FINANCIAL ASPECTS OF OPERATION AND MAINTENANCE OF PUBLIC CANAL IRRIGATION SYSTEMS IN INDIA.

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MASTER OF PHILOSOPHY

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CERTIFICATE

I, Moumita Basu, certify that the dissertation entitled **"FINANCIAL ASPECTS OF OPERATION AND MAINTENANCE OF PUBLIC CANAL IRRIGATION SYSTEMS IN INDIA"** for the degree of **MASTER OF PHILOSOPHY** is my bonafide work and may be placed before the examiners for evaluation.

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DEDICATED TO MY PARENTS

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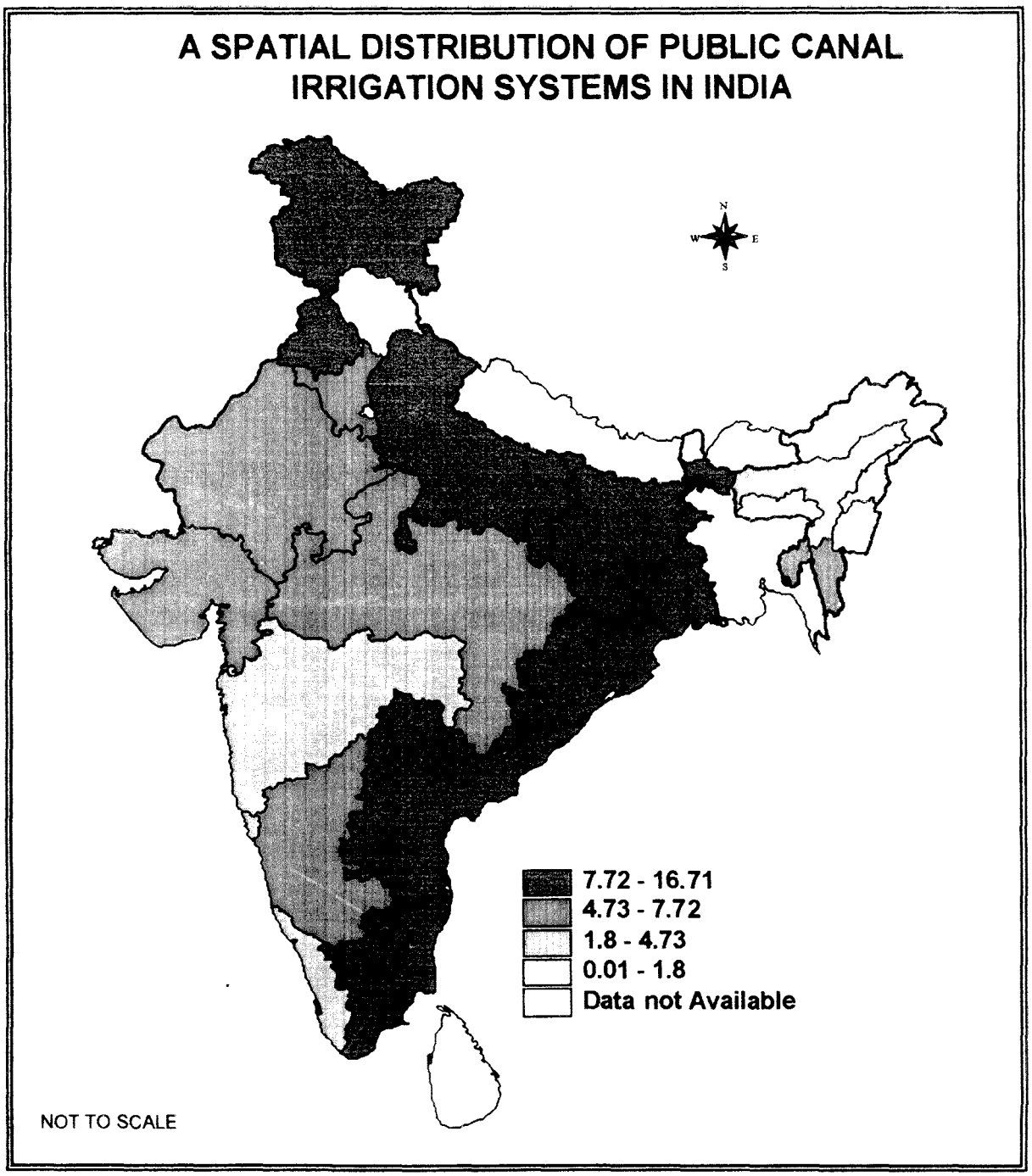
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CHAPTER 1

INTRODUCTION

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Introduction

1.1 Introduction:

The expansion and improvement of irrigation facilities occupy a strategic position in Indian agriculture. The investments in irrigation comprise the lion's share of the total investments in the agricultural sector. Since the introduction of the Green Revolution during the mid 1960s, lot of efforts have been undertaken to build up adequate irrigational infrastructure, in the forms of canals, tanks and wells for the implementation of the new agricultural strategy. This has made enormous impact on the crop yield, crop diversification and greater efficiency in the use of fertilizers and pesticides.

Until the 1960s, irrigation development in India was financially profitable. With the exception of some unproductive irrigation works undertaken as drought relief measures, irrigation was classified as a " commercial undertaking". Large amounts were allocated for laying out the irrigation infrastructure. However the once plentiful funds for canal irrigation are now drying up in response to the changing priorities of the policy makers (Ahluwalia, 1996). "The New Economic Policy is not against public investment in agriculture but it does require that higher levels of public investments must be achieved within the macro economic constraints of fiscal prudence"[1]. In other words the desirable increases in the public investment in agriculture cannot be simply financed by the increasing fiscal deficit. Hence, the major contribution towards sustained financing even in the irrigation sector must be generated from within the sector and should aim at achieving higher revenues and reduce the current expenditures. Since the capital expenditure in the Indian economy is decreasing (from 4.4 percent of GDP in 1990-91, to 2.2 percent in 2000-01), it would not be unreasonable to expect a similar decline in investments towards new irrigation projects, particularly for the larger projects. The efficiency of the existing canal systems thus is of crucial importance. It is therefore in this context that the present study primarily aims at looking at the receipt, operational and maintenance aspects of the canal irrigation systems in India, at the backdrop of the present macro economic constraints.

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[1] Ahluwalia, M. "New Economic Policy and Agriculture: Some Reflections" Indian Journal of Agricultural Economics, pp. 412,Vol. 57, No.3, July-Sept, 1996.

The physical conditions of most of the large irrigation systems are deteriorating. The consistently rising fiscal deficit has resulted in dwindling of available funds for the maintenance of the existing systems as well as for financing new irrigation projects. The favourable food balance currently prevailing in India, historically low prices of food grains, the rising costs in canal construction and the heavy external debt are also some of the important factors behind the financial crunch in this sector. It is in such a backdrop that the present study, attempting to look at the adequacy of funds in this sector for the actual operation and maintenance of these systems becomes topical.

The near unavailability of funds has resulted in deterioration in the operation and maintenance of the public canal irrigation systems in India. (Dhawan, 1989). Hence what various planners and policy makers have suggested is to encourage and chalk out ways in which the sector itself has the potential of generating its own income. One of the promising and assured supplies of funds can come through the levying of irrigation charges through water tariffs levied from the users. However, the overall trend in receipt has not been promising. During the past decade, the revenues from collection of water charges have increased modestly by a mere 29 percent in real terms due to primarily the expansion of the canal irrigated area. By contrast, non-plan expenditure such as those on operation, maintenance and administration and other establishment costs have soared up by about 280 percent in real terms. Such a steep rise in the Non-plan expenditure has caused a considerable shift in the composition of total expenditure on irrigation. This decline in the net financial situation in this sector has been due to the combined impact of a decline in real terms in per hectare revenues earned through water charges and an appalling increase in the recurring expenditures. The table 1.1 summarizes the above statement.

Table 1.1 Revenue and Expenditure on Major and Medium Irrigation Projects.

(Rs. Million at 1980-81 Prices)

Revenues and Expenditures	1980-81	1988-89	% Increase
Revenues (Current Account)	874	1125	29%
Non Plan Expenditures	3930	15000	280%
Revenue as % on Non Plan Expenditure	22%	7.50%	

Source: Reserve Bank of India Bulletin, 1990.

Water rates form an important basis for collection of revenue from the direct beneficiaries or the farmers. In most of the states, these are levied on a per hectare-crop wise basis. Generally higher water rates are levied for water intensive crops like sugarcane and lower rates are fixed for less water intensive crops like certain coarse cereals. However the main problem with this is that, the farmers seldom pay the nominal irrigation charges. This has resulted in accumulated arrears of the water charges. Another pertinent problem related with this issue is the considerable lag in the revision of water rates.

On the other hand, the recurring or the operation and maintenance expenditure has been rising showing no match with the collected receipts. Different Committees from time to time have recommended increase in the allocation of funds for the maintenance and operation of the systems to ensure long term sustainability of these systems. Urgent improvement in operation and maintenance immediately needed in most of the states as the irrigation structures are in a precarious condition and require immediate funds for their repair and maintenance. Government concern with maintenance needs across the different states is reflected in the *Public Account Committee Report, 1983*, where it stated that "maintenance of existing irrigation systems is not getting the attention of states as required."

It is a well-known fact that the water charges collected do not cover the working or operational expenses, leaving aside the depreciation and the capital cost. " The situation in which the State is investing enormous amounts of public money, largely borrowed, without recouping any part of it, is both inequitable and untenable- inequitable in as much as irrigation increases the productivity of the users and enables them to enjoy, without bearing a reasonable part of the costs, a benefit not available to majority of cultivators and untenable in as much as the failure to recover costs."(Report of the Eighth Five Year Plan, pp 68).

Low receipt and recovery from the public canals have inflicted serious repercussions on the physical and financial health of the irrigation systems in India. Hence the financial aspect, determining the direction and nature of spending assumes special significance. The major focus of this work would be to analyse the nature of

spending on the operation and maintenance of the major irrigation systems in India, their quality and composition, the adequacy of the financial inflows vis-a vis outflows and provide suggestions for framing future policies and strategies to mitigate some of the problems engulfing this sector.

Objectives of the Study:

1. To analyse the regional variations in the systems of pricing of canal irrigation waters in India with, that is to examine the rationale of the existing pricing mechanism prevailing across the various states and suggest certain policy implications to rectify the lacuna existing therein.

2. To determine the efficiency of collection of irrigation dues across states.

3. To analyse the spatial patterns in the trends of operation and maintenance expenditure.

4. To assess the nature of direction and quality of spending on operation and maintenance activities across the states.

5. To determine the temporal and spatial trends in the adequacy of financial inflows vis-a vis outflows.

Database:

The database for this topic is quite restricted. Not many data sources are available regarding the issues dealt in this work. Problems have been encountered in collecting new sets of data pertaining to pricing of irrigation water as most of the states still publish old data. Discontinuity in the nature of data while dealing with the operation and maintenance expenditure aspect has restricted the analysis to certain extent due to its non-comparability.

The database used in this work are as follow:

- *Statistical Abstracts* (various years).

Data related to the gross irrigated area by various sources and the gross irrigated area under different crops used in the analysis have been taken.

- *Report of the Committee on Pricing of Irrigation Water, Planning Commission, 1992.*

Data related to water rates for different crops, gross receipt and expenditure figures, operation and maintenance expenditure across states with certain project specifications have been available from this source. To analyse the quality of expenditure, the sub components of operation and maintenance (O&M) as provided in this source from the year 1986 to 1991 have been referred to. For an overview of the different water users' associations existing in India, the report has served as the most important database.

- *Combined Revenue and Finance Accounts of Union and State Governments (various years).*

This has also been one of the most important data source for analysing financial aspects especially related to O&M expenditure. Data related to the project wise breakup of operation and maintenance cost for the years 1985-86 and 1997-98, taken for consideration in the analysis have been taken from this source.

- *Finance Accounts of various states:*

This too has served as an important data source for the analysis of the quality of financial expenditure for different years, across states.

- *Water and Related Statistics, Central Water Commission, 1989.*

Data related to the gross receipts and working expenditure from 1974-75 to 1995-96 for the major irrigation systems in India have been used in the analysis to show the adequacy of the financial inflows vis-a vis outflows.

- *Irrigation Sector Review, Volume I and II, 1991.*

This has provided data on receipts, operation and maintenance of certain important projects in selected states.

Methodology:

Simple statistical techniques like trend analysis and Spearman's Rank Correlation Techniques have been used in this work. Simple average annual growth rates to determine the rate of change of growth in O&M expenditure, receipt and recovery ratios

have been calculated. One of the difficulty faced during the analysis of the quality of expenditure for O&M expenditure over the years have been the change in their heads of classification. Hence, to make the data available from different sources more comparable, simple method of aggregation has been followed.

Literature Review:

Irrigation as an infrastructure assumes a vital position in the Indian agricultural scenario. The Government of India after independence launched massive programmes to increase the agricultural yield and output by investing huge amounts in building up the requisite infrastructure especially the irrigation infrastructure. Canals, which are the most significant sources of irrigation in the northern parts of the country, have played important role in bringing about a revolution in the agricultural yield and productivity. As a consequence, the investments in this sector have been consistently on a rise. Since 1951, the combined Plan outlays from central and state governments on the major and medium irrigation systems have totaled Rs. 673 billion at 1985-86 prices, and the expenditures ever since have been increasing in the following plans. (*World Bank Report, 1991*). Data on the performance and in particular the economic viability of irrigation projects are very limited. However sufficient literature is available on the financial aspect of this sector. Though a plethora of quality work exists in the arena of the financial performance of this sector, nevertheless most of these works primarily focus on the capital costs of the projects, their cost-benefit ratios. (*Mitra, Dhawan, 1997, Iyer, 1989*). However the focus of my work is to highlight on the issues of irrigation pricing and its relation with the recurring expenditure and the role of the farmers' groups who can help in mitigating some of the problems.

