in reality, spent on establishment costs like staff salaries and other administrative expenses leaving very little resources for the actual maintenance of the systems. This has led to the paradoxical situation where, while huge amounts to the tune of Rs 35,000/ha (at 1988-89 prices) (Gulati et al, 1994) is spent on development of irrigation facilities, available irrigation potential remains unexploited for lack of a small sum of about Rs 300 per ha annually. It needs to be kept in mind that if this small recurring cost is not made available, the productivity of the entire system which has been built up at an enormous cost, will fall to abysmally low levels.

Thus, in order to make a beginning in the right direction a hike in tariff rates on irrigation water is called for. This appears to be both feasible and justifiable in view of the virtually stagnant rates in various states of India. In fact, the pricing of water needs to be made volumetric in order to incorporate the concept of equity, such that tail enders are no longer subjected to paying for water they do not have access to. In this context, the Vaidyanathan Committee suggests a two-part tariff for irrigation water. There could be a fixed annual fee on a per hectare basis, which would entitle the farmer to use water. The second part, a variable one, could be determined volumetrically on the basis of the amount of water actually used (GOI, 1992). Since it might prove difficult to sell the water on a volumetric basis to the numerous individual farmers, the solution would be to form farmers' cooperatives. The Irrigation Department could sell the water by volume to these cooperatives who could then take up the responsibility of distributing the water to the individual farmers.

Thus, simultaneously with an increase in water rates, provisions also have to be made for an institutional change which would bring about an improvement in the quality and quantity of irrigation water supplied, as also the reliability of this supply. Given the current institutional set-up, with no incentives for either the farmers or the functionaries to make the system perform more efficiently, no further improvement in the functioning of the system can be brought about without bringing in innovative changes in the institutions of this sector. In this context, the most effective and, in fact, a pre-requisite appears to be to restructure the present institutions in such a way that they have greater degree of responsiveness to the farmers' needs. This can be done adequately by making the Irrigation Departments *financially autonomous*. This will mean making the department cover all its expenditure with the funds that it can generate through irrigation revenue and through other secondary sources. These would have the double effect of providing incentive to increase the agency income as well as an incentive to reduce cost (Gulati et al., 1994c). These two factors would help establish a relationship of mutual dependency between the user groups and the supplying agency, in this case the Irrigation Departments.

Experiments along these lines have been carried out with considerable success in countries like Philippines and China. As a

further step efforts can be made to incorporate farmers' organisations in the management and financial activities of the irrigation system in India. Some partially successful attempts in this direction have also been made within India in states like Gujarat and Maharashtra (for details see Gulati et al., 1994c). Farmers can also be issued certain equity shares which may be termed as "water bonds" (Gulati et al., 1994b). Such an instrument would not only allow recovery of part of the cost of developing the system, it would also increase the interest of the farmer in operating and maintaining the system well. Thus we find that in order to improve the sub-optimal performance of the irrigation sector in any significant manner, certain institutional changes have to be brought about and future government policies must focus their attention on bringing these about.

Endnotes

1. Apart from the main canal and its components, a number of branches, distributories, minors and sub-minors taking off from the main canals, also have to be maintained. The concerned department is also required to construct and maintain an elaborate communication network and supporting infrastructure. Some of the hydraulic and engineering components of irrigation schemes such as embankments and gates, need more regular maintenance and repair than others due to the frequent damages caused to them. Therefore, special attention has to be focussed on them.
2. This rate may be fixed on the basis of (a) gross annual irrigated area (followed in most states of India); (b) culturable command area of the projects (Bihar) or (c) irrigation potential created (Maharashtra).
3. The Conference also recommended the appointment of a committee consisting of five representatives from states, two from central government and one from Planning Commission to examine ways of effectively maintaining the systems and adequately providing for O&M costs of these. Ministry of Water Resources constituted such a committee which, after examining the data available for only four states, recommended a norm of Rs 180 per hectare per annum of gross irrigated area for O&M of major and medium surface irrigation projects, taking 1988 as the base year. Out of this, Rs 30 to 40 per hectare was to be allocated for head works; Rs 65 to 90/ha p.a. for the C.C.A component; at least Rs. 25 per hectare was to be provided for maintaining the drainage system in command area. Apart from this, one-third of the norm was meant for utilisation of unutilised potential while 20% of the above norm was to be provided for special repairs over and above the normal maintenance grant, as and when required.
4. The Eighth Finance Commission (1984) had reviewed the position of receipts and expenses of major and medium irrigation projects and found that receipts from irrigation had not improved and the deficit had further increased. In order to correct this, the Commission recommended a provision of consolidated amount of Rs 100 per hectare of gross irrigated area for maintenance, including normal repairs, special repairs and regular establishment. It was expected that this expenditure will be matched by receipts from irrigation charged and other irrigation receipts. For hill states norms were higher by 30 per cent. The Ninth Finance Commission retained the norms adopted by the Eighth Finance Commission after adjusting for the inflation factor.
5. Out of the total of establishment and work expenses, the 'work' component constituted about 85 per cent on a per ha basis in 1980-81. This share declined to just 60 per cent in 1984-85. This decline in share of actual maintenance work is partially due to a change in policy which entails more of such work being done directly by the Irrigation Department rather than through contractors resulting in cost savings, and partly due to a shift in expenses towards the establishment charges like wages and salaries. Similar trends have been noted in the four projects individually.

6. The total O&M expenses on the two types of irrigation works, commercial and multi-purpose, have been linked to the total irrigation potential created in each year in these states by major and medium surface irrigation schemes to obtain per hectare expenses incurred in each year.

A similar exercise has been carried out with respect to the direct receipts from the irrigation sector. The initial data for receipts, like expenses, have been gathered separately for commercial and multi-purpose projects and the total has been linked to the irrigation potential created by these projects in each year to obtain the receipts per hectare at current prices. These per hectare receipts have then been brought at the comparable level of 1988-89 prices using price indices. From the above two sets of data, the level of 'Recovery Ratio' for each of the years has also been calculated, where

$$\text{Recovery Ratio} = \frac{\text{Gross Receipts}}{\text{O\&M Expenses}} \times 100$$

7. 1986-87 is the last year for which information was available in published form, with the figures for the last two years being provisional. The analysis is based on data from the audited figures of Comptroller and Auditor General of India (CAG) published in the Combined Finance and Revenue Accounts of the Central and State Governments of India. The states included in the study are Punjab, Haryana, Bihar, Uttar Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu, Gujarat, Maharashtra, Orissa, Rajasthan and West Bengal. The comparable time series for the other states could not be constructed but the results in all the States seem to be fairly similar and may thus act as an appropriate guide to policy making.
8. The weights used are the figures of irrigation potential created during the different years for which the gross receipts and working expenses are reported.

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