To ensure overall development and flow of funds, the cost and pricing of irrigation water should match each other. The sooner it is implemented, the faster will be the growth of this sector. According to the economists and planners, the subsidies incurred in the different sectors should be explicit. However the subsidies provided to the irrigation sector is implicit in our Budget allocations. (*Sangal, 1991*). This altogether neglects the losses incurred by the power and the irrigation sector, which have serious constraints on the revenue earned from this sector. The concept of irrigation pricing is

attaining a lot of importance among the planners and the policy framers in the recent years. For the sustainability of the systems, sufficient funds need to be generated. One of the significant ways in which funds can be generated is by levying water rates on the beneficiaries for the water they use for irrigating their crops. The low level and poor collection of water charges has been an obdurate issue affecting nearly all the major irrigation projects in India. (*Irrigation Sector Review, 1991*). There has also been frequent politicization in the levying of water rate as farmers form a major chunk of the vote bank with politicians frequently promising not to increase in the water charges. Hence the state governments are reluctant to revise the existing water rates and enforce strict discipline on the users so that they pay their timely water dues. Politicians simply do not realise ' the myopia of their policy of gross under-pricing of water that ultimately lowers the quality of irrigation service.'(*Dhawan, 1986*).[2]

According to the *New Water Policy of India, 1987*, the small and marginal farmers should be provided with irrigation water facilities at a much concessional rate. It is also noticed that the farmers' notion about the water rate is that it is a kind of a tax. Since agriculture and other allied activities are excluded from the tax net, the beneficiaries are not willing to pay for the water they use for irrigating their crops. However it has been argued out that, water rates collected are not a part of tax, but a part of the user charge falling under the category of non-tax revenue in the budget documents. (*Report of the Pricing of Irrigation Water, 1992*). The farmers are even reluctant to pay even 4-5 per cent of the gross produce as canal irrigation charges. According to the Second Irrigation Commission Report, 1972, the farmers should pay a minimum of 4-5% of their gross value of produce for the less water intensive crops, and a maximum limit of 12% for the highly water intensive crops like sugarcane and certain horticultural crops. However at the same time, the willingness of farmers to pay more for the ground water than for canal water has also something to do with the fact that the former involves less waste during use and also permits greater control over when and how much water to apply.

[2] Dhawan, B.D, " Irrigation and Water Management in India: Perception of Problems and Their Resolution", Indian Journal of Agricultural Economics, Vol. 41, No. 3, July-Sept, 1986.

In most of the states, the system of irrigation on a crop-area based approach exists in pricing and not on the basis of volumetric basis. As a result of this, often the farmers, especially those who are at the tail end of the canals are dissatisfied with the quantity of water being supplied to them though they have to pay the same water charges as the head end farmers. *Bottrall (1981)* states that if water is not delivered to the watercourse outlet adequately and in a timely manner, investment below the outlet will produce disappointing returns. Thus the present state of affairs puts an unfair burden on the farmers who do not receive adequate water and at the same time, encourages wastage of water in the upper reaches as water there becomes a surplus. "Divorce of economic benefit from financial responsibility creates significant economic rents in public irrigation systems, which weaken incentives for efficient use of resources and promote inequities." (*Repetto, 1986*).

Most of the surface irrigation projects have a great deal of variability in the water available for use during different seasons. This is one of the most pertinent natural constraints on any large irrigation project. A case study of the Indira Gandhi Nahar Project shows that there is considerable variability in the distribution of irrigation water among the farmers. As water flows through different hierarchies of the canal, a variable amount of water is lost. This is also another important reason for the tail- enders virtually receiving very less water. (*Basu and Shirahatti, 1990*).

A classic study in irrigation financing and cost recovery is that of *Ramesh Bhatia (1987)*. According to his study, when the charges in water rates are adjusted for changes in the wholesale price of rice and wheat, the water rates actually did not increase at all during the past decade in real terms. In case of Bihar, water rates are charged either on the basis of a season involving three waterings or of a single watering. In 1983, a committee constituted by the Planning Commission, headed by Nitin Desai, recommended that the internal rater of return (IRR) criterion should replace the benefit-cost ratio and this ratio should be a minimum of 9 percent.

The first *National Conference of States on Irrigation and Water Resources* held in 1975, recommended the setting up of a water utilization team to study the irrigation systems for increasing its efficiency. The team visited various irrigation schemes and established the fact that the funds allocated for Operation and Maintenance expenses

were abysmally low and hence insufficient for the actual maintenance of the system. The operation and maintenance costs of a few selected projects as enumerated in their Report is as follow.

Table 1.2 Operation and Maintenance Cost of a Few Selected Irrigation Projects in India, (1975-77).

States	Project Name	Operation and Maintenance (Rs./ha)
Bihar	Sone Canal	8.75
Uttar Pradesh	Lower Ganga	5.0
Uttar Pradesh	Upper Ganga	7.93
Kerala	Peechi Project	18.25
Maharashtra	Purna Project	17.5

Source: Gulati, Svendsen and Roychowdhury,"Towards Better Financial Performance of Major and Medium Irrigation Schemes in India". NCAER, Working Paper No.46.

The *Public Accounts Committee* of 1983 opined that adequate irrigation revenues should be generated for proper maintenance, operation and depreciation charges. Subsequent groups and various committees such as the *National Conference of Irrigation and Water Resources Ministers (1986)* and the *Jakhade Committee (1987)* remarked on the extremely low water rates which were insufficient to cover the operation and maintenance costs. Low water rates have been prevalent in the various states for years despite the Irrigation Commission's recommendations that the rates be revised every five years. One such example is that of Tamil Nadu, where water rates have not been revised for the past thirty years. This lag of attitude among the various state governments in the revision of water rates have resulted in a wide gap between operation and maintenance expenses and the cost of providing irrigation services, 'although a the rise in price of agricultural output, does not in any way justify stagnant water rates.' (*Gulati, Svendsen, Roy Choudhury, 1994*).

The *Fifth Finance Commission (1969)* felt that the receipts from irrigation should cover the entire operation and maintenance cost as well as about 2.5 percent of the capital cost. However the *Sixth Finance Commission (1973)* and the *Seventh Finance Commission* (1978) suggested that the revenue collected from the water charges should be able to cover the entire operation and maintenance expenses plus 1 percent of the

capital cost. However the *Eighth Finance Commission (1984)* and *the Ninth Finance Commission (1988)* reiterated that the revenue collected should cover the operation and maintenance charges, remaining silent on the percentage of capital charges to be levied.

The Tenth Finance Commission (1994) brings out the fact that the losses incurred by the irrigation projects have continued to escalate. Such mammoth losses have amounted to about Rs 881 crores in 1992-93. " Presently the receipts are not meager but they constitute a negligible proportion of the value of produce per hectare of irrigated area."[3]

The National Water Policy (1987) laid down certain directions with regard to the pricing of canal waters. It stated that the rates should be such that would encourage farmers to practice utilization of water economically. It also stated that the receipts should cover the annual operation and maintenance charges as well as a part of the capital cost.

Ratna Reddy's (1998), classic study on the issue on willingness to pay for the irrigation water deserves special mention conducted during her field survey in a few villages in Rajasthan. In this study the Contingent Valuation Method (CVM) is used to elicit information on willingness to pay for irrigation water by asking the farmers the amount they are actually willing to pay for the water they use for irrigation. According to her, the willingness to pay for the water is actually two to three times higher than that what they presently pay provided they get an assured supply of water on a routine basis. The study also reveals that a positive association exists between the willingness to pay and the income of the farmers.

The government of Bihar has an elaborate revenue administration in its irrigation department. The cost of collection itself amounted to Rs. 64 million in 1984-85. In fact the costs of collection were about 78 percent of the total revenue collected from different irrigation projects. Another significant reason for the low level of irrigation charge collection was due to the lack of incentive on part of the government to revise the water rates on time. According to a study pertaining to Haryana, water rates were revised once in a decade. (Bhatia, 1989). However it should be remembered that, by simply increasing the water rates, there might not be any 'accountability linkages between operating agency

[3] Report of the Tenth Finance Commission, 1994, para.11.3.23.

and the farmer clients that are necessary for sustained provision of high quality irrigation service.' (*Gulati, Svendsen, Roy Choudhury, 1994*).

Directly related to the issue of pricing of irrigation water is the operation and maintenance cost aspect of the various irrigation projects. A plethora of literature is documented in relation to the O&M cost aspects. In most of the documents, the operation and maintenance costs are discussed along with the pricing aspect.

Many irrigation systems in India perform at all levels far below their design standard, and the need to improve the performance of the existing irrigation systems is therefore very important. The performance of an irrigation system can be improved by the following:

1. Improving the physical structures.
2. Improving the operational performance of the system by better management facilities.
3. Assured supply of water to the farmer groups.

The *Working of Major and Medium Irrigation Projects* was set up to formulate programmes for the Eighth Plan observed that not only the rates are low for the different states of India but they also do not cover the operation and maintenance costs. The group felt that the present system of fixing flat rates per hectare of irrigated area for operation and maintenance expenses without considering the nature of the project is irrational as the need for maintenance is pertinently different for different projects. The Working Group proposed provision of funds at the rate of Rs 150 per hectare for special repairs necessary for proper maintenance and long-term sustainability of the systems.

According to the *New Water Policy of India 1987*, "Water Rates should be such as to convey the scarcity value of the resources to the users and to foster the motivation for the economy in water use." According to its policy, they should be adequate to cover the annual operation and maintenance charges and a part of the fixed costs. The report also asserted that the water rates should be rationalized with due regard to the systems created through massive investments and should be kept in proper health and condition. *This report also stated that the bulk of the receipts (about 80 percent) are actually spent on the payment of wages and salaries of the staff employed leaving a nominal amount for the actual maintenance of the system.* Hence it should be reiterated that apart from rationalizing and revising the existing irrigation structures it is also important to rationalize the expenditure side also so that the bulk pf the receipts are not spent on the

wages and salaries and other such establishment costs at the expense of actual working expense.

The *Report on the Working of Major and Medium Irrigation Projects for the VIII th Five Year Plan (1990-95)* has suggested that the Operation and Maintenance will be carried out under Non Plan expenditure on the norm to be fixed in each state depending on certain climatological and other physical factors. Special repairs of the existing systems should be carried out under plan provision of funds at the rate of Rs. 150 per hectare of Net Area Irrigated.

Pawar (1985) studied the operation and maintenance cost aspect of a few selected a sample of irrigation projects in Maharashtra. According to his study, about 65 percent of the potential created in these sample projects, remained unutilized. One of the overriding factors for this poor utilization was due to the lack of proper repair and maintenance of the irrigation projects.

Bhatia's study, (1989) focused on the financial performance of the major irrigation systems in Bihar and Haryana. His study revealed that, the net revenue earned from the sale of irrigation water (total revenue earned-cost of collection) was only about 30 percent of the total operation and maintenance expenditure. His field surveys during the years 1980-84, related to the four major projects of Sone, Kosi, Badua and Chandan indicated that the cost of establishment like the expenditure on salaries and wages, shot up by about 173 percent. On the contrary, the expenditure on the actual works component like the maintenance and repair aspect declined by 23 percent in real terms. The lion's share of the revenue expenditure includes not the repair and maintenance aspect but payment of salaries ad wages to the staff employed in this sector. His study of Haryana, carried out in 1989, revealed that, here the revenue establishment cost was low and a significant proportion of the total expenditure was made on the "extension and improvement an d maintenance" component. However this too does not reflect the actual nature of spending as this head also includes the wages and salaries component.

Patel, (1989) studied four irrigation projects in Gujarat namely Kakrapar, Mahi, Dantiwada and Shetrunjee. His study clearly indicated that except for Kakrapar multipurpose project, in the other three projects the revenue expenditure far exceeded the revenue earned. Although there were fluctuations in the per-hectare O&M costs, the share

of establishment in the recurring cost expenditure has been rising indicating clearly that the actual repair and maintenance has take a back seat. This resulted in poor quality of irrigation services resulting in widespread dissatisfaction among the farmers.

Similar findings were obtained from the study on the Chambal Irrigation project, in Madhya Pradesh, by *Sisodia, 1992*. Here too his work revealed that the water charges have failed to keep pace with the rising expenditure. All these have resulted in a chain effect, whereby, the poor quality of water supplied to the users have resulted in lower yield and productivity of crops, thereby resulting in income crunch for the farmers. This is also another important cause for the poor recovery of the irrigation charges from its beneficiaries.

Today, 'not only is there need for better dissemination of data, there is need for forethought and proper planning of the maintenance and operation of the system.'(*Ghosh, 1991*).[4] As discussed in his paper many of the past irrigation projects are virtually in a moribund state because of lack of proper maintenance and repair work. He therefore suggests that this operation and maintenance aspect could be improved if there is participation and agreement among all the beneficiaries and there is a system of regular monitoring of the irrigation systems.

In *The Report on the Pricing of Irrigation Water*, chaired by A. Vaidyanathan, published by the Planning Commission, in 1992, discussed vividly regarding the operation and maintenance cost of irrigation projects. According to the committee, there should be separate norms for head works, main canals and branches, distribution network, communication network and buildings. It would be appropriate that, based on these general recommendations, the states should work out the norms for the head works, canals and distribution system. Based on these norms, the per hectare norm for operation and maintenance should be worked out varying across regions and projects there in. the committee also reiterated the fact that, a periodical review of O&M costs and pricing of the irrigation water. This committee is of the view that the states should form a high powered autonomous board or the irrigation pricing board to review the policy, establish the norms regarding the maintenance costs for various components and staff costs, assess

[4] [4]Ghosh, Arun: Eighth Plan: Challenges and Possibilities-X, Agriculture and Irrigation Management of Water Resources. Economic and Political Weekly, April 6, 199. pp. 870.

the actual expenditures in relation to these norms, and determine the parameters and criteria for revising the water rates. There should be a mandatory review of all these matters every five years with an opportunity for users to present their views.

Realising the gravity of the financial problem in the irrigation sector and its consequential effect on the repair and maintenance work of the irrigation structures, planners and policy makers have provided certain solutions to mitigate some of the problems. One of the ways in which such problems can be solved as suggested by the various committees and planners is to hand over the ownership of the irrigation structures to the direct users or in other words to the beneficiaries. It has been suggested that if the farmers are made the real owners of the irrigation systems, then they themselves would take renewed interest in the proper maintenance of the same. For the proper functioning and maintenance of the systems funds need to be generated which can be done if they themselves collect the water charges from the users. Hence following this logic, experiments are on in a number of states to transfer the management of water distribution to the farmers' groups *(Patil, 1997)*, has discussed about such water management institutions in Maharashtra. According to his study we find that about ten to fifteen such water management societies are working satisfactorily in the state. The major task of the farmers is to look after the distribution of the water to the fields as often the tail-end farmers complain of the problem of inadequate water supply to their fields.

In India debate on irrigation management is polarized between the 'top down' and 'bottom up' approaches though institutional reforms are not given due importance. *(Vaidyanathan, 1996)*. Hence as suggested by different scholars and planners, an integrated approach needs to be embraced for the success of pricing and institutional mechanisms in irrigation management. *(Reddy, 1998)*. However it should be remembered that in India till now institutions have not made much progress in India. Hence it has been suggested that the institutional mechanisms nee to be more reinforced to make pricing and operation and maintenance aspect much more effective. Hence it has been suggested that the irrigation departments need to be decentralized. The irrigation departments should sell the water on a volumetric basis rather than to the individual farmers. Their responsibility of maintaining the system ends at the point of delivering the water to the farmers' groups. Hence the joint effort on the part of both the authority and the user

groups prompts the promotion of local level institutional arrangements and provides the necessary environment for sustenance. (*Lam, 1996*). When accompanied with institutional reforms, at the administrative level, user societies are expected to bring about an efficient distribution system as is evident from many of the experiences of the South East Asian countries. (*Postel, 1992; Sengupta, 1991; Raby, 1991; Mitra, 1992; Bruns, 1993).*

Hence in conclusion it can be said that the issues dealt in here need immediate and sincere attention from scholars and planners. The capacity to pay for higher irrigation charges is there with the farmers, and most of them are also willing to pay, but the problem is that they need to be assured of better irrigation services and plugging of leakages in irrigation funds for this. One has to grant greater autonomy to irrigation authority, involve farmers in actual management and decision-making, and establish independent regulatory commissions (*Raju and Gulati, 2000*) similar to what has been done in the power sector reforms. The need of the hour is to make the system much more transparent than what it is at present. With institutional reforms one hopes that canal irrigation in India will be able to overcome not only the issues of subsidy, recovering operation and maintenance expenses, but also tread on a sustainable path with higher efficiency in water supply to the farmers.

CHAPTER 2

OVERVIEW OF INSTITUTIONS IN PUBLIC IRRIGATION SYSTEMS IN INDIA.

CHAPTER 2

Overview of Institutions in Public Irrigation Systems in India.

2.1 Introduction:

Irrigation facilities are created to supply water to the farmers for the growing of crops and thereby to increase their crop output and income. Since independence, each farmer is required to directly deal with the government regarding water supply except in certain cases like in the Punjab and Haryana where the Warabandi system of irrigation prevails since there is some scope of collective participation among the farmers in the management of these systems. In all other systems, the farmers do not take much care of the field channel maintenance and in economizing the water use. The public irrigation systems in India, is encountered with certain serious problems, like inefficiency and management problems, which need to be addressed as early as possible. The present system of water management does not provide collective efforts in self-governance by the users. (Gopinath and Kalro,1986). The result is that, there is no effort on the part of the farmers to maintain even the field channels, which are constructed in their fields by the government. The effective involvement of farmers who are the actual beneficiaries of such systems, can, help in their improvement of the operational efficiency and financial viability. To ensure better management and efficiency in these irrigation systems, it is essential to move progressively from management wholly through the government bureaucracy to the management by the users' groups (Botrall,1981). *Ensuring active participation from the actual users or the beneficiaries can mitigate some of the management problems encountered by this sector.* Hence this chapter as a prelude to the following chapters would essentially deal with the role the local institutions can play in solving some of the crippling problems of this sector.

Hence the primary objective of this chapter would be to essentially focus the importance of the Water Users' Associations- (a relatively new concept, which has emerged after the 1990s), which can as a matter of fact, offer some solutions to the problems encountered. In the 'Introduction' section of this work, some information have been provided to highlight the financial, maintenance, and operational plight engulfing this sector. The problems related to the financial mismanagement, improper operation

and maintenance of the systems, the faulty pricing system- can be resolved if the farmers or the actual users of such systems obtain the ownership rights of the existing structures. This would make them the true owners to encourage them to take initiatives for the proper maintenance of the same (Irrigation Sector Review,1991).

Though the importance of pricing of irrigation water or about the need for proper operation and maintenance activities are yet to be discussed in the following chapters, it can be inferred that, the massive size of our irrigation structures, coupled with the ill equipped administrative set ups, make the irrigation pricing a very difficult proposition especially under the present institutional set up. Various literature suggest a complete change in the institutional set up, so that the farmers or the actual beneficiaries are handed over the ownership of these structures. Hence the major stress is on the farmers' participation in the management as well as on the designing of irrigation projects (National Water Policy,1987).

The background to which the strength of the beneficiaries has been realized in our country can be attributed to the successful experience of farmers' participation in irrigation management in East Asian countries where irrigation systems are rather small in size. However reaping similar results through farmers' participation even in India, where most of the structures are massive, is still a highly uncertain proposition. (Reddy, 1998). The debate on irrigation management is centered on two major approaches- the 'top down' and the 'bottom up' approaches. It has been argued by scholars that an integrated approach of the two is required to bring about success in realizing the objectives of the institutional mechanisms in irrigation management in India.

2.2 Importance of a Group Based Participatory Approach:

With the introduction of the 73 rd and 74th Amendments in 1992 and 1993 in our Constitution, the concept of Participatory Irrigation Management (PIM) has become very crucial. The status of farmers, long accustomed to their self-perception as passive recipients and perceived by the management agency as the "clients across the bureaucratic counter,"(Namika Raby, 1994), has been changed by their participation and empowerment as the managers of small irrigation systems. It is anticipated that such a transfer of ownership to the actual users would result in increased productivity and

income generation for the users too. Such has been experienced in many of the South East Asian and some of the South Asian countries. The major objectives of participatory irrigation management (PIM) are to increase productivity and income of its immediate beneficiaries. State intervention to develop irrigation and other local resources has often ignored and disrupted existing local institutions for resource management. (Bruns, 1993). Fortunately, now there is an increasing trend in giving recognition to develop approaches, which respect to local knowledge and experience and confer greater responsibility to the local people in taking decisions regarding the means in which the resources can be developed and managed. (Cernea, 1991; Korten, 1990; Berger, 1974). Participation does not mean sharing costs, receiving benefits or being incorporated in a government controlled organization (Korten, 1990). The major focus should be on activities in which farmers either make important decisions about irrigation system development themselves or strongly influence the outcomes of decisions made through a process of discussion and negotiation with the government agencies.

2.3 Experiences of some South Asian Countries:

According to the various literature reviewed, the South East Asian experiences show the right approach to formulate this concept of PIM. In case of Philippine, the farmers have been endowed with a greater role in developing and managing the system. In 1985, the Thai Royal Irrigation Department (RID) and Khon Kaen University began work to develop methods for improving participation in development of small-scale irrigation. RID constructed over 2000 small reservoirs and weirs in northeast Thailand. Beginning in the early 1980s, the Indonesian Department of Public Works conducted a series of pilot projects and studies, which were directed at improving participation in irrigation by giving more autonomy to the farmers in the management of these systems. The farmers were encouraged to formulate plans regarding the design, construction and management of small and large irrigation pilot projects. These series of pilot projects and studies helped in building the foundation for the Indonesian government's decision to establish a policy to gradually hand over all systems irrigating less than 500 hectares to the water users' associations. All these various water users' associations in the various countries as discussed above have definitely achieved much of their targets. Their role is very

important as the government agencies suffer from severe limitations in their capability to assist operation and maintenance of small-scattered irrigation systems (Coward, Johnson and Walter, 1988).

Water distribution is complex, requiring timely responses to diverse local conditions, which local people usually understand well. Operation and maintenance are closely linked to farmer's interest in providing enough water to ensure good yields. However the role of the government cannot be completely negated as it ensures greater equity in water distribution as well as in the area of maintenance rather than operation of the irrigation systems. (Moore, 1988).

Hence handing over the ownership rights of the systems to the real beneficiaries can solve the myriad problems, which the Indian irrigation sector is encountered with. The conventional wisdom behind efforts to promote participation seems to be that if farmers feel they truly own the system, they will surely take good care of it. This view persists despite the obvious evidence of frequent poor maintenance in villages of both individually owned private property and common property with well-defined local ownership. However before we discuss the various institutions prevailing in India and try to evaluate their performance, it is necessary to have some brief idea about the historical evolution of the concept of the local farmers' institutional systems in India.

2.4 Genesis of the Concept in India.

In India, the concept of user involvement in irrigation management is not new. Traditionally, local systems in several parts of the country were constructed and have been managed by the village communities. However primarily the small irrigation systems are managed by the individuals or the local farmers' groups, but the evidence of community ownership or management in case of the large canals are hardly found in India. It is the Government who manages almost all the major and medium irrigation systems. However the experiences of the various South Asian and South East Asian countries as already discussed before have clearly made the government recognize the necessity for wider involvement and participation of the actual beneficiaries for effective management of these major irrigation systems. The government has also reiterated time and again in its various national water policies, the potential of these associations formed

exclusively of the beneficiaries. In-fact a lot of efforts are now being undertaken by the government to adopt the scheme of farmers' participation on a pilot basis for initiating the process of farmers' involvement and active participation in water management and maintenance of field channels. However the picture related to the major irrigation systems is quite different. Majority of them are under the management of the government. However the only significant instance of the involvement of the users in water management has been in the case of the Warabandi system prevailing in Western U.P., Punjab and Haryana. Here too the activities of the local farmers' groups are quite limited in scope (Gulati, Svendsen and Roy Choudhury, 1994).

2.5 Role of the Farmers in Management Aspect:

The farmers' groups can play very important roles in the system improvement. These farmers' groups can be assigned the task of handling and managing the volumetric supply of water, an alternative that has been suggested to undermine and reduce the various problems being faced by this sector. Another important role, which can be played by the farmers, is the cost sharing aspect. This would bring about 'cost-consciousness, and the execution of improvements may be contracted to the water users'. (Vaidyanathan, 1992). The Vaidyanathan committee suggested the following roles, which can be effectively played by the farmers' groups. They are as follow.

- To economise on the use of irrigation water.
- Proper maintenance of the field channels
- Proper and timely payment of the water rates.
- Determining and enforcing the rules of allocation of water among the users though no restrictions would be imposed on the type of crops grown, construction of storages. The farmers' groups given such autonomy would exclusively take decisions regarding such matters.
- The groups would be free to determine the basis and the level of water charges to be levied. The surplus collection if any would be maintained as reserve money to be used in case of any emergency like repairing, maintaining the existing structures and a further improvement of the facilities.

Price reform in the irrigation sector can be brought about only if it is accompanied by certain institutional reforms in this sector. Price reform is essential but not sufficient for the well being of the sector. Recent studies have indicated that the efforts at institutional reforms would not succeed, unless these systems are distanced from the political interference. The recent debate on these issues, suggest making the project authorities financially accountable by giving them operational autonomy, providing them with more decision making power, entrust the water users associations with the tasks of managing the systems in their area of operation as well as collecting the water charges on the basis of some uniform parameter, like linking the water rate with the volume/quantity of water consumed and also allow the private sector to take up renovation and modernization of parts or the entire project wherever feasible.

Irrigation is a state subject; until and unless the farmers in a given region, come to a consensus regarding the crops to be sown, the amount of water required for watering, the crop productivity of the given region would not increase much. Again the maintenance aspect of the field drains, the field channels, the irrigation structures, are also equally important decisions to be adopted by the farmers to maintain the overall health of these irrigation structures. Irrigation is a community subject and the farmers should follow a common approach in dealing with the overall management of the canal waters. A group approach needs to be followed in dealing with the overall changes in cropping pattern, sowing and harvesting time, the volume of water to be delivered to each farmer. The operation and maintenance aspect like the maintenance of the field channels, field drains, and timely repair of the existing structures and also for proper draining out of excess water from the field to prevent water logging and salinization of the irrigable lands need special care. The necessity of involving farmers in water management has always been encouraged by the planners from time to time. This would not only ensure a better supply of water to the fields, but such a group approach would also lead to a better cost efficiency in the water distribution. The user group should also take decisions to have a choice in selecting crops, the cropping pattern, the time of water supply, the collection of water charges and payment of these to the Government.

One of the most important area in which the potential of these farmers' groups have been realized is in the activity of delivering water to the fields. At present, water is

sold individually to the farmers' groups by the Irrigation Department authorities. However there are certain problems associated with such a system of delivery as economic utilization of water do not occur. Hence it is in this context that, the government has thought of transferring the power of delivering water to the farmers' groups so that, a judicious utilization of water is ensured. According to the planners, such a system of water management would ensure reduced cost in water distribution and also ensure maintenance of the systems at the field level (Palanisami, 1984). This would lead to a more assured and equitable distribution of water, which would eventually provide stability to the operation and maintenance activities.

Hence providing autonomy to the farmers would directly make them parts of the entire functioning of the existing systems. However there will be definitely some pertinent problems regarding this as there might arise lack of co-ordination and co-operation among the farmers' groups, clash of their personal interests and many other such things. Another major problem, which is usually encountered in handing over the management of these large irrigation systems to the farmers' groups, is that the users might not be willing to take so much of responsibilities of group management. Hence what is therefore necessary is that, there should be some incentives provided for a group based approach vis-à-vis the individual services. This can be encouraged through revising the water rate in such a manner so that a lower water rate is levied for those areas where water management is undertaken by the farmers' groups and a higher water rate for those areas where the farmers do not form such groups. (Vaidyanathan, 1992).

Overall it appears that, the change is in the right direction but it requires strong involvement of the beneficiaries. However the speed of change is slow and also one will have to wait and examine the exact nature and design of this experiment. Their degree of success will depend upon how far the user groups would be interested in the management of the channel networks, the expenditure pattern of the collected funds and other such related works. Such reforms would encourage formulating better irrigation water pricing structure- a concept to be dealt in detail in the following chapter; lead to decentralization of the various activities to free them from government control thereby leading to a better management, operation and maintenance of the existing structures. In India, there have been quite a large number of cases where the farmers' associations, either formal or

informal, have been successfully managing and distributing the irrigation water supply. In many of the instances, the associations have been able to economize the water use, increase productivity, and create a sense of assurance among the farmers in getting the water at the correct time, and in adequate quantity for the various crops grown by them.

2.6 Institutional Experiments in the Management and Cost Recovery of Major and Medium Irrigation Projects in India:

In this section, the experiences of a few selected states have been penned down to show the role of the farmers' institutions in the overall management of the irrigation sector. Though not much have been achieved in this aspect, yet it can be said that the trend has been set in many of the states, which is definitely a promising indication.

***Andhra Pradesh*:**

In Andhra Pradesh, reasonably successful attempts have been made during the past four decades in terms of institutional management in the irrigation sector. Water users associations formed in the state have truly helped in solving many of the problems. The first such successful attempt in this regard was carried out with the creation of Command Area Development Authority (CADA) in the mid 1970s. In this case a close relationship existed between the CAD authority, Water Management Circle, and the newly formed farmer's groups. This close association between the farmers and the authority took place at two levels: construction and maintenance of the field channels. Even in other areas of the state, the experiment with the farmers' partaking continued. In these areas the major focus was to try to ensure that the farmers receive sufficient amount of water at the right time.

After several months of consultations, involving the state legislature, various government agencies, political parties, farmers' groups, and the media, the Andhra Pradesh Farmer Managed Irrigation System Act, (APFMIS Act) was passed by the legislative assembly in April 1997. Some of the major changes brought about by this Act were that the water charges have more than tripled that is from Rs.60/acre to Rs.200/acre. In June 1997, more than 10,000 WUAs were created through a statewide election. Some of the major provisions of this Act provided for a mandatory constitution of farmer

organizations and automatic membership conferring more powers to the farmer organizations to collect the water charges (Gulati,1999).

Hence the primary focus of these WUAs would be to increase the net irrigated area, to reduce the gap between the potential created and utilized, to reduce the salinity and seepage problems if any in the cultivated regions. The other major focus of these WUAs would be to ensure maximum crop yield with a judicious use of irrigation water, generate more funds through the timely collection of water rates from amongst its users, and a periodic revision of the water rates so that the capital collected can be used in the recurring expenditure like in the maintenance of the system and the remaining part can be kept as emergency funds.

The following table gives the name of two important projects and the associations formed and the functions being performed by these farmers' associations. As seen in the table, most of these associations primarily have the task of distributing water on a volumetric basis to the members.

Tables 2.1 Water Users' Associations in Andhra Pradesh.

Project Name	Association name	Functions performed
Sriramsagar	600 Pipe Committees	Distribution of water.
Nagarjunasagar L.C.	196 Pipe Committees	Distribution of water.

***Source**: Report of the Committee on Pricing of Irrigation Water, Planning Commission, 1992*

Tamil Nadu:

In this state too farmers have been encouraged to organize themselves in groups to form water users' association. This however is prevalent only among a few specific projects like in the case of the Lower Bhavani project. So far about a four tier system existed in these farmers' associations. The main function of the associations formed is to demand the required water from the government officials and to distribute the requisite water to the member farmers. The functions of a few water users associations running in the state have been enumerated in a tabular form in the following table 2.2.

Table 2.2 Water Users Associations in Tamil Nadu.

Command	Project name	Association name	Functions performed
Cauvery	1.Paminiyar	A-60 Kardapari Farmers Council	To demand required water and to distribute among members.
	2.Kuduvauar	A-40, Kudiraseva Kanar Farmers Council	Same as above.
Lower Bhawani		M-6, Farmers Council	Same as above
Periyar Vaigai Command		P.D. 8 Farmers Council	Same as above.

Source: *Report of the Committee on Pricing of Irrigation Water, Planning Commission, 1992*

Gujarat:

Another state where the role of the farmers in the management of its irrigation projects has been realized and a number of farmers' associations have been formed is Gujarat. One of its most successful co-operative groups is the Mohini Water Cooperative Society in the Kakrapar system. This association has been very much successful in the efficient cost recovery through farmers' participation. It took up the task of effective implementation of revised rotational schedules and charged the farmers the water rate already fixed by the government. The farmers at the tail ends are usually the sufferers whereas those at the upper reaches use more water than actually required. All these had negative repercussions on both the upper and lower end farmers. To resolve these problems, the Mohini Water Cooperative Society had been formed where the irrigation water is sold to the cooperatives in bulk and the water rates are levied on the basis of the volume of water measured at the supply point. The responsibility of equitable and efficient distribution of the water among the farmers, vests with the cooperative society. Its success lies in the fact that that it has been able to reduce the arrears in the payment of water rates and also minimize the wastage of water thereby increasing the efficiency of water utilization. Another significant achievement brought forth by this co-operative agency is regarding the increase in yield of the crops grown. The state in many projects constitutes committees with user representatives at various levels- like at the village level, branch level, and at various project level. The state has also in many areas formed water users' cooperatives. The primary role of these cooperatives would be to ensure an overall management of the project, which would be entirely handled by the users. The names and the functions of a few water users' associations operating in the state have been provided in the following table 2.3.

Table 2.3 Water Users' Associations in Gujarat.

Project name	Association name	Functions performed
Ukai Kakrapar	Mohini Cooperative Society	To distribute water
Ukai Kakrapar	Saras Water Cooperative	Same as above
Mahi Kadana	Mogri Irrigation Cooperative	Same as above
Machhu-1	Panch Dwarka Cooperative	Same as above

Source: Report of the Committee on Pricing of Irrigation Water, Planning Commission, 1992.

***Maharashtra*:**

Here too a well developed farm management system is prevalent. Institutions like the Pani Panchayats and Bagaitdar Sangh have been developed through centuries. Here the irrigated lands have been divided into a number of small units like the Phads. It is the role of the Pani Panchayats to look after the management of these Phads. The main thrust of their activity is to evolve a participatory management approach to maintain the secondary distribution networks, to determine the water to be released for irrigating of the crops, the cropping pattern to be followed. However the major focus of these institutions is not on financial recovery and hence the aspect of revision of water rates, their collection and other related matters are treated as of secondary importance.

In this state, the main focus of the state Government is to form the WUAs to promote the active participation of the users in the overall management of the irrigation systems to achieve an overall increase in crop production. *Here the WUAs receive the irrigation water in bulk from the Government on a volumetric basis and then distribute them to its members and non-members according to the area under the crops to be irrigated. Another important task entrusted to the WUAs is to maintain the field channels and other such related things. However one of the most important functions of these associations is to encourage a judicious and economical use of water.*

Another important duty of these WUAs would be to collect the water rates to be fixed on the basis of the volume of water supplied. However these rates may be different for non-members and the members of the WUAs. To maintain the efficiency of the collection rates, the government reserves the right to discontinue the supply of water if

the fees are not paid within a given time limit. So far about 10-15 societies are working quite satisfactorily and the state government is also trying to revitalize the remaining dormant ones.

West Bengal:

The state's irrigation is dominated primarily by tube well. It has been decided by the state Government, that these tube wells would be handed over to the Panchayat Samitis for repair, operation and maintenance. These associations to be formed of farmers have been authorized to realize the water rates from the users. Greater autonomy has been provided to the Samities, as they possess the right to change or revise the water rates to meet the actual operation and maintenance cost. These Samities also reserve the right to collect the water rates.

Hence from the above examination of a few institutional set-ups in a few selected states of India, it can be inferred that the major functions of the users' associations is primarily to distribute the water in the Command area.

We have therefore observed that, successful irrigation systems could be run in areas where at least a part of the system is partially owned. In India, though the minor irrigation systems are privatized, the canals are still fully under the state control. So in this context, the concrete step that could be taken would be to create autonomous users' groups to handle all or most aspects of the operation and maintenance activity of the irrigation systems. Again if greater financial autonomy is imparted to these user groups, then there will simultaneously a greater incentive for the beneficiaries to take care of the system, to manage and operate these systems in a proper manner to ensure sustainability of the system. However in India, as observed, in most of the states this autonomy is restricted to managing the systems only rather than on cost aspect. However Andhra Pradesh is one such state where a lot of efforts have been undertaken to provide full autonomy to the farmers. Here the management autonomy as well as the financial autonomy have been granted to them. But these have been only done quite recently and so we have to wait a bit more to achieve the actual fruits of the result. The most obvious reason for the general ineffectiveness of such initiatives is the lack of proper incentives for the farmers. Hence as part of the reform structure, the 'irrigation departments need to be converted into financially autonomous corporations to make them more responsible

towards their duties and responsibilities.'(Gulati, Svendsen, Roy Choudhury, 1994). To generate sufficient funds for operation and maintenance, water rates, which are at present much below the O& M costs, and the efficiency in collection will have to be bettered. However by merely increasing the water rates without taking into account the improvement in the quality and quantity of water supplied, would not solve the crisis. So until and unless there is considerable improvement in the supply structure of canal water, the farmers would be unlikely to accept any significant change in the price structure of water and till then it would be the task of the irrigation department to continue with its functions.

The major problem with these projects is that, the area covered by these farmers' groups are very small, sometimes even less than 1 percent of the total irrigated area in the state. At times even if associations exist in the command area, neither do they have well defined functions, nor do they take initiatives to discuss the substantial issues regarding water distribution. However proper initiatives need to be adopted to accelerate the effective functioning of the users' groups for the better management of the systems. An important requirement for a proper group formation is to convince the users that they will be benefited from such associations by means of better quality and timely supply of water. If the farmers are assured of timely delivery of water, then there would also be greater crop diversification, increased crop productivity, along with better management of the systems.

Hence the farmers' groups will have active roles to play to enable a group based volumetric supply of water and a rational pricing of the irrigation water. The groups are also required to promote optimum use of surface and sub-surface water resources for increased productivity.

Therefore it van be said that in order to arrive at any substantial solutions to irrigation management in India, it is essential to bring an institutional changes at the grass root as well as at administrative levels. However inter and intra-village unity can be facilitated by the participation of the local NGOs to a large extent. Hence the replicability of the South East Asian experience is only possible through decentralization of irrigation departments and assigning them with authority and responsibility at the local level

coupled with the sharing of responsibility of maintenance with user groups and even the NGOs.

Hence determining from the experiences of some of the states explained above, the following **Duties and Responsibilities**, can be taken over by the farmers' organizations in the major canal irrigated states:

- Distribution of water on a regular basis, measuring the discharge at the outlet to determine the volume of water actually used.
- To ensure proper maintenance and repair of the field channels, field drains so that, problems like water logging or salinity can be mitigated.
- Collect the irrigation dues from the farmers who are the members of the cooperatives, so that the amount collected from them can be used for further on farm development activities.

Now the main question related to this is that, by performing such duties and responsibilities, what will be the farmers' advantage? These can be enumerated as follow:

- The farmers would become the actual owners of these systems.
- They can take decisions regarding the frequencies of water deliveries required by different crops.
- Reliability in water supply.
- Special priorities in water supply from the irrigation department to the members of the associations in case of water shortage.
- Increased farm productivity would result in increase in farmers' income.

2.7 Conclusion:

As evident from this study, the water cooperative societies have promising future in the command areas of irrigation projects. Handing over the ownership of these canals to the farmers' groups can solve a large number of at least the micro and meso level problems. In order to encourage the formation of farmers' associations, the Centre may consider giving 100 percent grant for Warabandi against the present provision of 50 percent if the farmers' associations have been actively engaged in the implementation of the Warabandi programme. (Report of the Working Group on CAD for formulation of the Plan proposals for the Eighth Five Year Plan, 1990-95). Therefore it can be said that the *farmers' groups*

have a lot of potentials in generating income and in the proper distribution and management of public irrigation systems in India. As it has been evident from various literature that the major problem of this sector is the financial resource crunch. The pertinent causes are low receipts and escalating expenses. Since irrigation is the most important infrastructure ensuing in higher yield, greater crop diversification and consequently augmenting the farmers' income, it is the foremost task among the policy framers to encourage the actual users or the beneficiaries to get actively involved in the management of the irrigation systems.

Since the concept of the farmers' institutions and the significance of a bottom up approach have been revitalized after the introduction of the 73 rd and 74 th Amendment, we have to wait for a few more years to reap the benefits of such changes. Nevertheless within a period of only a decade, prominent changes have been brought about in which these cooperatives are now playing active roles in volumetric supply of water, in the collection of the irrigation charges from the users and in certain states, they have also been assigned the duty of ensuring proper maintenance and repair work. Hence it can be concluded that proper organization and training of the farmers is very essential in the decentralisation of such duties. Each of the farmers' groups within a command should have well defined duties to be strictly followed. This would definitely ensure adequate resource generation, increased income and proper maintenance, thereby bringing about long-term sustainability of these systems.

CHAPTER 3

DYNAMICS OF PRICING AND FINANCIAL RECOVERY IN THE PUBLIC CANAL SYSTEMS- A STATEWISE ANALYSIS.

CHAPTER 3

Dynamics of Pricing and Financial Recovery in the Public Canal Systems- A Statewise Analysis.

3.1 Introduction:

There has been widespread concern about the large and growing losses faced by the irrigation sector particularly in the public canal systems. A need has therefore been felt to look at the financial aspects of this sector with respect to the financial inflows and outflows. The issue of pricing of irrigation waters has become a matter of special significance today. In private forms of irrigation or in the co-operative sector, the farmers pay much more for the irrigation water by paying higher water rates, along with efficient recovery and usually do not have acute maintenance problem that are characteristic of the public irrigation systems. In case of the public canals, the issue is quite critical. Today, there is a steep hike in the costs of a variety of inputs like seeds, fertilisers, and other such inputs and hence the cost of cultivation is increasing. At the same time if the price of irrigation water is also hiked, then agricultural production would become highly unremunerative if the quality of water delivery is not improved significantly. The lack of maintenance of the canal systems due to the non-availability of funds could impact the agricultural productivity, making both the issue of pricing of irrigation water and recovery of water rates issues critical to the question of efficiency of the canal systems. Various economists and planners have stated that, since the farmers in the irrigated lands incur higher yields and incomes, so it is their duty to pay for the canal water they use, in the form of a nominal irrigation 'tax'. However in recent literature, the word tax has been replaced by the word 'user charge', since the entire agricultural sector is kept out of the ambit of taxation; but the main problem arises, when the farmers too perceive irrigation charge as a kind of tax.

3.2 Principles of Water Charges and their Application in India:

The academic literature suggests three principal objectives to be considered in the establishment of water pricing: efficiency, equity and financial.

- The **efficiency** objective considers that the water used by the farmers should be used efficiently. It suggests that, if the water rates are too low for certain crops,

then the farmer would not have any incentive to economise on the water use. He would use the irrigation water indiscriminately, thereby leading to wastage of this scarce resource. However the efficiency in pricing mechanism can only be ensured if there is a sophisticated mechanism for the control of water.

- The **equity** objective argues that as irrigation provides adequate benefits in terms of enhancing farmers' incomes, hence even in the pricing of the irrigation water, the equity objective should be followed, i.e. the farmers should pay back at least a part of the "economic rent" they receive from irrigation in form of water rates. This principle also stresses on the aspect of a progressive form of irrigation rates, whereby farmers using more water would be required to pay higher water rate.
- The **financial** objective is the most important objective to be followed during the pricing of irrigation water. According to this objective the farmers should pay a certain percentage of their gross returns as water charges.

3.3 Basis for the Fixing of Water Rates as Suggested by Various Commissions over the Years:

According to the Second Irrigation Commission Report, 1972, there should be certain fixed criteria for the fixing of water rates.

- The farmer is interested in the net gain from irrigation and to him; the cost incurred for the operation and maintenance of the system is of no significance to him. Hence, the Commission suggested that the water rates should be related to the benefit which irrigation provides rather than the cost of its maintenance.
- The irrigation requirements of crops depend on a large number of factors like climate, contribution of effective rainfall, the level of ground water table, duration of a crop in the field. Because of these factors, the requirements vary not only from crop to crop but also for the same crop grown in different seasons. Hence the quantity of water supplied also assumes a very important part.
- Water rates should also depend upon the type of irrigation project supplying water to the farmers.
- To ensure a judicious utilization of water and prevent wastefulness of this precious natural resource, levying of irrigation charges is the best solution.

Water rates play a very decisive role in the farmers' decision-making regarding cropping pattern of that area. In-fact a farmer might have disincentive to grow certain water intensive crops like sugarcane or banana if he has to pay a higher charge for the water to be used for the cultivation of such type of crops. On the contrary if the water rates in an a region were too low then the farmers of that region would obviously opt for growing more of the water intensive crops, which are usually commercially very profitable.

It was hence suggested that depending on the basis of crops grown, the water rate should be fixed within 6-12 percent of the gross output of the crops. The higher limit was suggested for the water intensive cash crops like sugarcane, and the lower limit for food crops.

There should be no disparity in water rates between one project and another. However, quality of water service would definitely play a very important role in water rate fixation. The report also suggested that the water rate for different crops should depend on the volume of water used.

However low water rates still have been prevalent in many of the states for years despite the Irrigation Commission 's recommendations that the rates should be revised every five years, which in practice unfortunately has remained an unfulfilled dream yet to be realised.

3.3(a) Basis of Fixing Water Rate as Share of Gross Value of Output in India (1971-72): An Empirical Analysis:

The Central Water Commission's survey indicates the considerations, which the states have to adhere to in fixing their respective water rates. The considerations include the volume of water actually used, the paying capacity of the irrigators, assurance of supplies and the total cost incurred in providing the irrigation water to the states with due considerations given to those states where a high percentage of the gross irrigated area is under water intensive cash crops. Most of the principles have been recommended as already mentioned in the Second Irrigation Commission Report of 1972. However the commission did not indicate how exactly the various considerations would help in determining the actual basis for the fixing of the water rate.

Table 3.1 Share of Water Rate to the Gross Value of Output for Rice and Wheat Across States (1971-72).

States	1	2	3	4	5	6
	Crops	Water Rate Rs/ha	Yield/ha Kg	Harvest Price Per Quintal (Rs)	Value of Crops (Rs.)	Water Rate as % To GVO
A.P.	Rice	37.5	1428	98.44	1406	2.6
Bihar	Rice	37.5	926	56.63	553	7.0
	Wheat	22.5	940	87.02	818	7.7
Gujarat	Rice	45-62.5	1358	101.39	1.37	3.2-4.5
	Wheat	45-62.5	1529	92.69	1417	3.1-4.4
Haryana	Rice	24.4	1433	53.96	773	3.1
	Wheat	14.5	1822	69.27	1262	1.1
Kerala	Rice	12.5-2.5	1447	107.56	1566	0.8-1.6
Maharashtra	Wheat	22.5	626	123.47	773	2.9
Punjab	Wheat	13.1	1140	92.57	1055	1.2
Tamil Nadu	Rice	40-50	1517	73.79	1120	3.5
U.P.	Rice	10.0 -35	1483	52.69	781	1.2-4.4
W.B.	Rice	13.4-31.5	1824	128.32	1699	0.8-1.8

Source: Report of the Second Irrigation Commission, Vol. II, 1972, Planning Commission.

The Second Irrigation Commission Report of 1972 and The Report of the Pricing of Irrigation Water of 1992, prepared by the Planning Commission suggested emphatically that the share of water rate should be around *6-12 percent of the gross output of the crops*-the higher limit for the water intensive cash crops and the lower limit for the food crops like coarse cereals.

According to the table 3.1, the gross value of output for the two major crops have been calculated and the shares of water rate to the gross value of output have also been calculated. According to this table we find that this share of water rate to the gross value of output (GVO), has not even touched the lower limit of 6 percent for either of the crops in almost all the states during the said time period. It is only in Bihar that we observe that the share of water rate to the gross value of output for both wheat and rice reached the minimum level of 6 percent as suggested by the Commission. Hence this explains the flaws in the system of levying and collecting the water rates for these two major crops, which are grown in almost all the states of India. So this table *justifies the concept of*

increasing the water charges, as the farmers should contribute some amount as user charges for the water they use.

Table 3.2 Share of Water Rate to the Gross Value of Output for Rice and Wheat Across States (1985-86).

States	Crops	Irrigation Charges in Rs/ha	Irrigation Charges as % of Gross Returns
Bihar	Paddy	75	1.6
	Wheat	79	1.2
Orissa	Paddy	53	1
Gujarat	Paddy	110	1.1
	Wheat	110	1.9
Maharashtra	Wheat	100	3.6
	Paddy	105	4
Tamil Nadu	Paddy	37	-
A.P	Paddy	222	4.1
Haryana	Paddy	74	1.4
	Wheat	61	1.4

Source: Bhatia (1989), Pawar (1985), Patil et al (1980), Brahmabhat (1988)

To see the change in the share of water rate to the GVO over the years, especially after the new recommendations given by the Planning Commission, 1992, the share of water rate to the GVO for the year 1998-99 has been calculated. This has been done to evaluate the performance of the states in regard to their share of water rate to their output. The Commission recommended new and revised water rates in many of the states for a large number of crops and also reiterated that, this share should be between 6-12 percent. To see whether the respective states have adhered to the norms, let us compare the two tables 3.2 and 3.3.

According to table 3.3, we find that both the yield and the water rate per hectare of irrigated crops have increased over the twenty years time period. This is clearly discernible from the two tables (3.2 and 3.3) when compared. However the moot problem still remains and in some states, the problem has only got aggravated. According to this table computed from various sources, the shares of water rate to the gross value of output have not in any way increased. This clearly indicates that the share has infact declined for the two major crops, rice and wheat considered here. *Though their output has significantly increased over the years, the percentage share of water rate to the gross value of the crops have actually declined.* This indicates that inspite of the committees'

recommendations time and again, the situation has not in any way improved. This justifies the need to adopt measures as soon as possible so that, the states adhere to the norms as recommended. Inspite of the recommendations, most of the states still levy the older water rates, which is also anther reason for which the share of water rate to the GVO is low.

Table 3.3 Share of Water Rate to the Gross Value of Output for Rice and Wheat Across States. (1998-99).

States	1	2	3	4	5	6
	Crops	Water Rate Per ha (Rs)	Yield/ha (Kg)	Harvest Price Per Qntal (rs)	Value of Crops (Rs)	% of Water Rate To Total Value
A.P.	Rice	222	2499	458	11445.4	1.9
Bihar	Rice	89	1374	450	6183	1.43
Gujarat	Rice	110	1450	537	7786.5	1.41
Haryana	Rice	74	2222	390	8665.8	0.85
	Wheat	61	2611	384	10026.2	0.6
Kerala	Rice	99	2380	440	1047.2	0.94
Maharashtra	Wheat	80	1279	463	5921.7	1.3
Punjab	Wheat	29	3132	391	12246.12	0.2
	Rice	49	3877	375	14538.75	0.3
Rajasthan	Wheat	74	2501	473	11829.73	0.62
Tamil Nadu	Rice	49	3394	661	22434.34	0.21
U.P	Rice	143	1867	388	7243	1.97
	Wheat	143	2508	404	10131.32	1.41
West Bengal	Rice	125	1997	525	10484.25	1.19

Source: 1. Agricultural Situation in India, Dec.2000.
2. Rates for Surface Water in India, CWC, 1988.
3. Farm Harvest Prices of Principal Crops in India,1995-96.

Another part of this analysis is to look at the share of irrigation charge to the total cost of cultivation, as incurred by the farmers. This proportion thereby indicates the cost of paying the irrigation charges to the total cost in cultivation.

Table A.3.1 enumerates the per hectare cost incurred by the farmers during cultivation. Cost items include a variety of heads namely, operation cost, cost on human labour, bullock labour and machine labour; costs on seeds, fertilizers, insecticides; interest on working capital and irrigation charges. This table shows the share of irrigation charges paid by the farmers in the form of water rates to the total costs incurred by them. This has been done for three crops, namely, paddy, wheat and sugarcane across a few selected states. According to this table we find that, the percentage of irrigation charge to

the total cost incurred by the farmers is quite meager in most of the states for paddy. *This therefore indirectly shows that, the farmers pay a mere amount as irrigation charges to the government.* The farmers can not compromise on the buying of fertilizers, bullocks or other such cost components as these directly affect their yield and thereby their income. Though irrigation is the most important infrastructure in cultivation, the water is provided to the farmers at a highly subsidized rate and this is the only component where the farmers can afford to pay less to maximize his net returns. Hence we observe that in most of the states this share ranges between 4-5 percent for the three crops taken into account. However, we find that in case of paddy, Haryana is the only state where, the irrigation charge to the total cost is as high as 10 percent. This is also observed for Punjab, Rajasthan and Uttar Pradesh in case of wheat, and for Maharashtra in case of sugarcane. This may actually be because in case of Punjab and Haryana, private sources of irrigation co-exist along with the public sources and the income of the farmers in these states too are much above the average income. In case of Maharashtra, a large number of water cooperatives have been set up and it is from these cooperatives that the farmers buy water. Hence the share of irrigation cost to the total cost is higher.

3.3(b) Basis of Determining Water Rates through Cost Recovery:

Cost recovery should undoubtedly be one of the important considerations governing the rate of irrigation price determination as proper maintenance of the systems lead to the sustainability of productivity accompanied by improved management of the system. 'To provide a simpler, more transparent and easy to administer principles for rate determination, cost recovery of the expenditure incurred in the operation and the maintenance of the system should form a logical basis for water rate fixation.' (Vaidyanathan, 1992).

Costs will obviously vary from one project to the other, depending on the age of the project, the construction of the irrigation project, the responsibility taken by the government in the upkeep and management. Generally the costs of repair and maintenance of old projects tend to be higher compared to the younger ones. However the problem with such a basis for fixing the norm is that the water rates would be different not only across regions but also across different projects. Such charging of

uniform rates, definitely avoids a lot of complexities. It has been observed that the cost of delivery of water would be more at the tail end than the water supplied at the head reaches. As a result of this it may be argued that the rate should be higher in the former case, compared to the latter. However the farmers in the head reaches enjoy the advantage of a more regular supply of water compared to the tail enders. Thus very obviously, the quality and amount of water delivered along with the cost of water delivery should be considered as an important parameter for fixing the water rates. Along with the above criteria, the relative institutional systems should also be taken into account for pricing of the irrigation water. This is observed in case of North Western India where the Warabandi system is prevalent. Attempts at distinction in terms of head and tail reaches of a system, quality of soil or other criteria for rate determination should be approached with considerable caution as they are difficult to apply and will add to the complexity of water pricing.

3.4 Existing Basis for Pricing:

At present water rates more or less are fixed on the basis of the area irrigated-i.e. more the area irrigated under a particular crop more is the water rate per hectare. Under such a mode of collection, the task of the irrigation department is to record and verify whether each individual plot receives command irrigation or not and to keep a record of the volume of water used by different crops within and across seasons. However the problem with such data handling is that it requires enormous amount of expenditure –most of the times the amount spent exceeds the amount actually collected by the revenue officials.

Area irrigated however is definitely a poor indicator to determine the service provided by different irrigation systems- as the water requirements depend on a large number of other factors, like duration of water supply, the season in which the crop is grown and the needs for 'non-consumptive use', essentially for crops like paddy where water is used even before the actual cultivation starts.

Apart from the areas (especially North Western areas), where the Warabandi System of irrigation is mostly prevalent, (where the farmers usually receive an assured supply of water), in all other areas, farmers have to face the problem of scarcity of water supply; yet the rates are fixed in relation to area under crops irrigated without keeping

into account the water supplied to the farmers which definitely have impacts on the users' returns. Hence the argument here is that whenever in future the water rates are to be revised, it is essential to take into account some criteria so that the rate fixed conforms to the interests of the farmers. The government should also be assured to receive substantial revenue to ensure a proper maintenance of the system. Hence in conclusion it can be said that the area irrigated is definitely not a good indicator to determine the water rate; *it is the volume of water used, which should serve as the basis for the water rate determination to determine the actual amount of water actually used.*

3.4(a) Rationale of Volumetric Pricing System:

Volume of water supplied to the farms is the most rational method for determining the water rate. Such a system of levying water rates on the basis of volume of water supplied is fairly common in case of tube well and well irrigation, partly due to the fact that the time is controllable and for a given well, the volume supplied is closely related to the number of hours of water supply. However such a method of volumetric pricing is seldom used in case of public canal system of irrigation as it becomes cumbersome and extremely expensive in measuring the volume of water supplied.

In case of volumetric supply of water the rate to be paid is fixed on the basis of membership acquired for the system which entitles them to claim water and gives them the benefit of several other facilities which are associated with the spread of canal irrigation and a variable fee to be levied individually for the extent of the service paid from the beneficiaries. Hence a two part tariff is to be levied irrespective of the fact whether the farmer uses the water at that time or nor which would comprise the fixed or the basic tariff part. Such a system would ensure the government of fixed revenue that would in turn lead to better maintenance of the canals. The other part would constitute the variable part depending on the volume of water used. This volumetric pricing can be realized on the on the following criteria.

3.4a(i). *Crop Based Approach- Fixing of water charges on the basis of water requirements of crops grown*:

Characteristically, in most parts of India, the irrigation requirements are lowest in the Kharif season because of monsoon rainfall and highest during the summer season when

there is almost an absence of the monsoon along with a receding ground water table. Hence the most imperative task is to work out the water requirement for the major crop seasons like Kharif, Summer and Rabi. This can be premeditated on the basis of the potential evapo-transpiration (PET) and effective rainfall (ER). The assumption in such calculations is that the areas irrigated in a given season and region use directly or indirectly canal water equal or excess of PET over ER. As a result, given the total volume of water supplied by the canals to the fields, and the average area irrigated by each crop in a season, it is possible to estimate the relative water consumption per hectare of land irrigated in different seasons. Hence based on this data, the volumetric pricing should be introduced. Hence such a pricing method would take into account the differences in irrigation requirements among crops and among different seasons. However the important consideration here should be regarding the assurance of water supply and proper maintenance of the system. Along with the physical maintenance of the system, operation plans regarding the duration of water supply and its scheduling would need proper management of the beneficiaries also.

Hence what is suggested is that the tariff implementing authority should monitor the deliveries and accordingly charge the individual farmers. The system should take the responsibility of buying water in bulk and then supply the water in bulk to a group of farmers. Such a system would definitely reduce the cost of supply substantially. Hence the role of the farmers' groups would be to buy the water in bulk from the government authorities and eventually distribute it among the farmers and collect the irrigation dues, depending on the volume of water sold to the farmers.

Table 3.4 provides data on water rates and the volume of water used by a few selected crops in a few selected states of India. As already argued, water rates should depend on the volume of water consumed by the respective crops. Accordingly, more the water consumed by a crop, more should be the water rate paid by the farmers growing that crop. However to see whether the existing water rates for the individual crops are *rationalized* or not, the implicit water rates in selected crops in some few selected states of India have been computed. According to this table the implicit water rates for the selected crops like paddy, wheat, cereals, sugarcane, coarse cereals, pulses, oil seeds and cotton have been calculated.

Table 3.4 Water Rate per Hectare-Cm of Water used by Different Crops Across Selected States, 1992.

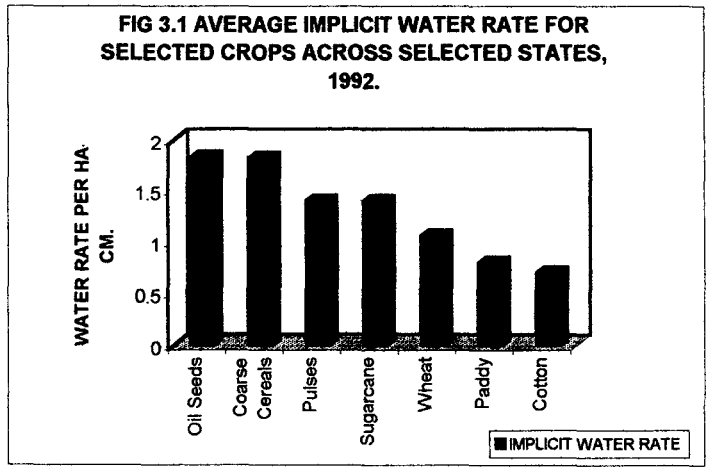
Crops	Gujarat			Karnataka			M.P			Orissa			Punjab			U.P.		
	1	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*
Paddy	91	110	1.2	78	87	1.12	100	59	0.6	85	40	0.5	123	48	0.4	87	98	1.1
Coarse Cereals	18	40	2.2	30	49	1.63	15	47	3.1	41	21	0.5	20	30	1.5	26	88	2.6
Wheat	75	110	1.5	83	54	0.65	63	76	1.2	38	32	0.8	51	29	0.6	52	98	1.9
Pulses	23	60	2.6	29	37	1.28	49	42	0.9	25	19	0.8	16	24	1.5	42	66	1.6
Sugarcane	278	830	3	251	370	1.44	169	297	1.8	122	100	0.8	160	149	0.9	172	198	1.2
Oil seeds	60	100	1.7	30	59	1.97	24	54	2.3	69	26	0.4	44	32	0.7	17	68	4
Cotton	107	100	0.9	96	99	1.03	40	59	1.5	-	-	-	59	33	0.6	59	35	0.6

Source: Calculated from Report of the Committee on Pricing of Irrigation Water,1992.

1.Depth of irrigation water.

2.Water rate in Rs/ha.

3. Implicit water rate per ha-cm of water used (2/1).



This table projects the per hectare cm. of water rate for the selected crops. From this table we can judge the rationality of the existing water rates. Fig. 3.1 depicts the average (across states) the implicit water rates for various crops. This reveals that, the implicit water rates for paddy and sugarcane, which are highly water intensive, are lower than the implicit water rates of less water consuming crops like pulses and coarse cereals. Such a situation is present in almost all the states. In case of Punjab, the calculated implicit water rate (in Rs. per hectare for 1 cm of water used) for paddy gives a value of 0.39, whereas that for coarse cereals the value is as high as 1.5. Surprisingly even the

implicit water rate for sugarcane, which is presumed to be a high consumer of water, lands up paying a rate, which is much lower than the rate being paid by the cultivators of coarse cereals. The analysis clearly brings out the flaws in the present frame of water rate levied for different crops. We have discerned that though the water rate per hectare of water intensive crops are much higher than the less water consuming crops, nevertheless by working out the implicit water rate for the different crops in terms of the water rate per hectare-cm. of water used, for irrigating those crops the course cereals and pulses which are less water intensive crops as compared to sugarcane and paddy end up paying higher implicit water rates.

3.5 Trends in Receipts for the Major and Medium Irrigation Systems—a State wise Analysis:

Hence the financial problem with this irrigation sector is mounting up. Most of the times the existing water rates are not revised for even more than a decade. Theoretically, the irrigation charges paid by the farmers should be adequate to cover the operation and maintenance costs of the system along with some interest charges. However, this is not the case. The soaring expenditure is in no match with the receipts. *Hence it is in this context that the issue of a rationale pricing of irrigation systems assumes special significance.* For the proper maintenance and smooth running of the systems, sufficient funds should be left at hand and these funds need not come from any external sources. The irrigation systems themselves have enough capability to generate their own funds through appropriate and timely collection of user charges. Hence it is in this context that the issue of pricing of irrigation water dealt in detail in this chapter gains importance.

In most of the states, there has been a depreciating trend in the share of receipts to the total expenditure incurred in irrigation. One of the most important reason for such a trend is the lag in the timely revision of water rates in most of the canal-irrigated states. As prices increase, the expenditure on the proper maintenance of the irrigation structures also increase. To keep pace with this, the corresponding receipts too should have been revised time and again. However, the major problem with this is that, there has been a significant lag in the revision of water rates for a considerable time period as evident from table A.3.2

3.5(a) Trends in Gross Receipts on an All India Basis -1976-77 to 1995-96.

For the analysis of this part of the study, let us refer to table 3.5, computed from table A.3.3. This table gives the simple average annual growth rates in receipts from the sale of irrigation water from *1976-77 to 1995-96,* for the whole country. This twenty years time period has been divided for analysis into two, one from 1976-77 to 1986-87 and the other from 1987-88 to 1995-96. The latter has again been divided into two i.e. pre 1992 and post 1992 period. Simple average annual growth rates have been calculated for these three time periods as enumerated in table 3.5.

Table 3.5 Growth Rates in Receipts. (1976-77 to 1995-96)

Period	Average Growth Rate in Receipts (%)
1976-77 to 1986-87	3.32
1987-88 to 1995-96	4.76
1992-93 to 1995-96	9.5

Source: Computed from table A.3.3

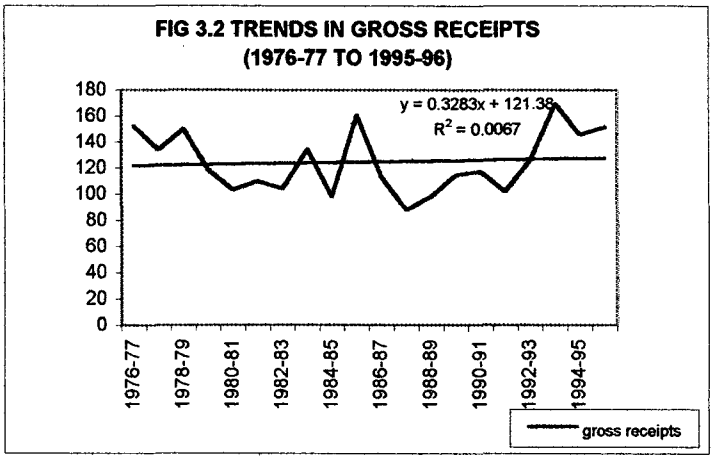
During 1987-88, a large number of canal irrigated states introduced price reforms in irrigation water. Hence, taking this period as the benchmark, we notice that, between the periods 1976-77 to 1986-87, when no reforms in irrigation pricing were introduced and most of the states followed their old water rates which were in majority of the states about twenty years old, the average annual growth rate of receipt component was only 3.3 percent. However, after 1987-88 to 1995-96, the period during which most of the canal irrigated states introduced an upward revision in irrigation water rates, it is interesting to find that, the growth rates in receipts remained more or less the same as the pre 1987-88 rates, with only a mere increase from 3.3 to 4.7 percent. This shows, that inspite of revision, most of the states have not actually implemented the new water rates. This therefore explains the reason, why, even after the revision of irrigation water rates, the average growth rate of receipts during this period remained more or less the same as that of the pre-revised period.

The year 1992-93 again is an important year to be considered in this analysis. It was during this year, the new pricing policy of irrigation water was introduced as recommended by the Planning Commission. Following its recommendations, a number of

canal irrigated states have introduced new water rates and also constituted a number of Water Users' Associations formed by the local farmers' groups to levy the revised water rates. It is interesting therefore to find out whether its recommendations have been adhered to by the states or not. In the table 3.5, we find that, the period 1992-93 to 1995-96, has experienced an increase in the growth rates in receipts from 4.7 percent of the earlier period to 9.5 percent in this period.

Hence from this part of the analysis it can be inferred that, the overall growth in receipts during the period 1976-77 to 1995-96 has been very low. It is only during the last phase that is from the post 1992 scenario, we find a steady increase in its annual growth rates showing that most of the states have more or less adhered to the recommended irrigation pricing structure.

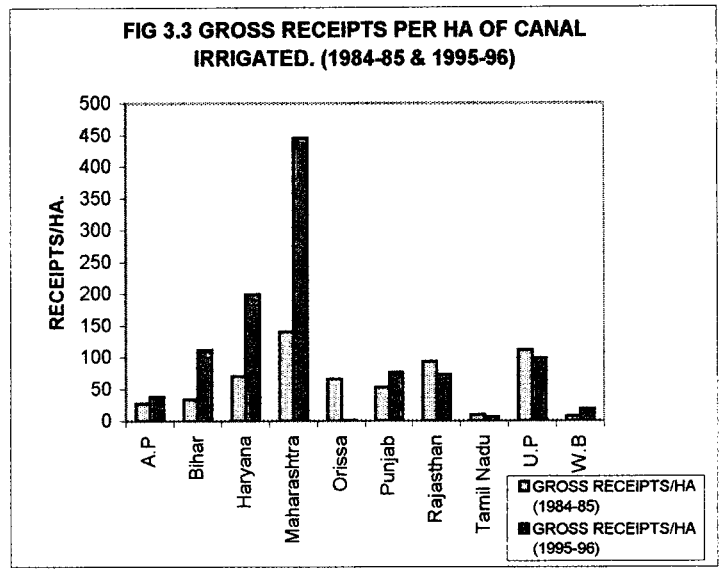
The trend in receipts in India as a whole has been illustrated by fig.3.2. The nearly horizontal trend line with an insignificant beta value and the corresponding low R^2 value indicate mere stagnation in the gross receipts over the twenty years time period. The nearly stationary trend line validates that, the gross receipts over the time period have remained more or less uniform.



3.5(b) Trends in Receipts Across States:

In this section, the temporal change in the Gross Receipts per hectare of irrigated land under canals has been calculated for two points of time across selected canal irrigated states. Here the gross receipts from the Major and Medium irrigation projects have been

divided by the Gross Irrigated Area under canals. This has been done so as most of the Major and medium irrigation projects in a state are canal irrigated.



As evident from fig.3.3, the gross receipts per hectare of irrigated land have increased in a number of states, but also declined in a few during a span of about a decade, i.e from 1984-85 to 1995-96. We can observe that, in states like Bihar, Maharashtra, Punjab and Haryana the gross receipts per hectare of irrigated lands have increased. However, in states like U.P, Rajasthan, Orissa and West Bengal the receipts per hectare have declined. The major causes for such can now be analysed.

In case of Maharashtra, Punjab and Haryana we find that, the revision of water rates have been quite frequent. However, in case of Rajasthan, U.P and West Bengal the revision of water rates have been quite infrequent. Again we find that, the institutions or the roles of the farmers' groups have been quite strong in states like Punjab and Maharashtra. These institutions have taken steps in revising the water rates, with good collection efficiency.

So the important question that needs to be asked is that, what should be the basis of fixing the water rate to solve the problems encountered by this sector as discussed before. This answer is provided in the following section.

Till now we have discussed about the basis of water rate across states and also the rationale of such levy across a few crops. The general observation indicates that, there is

not only under pricing of irrigation water in many of the states (as evident from table 3.2 and 3.3). However one of the major problem encountered in this sector is the inefficiency in irrigation dues collection. The following section analyses this fact.

However, another important analysis carried out in this section is to see whether the actual recovery through the levying of water rates for the different crops in a state (in per hectare Rs) is the same as that of the total receipts per hectare from the major and medium irrigation projects. This analysis has been carried out for mostly the canal irrigated states. The four states taken into consideration in this section of the analysis are Rajasthan, Punjab, Haryana and Uttar Pradesh. The table 3.6 computed from table A.3.4 gives the results of this analysis.

Hence it is observed that, if the total water rates are levied for all crops as fixed by the government, the total recovery would be much above the actual amount recovered for the year 1997-98. In this analysis, the individual water rates (Rs/ha) for the major crops are taken into account. Then, this rate is multiplied by the gross irrigated area under those crops to get the total recovery through the levying of water rates. However to compare whether this figure is more or less equal to the total receipts (Rs/ha) from these canals, from the respective state's budget documents, we find that, in the four major canal irrigated states where this analysis have been carried out, in most of them there is a huge gap between the two. This therefore sets the ground for an efficient revision and collection of the water rates in most of these canal irrigated states in India.

Table 3.6 The Difference between Total Recovery and the Actual, 1997-98.

States	Average Water Rates per ha. (Rs.)#	Actual Total Receipts per ha. (Rs.)##	Percentage of Water Rate to Receipt
Punjab	35.00	14.00	16
Rajasthan	64.00	3.00	4.6
Haryana	65.00	62.00	95
Uttar Pradesh	151.00	20.00	13.2

Source: 1. Report of the Pricing of Irrigation Water 1992.
2. Combined Revenue and Finance Accounts of Union and State Governments, 1997-98.

Water Rate of crop i*Gross Irrigated Area under i / Gross Irrigated Area in the State.
Total Receipt / Gross Irrigated Area in the State

3.6 Efficiency in Collection of Irrigation Dues- A Statewise Analysis:

Apart from under pricing of irrigation water, another pertinent problem, which exists, is regarding the inefficiency of collection of irrigation dues from the farmers, by the government officials.

Table 3.7, indicates the efficiency in collection of irrigation dues till the year 1992. The logic behind its calculation is that, in places inspite of periodic revisions of water rates, an inefficient mode of collection might prevail, thereby increasing in the accumulated arrears. Hence in such states, what is required is not a revision or an increase in the water rates, but to better the efficiency in collection. To see whether this efficiency has improved after the recommendations in 1992 based on the revised water rates, the receipts per hectare were compared. We find that, except for Haryana, the collections are still being based on the old water rates, and not on the new ones i.e though on paper it shows a revised water rates, yet, the new water rates are still not implemented.

Table 3.7 Cost Efficiency and Share of Demand to Expenditure Across States. (1986-90 and 1997-98).

(Rs/ha)

States	Years	AvgDemand/ha*	Avg Actual collection/ha*	Efficiency of Collection (%)
Bihar	1986-90	50.8	28.8	62.18
	1997-98	25.0	15.0	60.0
Gujarat	1986-90	53	123	238
	97-98	263	153	58.17
Haryana	1987-91	58	57.5	97
	97-98	65.38	62.49	95.0
Orissa	1986-90	48.4	31.2	63.8
	97-98	200	4.00	2.0
Punjab	1986-91	51	40	78.2
	97-98	35.0	14.0	40
Rajasthan	1990-92	83.5	76.5	91.5
	1997-98	63.41	2.06	3.2
Uttar Pradesh	1986-90	319.75	80.6	30.75
	97-98	151	20	13.2
West Bengal	1986-91	12.34	4.78	38.82
	97-98	10.0	3.0	30.0

Source: Tabulated from Table Report of the Pricing of Irrigation Water 1992 Combined Finance and Revenue Accounts for the Union and State Governments,1997-98.

* The average values for the four years 1986-90 have been taken.

3.7a *Collection Efficiency:*

In the table 3.7, the average of demand /ha, actual collection /ha and the collection efficiency have been calculated. According to this table we find that in most of the states like Orissa, Punjab, U.P and West Bengal, the rate of collection has always remained poor. The two time periods taken for analysis are 1986-1991 and 1997-98. From this table we observe that, except for the two states of Gujarat and Haryana, the efficiency of collection in the rest of the states is very low. In the states like Orissa, Punjab, Rajasthan and U.P., the efficiency of collection has infact deteriorated over the time period.

3.8 Conclusion:

Water rates therefore should convey the scarcity value of the resource to the users and foster motivation for paying as user charges, for the water they use. The pricing system should be formulated so that the total receipts can cover the annual operation and maintenance costs and a nominal amount of fixed costs. Efforts should be made to reach this ideal over a period of time accompanied by a much efficient distribution of irrigation water supply. The water rates hence should be rationalized with due regard to the systems created through massive investments. While discussing the issue of water rates, comparison is often made with the operation and maintenance expenditure, incurred by the states. However the actual O and M cost at present is not the measure of the actual operation and maintenance of the system to keep the systems in proper condition since, the bulk of the expenditure is consumed in the payment of wages and salaries, the details of which have been dealt in the following chapter.

It is in this context that it can be concluded that *for the smooth and proper operation of the irrigation systems, sufficient funds need to be generated, thereby guaranteeing a long-term sustainability of the projects.* This can only be achieved by introducing a revised and rationalized pricing system and ensure efficiency in collection of the dues as discussed before. However the present period is a period of crisis. Paucity of funds has lead not only to erosion of funds thereby weakening the financial base of this sector, but has also hindered true operation and maintenance activities. This therefore has threatened the sustainability of these systems. The consequence of low receipts on the financial health of this sector is myriad, but its implication on the actual maintenance and

repair of the canal systems is of utmost importance, which has to be given special focus during planning and formulating policies.

CHAPTER 4

A REVIEW OF OPERATION AND MAINTENANCE EXPENDITURE- A STATEWISE ANALYSIS.

CHAPTER 4

A Review of Operation and Maintenance Expenditure- A Statewise Analysis.

4.1 Introduction:

As discussed in the preceding chapter, the inimical pricing system and low rates of collection of water rates, have brought about a substantial financial crunch in the irrigation sector. This has serious implications for maintenance and repair, leading to poor performance of these irrigation systems, and an unsustainable trend of agricultural yield within the canal command. Hence *the primary focus of this chapter is to review the trends and spatial pattern of operation and maintenance expenditure of the canal irrigation systems in selected states of India.*

There has been consistent steep rise in the Non-Plan expenditures on major and medium irrigation systems in India. *Operation and Maintenance expenditure constitutes an important part of the non-plan expenditure in the budget pertaining to irrigation expenditure.* According to the Combined Finance and Revenue Accounts of Union and State Governments, the operation and maintenance expenses in Major and Medium irrigation systems in India, include expenditure under various heads. These heads broadly embrace the following sub-components:

1. Direction and Administration- The component of Direction and Administration includes primarily wages and salaries and other establishment charges.
2. Machinery and Equipment- Again the expenditure incurred on buying new machines and equipments, for proper repair and maintenance work too form parts of operation and maintenance (O&M) expenditure.
3. Extension and Improvement- Expenditure on extending and expending the canals to new areas.
4. Maintenance and Repair- Expenditure incurred on the repairing of the old structures.

Ideally for an irrigation system to function efficiently, there should be need based allocations for each of the component. However, the state governments seldom follow any stringent norm for allocating funds to the various components of O&M expenses.

Though the system of allocating funds for these components varies, every state by and large allocates a fixed amount for the operation and maintenance of the irrigation systems. However the main problem nevertheless is the acute scarcity of funds for actual repair and maintenance work as well as the quality of expenditure incurred for O&M of large irrigation systems.

Hence before going further, let us look at the **objectives** of this chapter to be considered, during analysis.

1. To make a review of the various committee recommendations on Operation and Maintenance cost.
2. To analyse the spatial patterns in the trends of operation and maintenance expenditure.
3. To analyse the nature of quality of expenditure, temporally for whole of India, as well as across some selected states.

4.2 Review of Policy Recommendations and Norms fixed by various Committees on the Operation and Maintenance Cost:

Various committees and commissions have recommended that water rate should be fixed at a level so that it is able to cover the entire operation and maintenance (O&M) cost and also a part of the capital cost spent for the project. The Second Irrigation Commission Report, **1972** opined that to encourage the farmers to use water more judiciously, it is inappropriate to keep the water rate too low, which could lead to cross subsidization to be borne by farmers, consuming less water.

The Public Accounts Committee of **1983** reiterated the stand that the irrigation authorities need to generate more funds to pay for maintenance and operation costs.

Various Finance Commissions appointed from time to time have suggested ways and means for proper maintenance of the systems. The Eighth Finance Commission, **1984**, reviewed the position of expenditure, and suggested a provision of a consolidated amount of Rs. 100 per hectare of the gross irrigated area for maintenance

In the memorandum on irrigation projects, the *Ministry of Water Resources, **1988,*** suggested a provision of Rs.450 per hectare for Major and Medium irrigation projects for

the maintenance of the utilized potential and a provision of Rs.150 per hectare for maintenance of the unutilized potential.

Report of the Working Group on Major and Medium Irrigation Program for the Eighth Plan, ***1989,*** observed that the present system of fixing flat rate per hectare of irrigated land for allocating the budget for the operation and maintenance of the system is actually not correct. According to their view, the allocation can only be done on the basis of the nature and type of project.

The Report of the Pricing of Irrigation Water, **1992** also reiterated this objective by recommending that the states should set up an expert group "to work out appropriate norms, and a procedure for periodic monitoring and updating for different agro-climatic regions and broad categories of projects".[1]

The Tenth Finance Commission, **1993**, adopted a norm of more than three times the amount as recommended by the Ninth Commission. It recommended an amount of Rs.300 per hectare for utilized potential and Rs.100 per hectare for the unutilized part.

The *Standing Committee on Agriculture* in their report of **1998-99** drew the attention of the Union Government on the imperative need for the proper maintenance of the irrigation systems. This Committee adopted the norm of Rs.450 per hectare for the maintenance of the utilized and Rs.150 per hectare for unutilized potential in case of major and medium irrigation projects as suggested by the Ministry.

In spite of various Committees suggesting the various norms to be followed in the allocation of operation and maintenance costs, the actual allocation solely for this purpose has been abysmally low. The actual reason for this according to the Eleventh Finance Commission, **1998**, is "due to the paucity of funds in budget allocation."

The World Bank assisted National Water Management Project aims at increasing the efficiency of canals. To work out the operational plan of a project, in most of the cases, ten years data on rainfall, evaporation, and cropping pattern are estimated. Based on these norms, the project-wise irrigated area, volume of water used and O&M costs to be allocated are estimated.

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[1] Report of the Committee on Pricing of Irrigation Water. Para 4.10, pg.100. Planning Commission, September 1992.

*The Eleventh Finance Commission Report, **1998**,* restated the fact that the receipts should cover the entire operation and maintenance cost and at least 1 percent of the capital cost. This Commission suggested that Rs.300 per hectare should be kept for the utilized potential and Rs.100 per hectare for the unutilized ones for maintenance of the systems.

This in brief discusses the various recommendations of the different committees regarding operation and maintenance cost. Now to review these recommendations and to see to what extent these recommendations have been adhered to by the states, let us refer to table 4.1.

It may be noted from table 4.1, that the allocated amount for O&M, for approximately the same years, was far below the recommended levels. This can be attributed to the low budgetary allocations for operation and maintenance expenditure.

Table 4.1 Recommended and Actuals in Operation and Maintenance and Expenditure Across States:

Commission	Year	Recommendations of expenditure	States with less than recommended expenditure	Actual Expenditure
Eighth Finance Commission,	1984	Rs. 100	Bihar, Rajasthan, Punjab, U.P	Less than Rs. 100.
Ministry of Water Resources,	1988	Rs. 400	Rajasthan, Haryana, Punjab, West Bengal, U.P, Bihar.	Rs. 85 to Rs.375.
Twelfth Finance Commission	2000	Rs.350	A.P, Haryana, Orissa, Punjab, Rajasthan, U.P.	Rs.290

The drawback regarding the recommendations of most of the committees is the provision of fixing flat rates per hectare of irrigated area, without considering the age, type of projects and other parameters relating to the requirement of maintenance of the canal systems. This however is not rational as the need for maintenance differs among various projects, such as for dams or canals. Again the O&M expenditure is likely to be quite different for the ongoing and completed projects. There are also other factors on

which maintenance of irrigation systems vary from one place to another. These may be due to certain topographical factors, like terrain characteristics, soil conditions or due to certain meteorological factors.

Hence in brief, it can be said that, the funding requirements for operation and maintenance activities have been escalating over the years. Although various committees as reviewed earlier in this section have allocated higher norms, nevertheless the actual increase in the per hectare allocated expenditure have remained low (Table 4.1). The reason behind this is that, most states do not have adequate funds to allocate the amount for operation and maintenance as recommended by the committees.

With respect to the budgetary provision for maintenance, existing practices vary to a considerable degree across various states of India. Some states prefer maintenance grants on the basis of per hectare of irrigated land whereas other states prefer the maintenance cost allocation as a percentage of the construction cost. Some states also have separate maintenance charges for head works, main canals, distribution networks and so on. This is a rational way of allocation of funds as different components have different physical characteristics and so require different budgeting.

4.3 Categories of Maintenance and Operation Costs:

According to the Report on Pricing of Irrigation Water, 1992, maintenance can be broadly divided into three categories. The actual meaning of each of these terms should be first defined.

1.**Preventive maintenance**. This mainly constitutes of certain allocations to be made from before as a preventive measure to ensure smooth running of the systems.

2.**Operative maintenance**. - The operative maintenance consists of repairing the damages caused. For example the earthen work might get damaged due to certain natural forces like rain, cyclone, wind or by human activities. All these damages have to be repaired and the work has to be restored to the original shape. Cementing of the cracked walls, proper drainage of the water pumped into the channels are some of the operative activities, which are carried out as part of the operative maintenance. After monsoons, damages take place due to the erosive action of water flowing and so they have to be periodically scrutinized and undergo repair whenever necessary. Siltation of the canals is

another basic problem. Dredging out of the silt to restore the proper flow of water along the canals is another basic activity under the operative and maintenance activity.

3.**Special repairs and disaster maintenance**. - In case of earthquakes, cyclones or heavy floods proper, remedial work for special repairing of the damaged structures, which is otherwise not in the plan, are undertaken. This constitutes special repair and maintenance.

Hence for proper repair and maintenance of the irrigation projects sufficient amount of funds need to be generated, as this would encourage proper operation and maintenance work to be undertaken, thereby ensuring sustainability in the systems.

4.4 Trends in Working Expenditure Across States:

The primary focus of the chapter would be to analyse the structural and temporal pattern of the working expenditure for the major irrigation systems in India. The period of analysis under consideration is from 1974-75 to 1995-96-covering almost a period of over two decades. An analysis of the trends and composition of operation and maintenance expenditure has been attempted in this section to evaluate the quality of recurring spending on the public irrigation systems for the same time period.

Operation, repair and maintenance in case of the Major and Medium irrigation projects actually signify "stabilization of the operating system".[2] Under normal conditions, it contains a gamut of a range of activities like maintenance of the structures, release of water from the reservoirs, canals and distributaries, special and minor repairs, desilting activities, removal of weeds, maintenance of canal banks and inspection of dam safety measures and other such related activities. It has also been observed that, inspite of insufficiency of funds; the allocation of expenditure is heavily related towards the head of wages and salaries. As a result of this, the health of this sector has been rapidly deteriorating over the time period. To address this pertinent problem, this chapter aims at looking at the regional and inter-state differentials in the quality of O&M spending of irrigation.

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[2] Source: Report on Employment Generation in Operation and Maintenance state of Irrigation Projects.pp5, para1.11 Plants and Machinery Directorate, (Man Power Planning Cell), CWC, 2001.

4.4.a Relative Position of States in total Operation and Maintenance Expenditure:

For this analysis, two points of time are taken to look at the changes in per hectare operation and maintenance expenditure across selected states and to look at the relative change in their position over the time period. This has been done by taking two points of time in this section of the analysis. The benchmark years chosen are 1986, 1990 and 1996. The year 1986 has been chosen as till this time the states followed a different criteria in categorizing the O&M expenditure; the year 1990 has been chosen to show the O&M expenditure in the pre 1992 recommendation period; the year 1996 has been chosen to give a more recent picture especially after the Planning Commission's recommendations. Here the per hectare operation and maintenance expenditures across the different canal irrigated states and their relative shifts in their position of hierarchy in terms of expenditure per hectare over the two decades have been enumerated in table 4.2.

Table 4.2 Changes in the Relative Position of States in O&M Expenditure/ha. (1986,1990 &1996)

STATES	1986		1990		1996	
	O&M/Ha	Rank	O&M/Ha	Rank	O&M/Ha*	Rank
Rajasthan	70	7	89	7	342	7
U.P	78	6	179	3	5900	1
Bihar	87	5	271	2	1237	4
Punjab	89	4	132	6	559	6
West Bengal	107	3	144	5	1747	2
Haryana	123	2	175	4	1015	5
Gujarat	339	1	376	1	1665	3

Source: 1. Report of Pricing of Irrigation Water, 1992.
2. 11th Finance Commission Report, 1998.
*values in current prices.

Table 4.3 Trends in Operation and Maintenance Expenditure Per Hectare. (1986 to 1996).

States with **improved ranks** in O & M expenditure.	**U.P, Bihar, West Bengal**
States with **deteriorating ranks** in O & M expenditure	**Punjab, Haryana, Gujarat.**

Table 4.2 reveals that over the decade, the relative position of the states has changed. Rajasthan the only exception has (over the decade), maintained its position with the lowest per hectare expenditure in irrigation. The hierarchy of all other states has

changed. Gujarat with the highest per hectare expenditure in the earliest time point shifted to the third position in 1996. It is also interesting to observe the relative change in the position of Uttar Pradesh as evident from the table. It may be noted here that the relatively poorer states over time have been spending comparatively more under O&M expenditure, like U.P, Bihar and West Bengal, whereas richer states like Gujarat, Punjab and Haryana have controlled the expenditure levels over time. When compared with the norms of the Working Committees, it is the latter set of states, which appear to have fallen behind. The expenditure undertaken under the head of O&M as a whole, however, does not reveal the quality of expenditure. Thus the relative positions of the states with respect to actual repair and maintenance need to be investigated into.

4.4b. Quality of Operation and Maintenance Expenditure:

Quality of expenditure under the broad head of O&M may be analysed by looking at the composition of expenditure. Certain components of expenditure have a more direct bearing on the performance efficiency of canal irrigation systems, when compared to others. For example, most of the expenditure incurred under the head of Maintenance and Repair, directly affect the functioning of quality of water delivery in the canal systems. On the other hand, since expenditure incurred under the head of Direction and Administration, primarily go towards the payment of wages and salaries, the effect that this kind of expenditure would have on the performance of the canal systems is likely to be more indirect. Hence it is for this reason, that it is important to look at the composition or quality of recurring spending on public irrigation systems across states and projects, to evaluate the efficiency of such expenditure.

4.4b(1) Structure of Operation and Maintenance Expenditure: All India Analysis. 1974-75 to 1997-98.

This analysis has been restricted due to the limitations in data unavailability. Over the years, the minor heads of the irrigation sector have changed. This has made comparability of data over the years more difficult. Till 1986-87, the subheads of working expenditure followed a set pattern, which completely changed in the subsequent budget documents. Hence while making an attempt to look at the trends in the various sub components of operation and maintenance expenditure, discontinuity in the analysis might be

encountered which can be attributed to the discrete nature of the data available. Nevertheless, efforts have been made to minimise such discontinuities in the following analysis.

According to the Combined Finance and Revenue Accounts of Union and State Governments, the sub components of operation and maintenance expenditure are as follow:

Direction and Administration- This component primarily constitutes the wages and salaries component.

Works, Maintenance, Suspense, Machinery and Equipment- are the main constituents of repair and maintenance. This classification continued till 1986-87; however after this period, the heads of classification changed. The data available from 1986-87 to 1990-91, divides the operation and maintenance expenditure into two major heads. These heads are Establishment Cost and Work component. However for post 1990-91 analysis, different state budgets had to be referred to. Hence the method of aggregation has been followed to bring about continuity in the data. The recent state budgets broadly classify the operation and maintenance cost in the following heads:

- **Direction and Administration**
- **Data Collection, Training, Research, Survey, Consultancy, Machinery and Suspense.**
- **Other Expenditure.**

The Direction and Maintenance Expenditure still constitutes the wages and salary component; thus expenditure under this head remains to be comparable across years. In all the state budgets, this constitutes the major share of working expenditure.

Data collection, Training, Research, Survey, Machinery, Suspense (the amount kept for emergency), and consultancy constitute the repair and maintenance aspect of O&M expenditure. Some of these heads like consultancy, research and others are new inclusions. Following liberalisation, in the post reform period, a lot of new avenues have been opened up for not only the industrial sector, but also for the agricultural sector. Irrigation being one of the most important infrastructure for rural development, the reforms have also introduced a number of new heads in the financial aspects of this sector. Today large sums of money are allocated towards certain new heads like training,

research and consultancy, which definitely try to ensure proper maintenance and management of these systems.

Other Expenditure includes expenditure exclusive of the above heads. Since the components of this head are not accurately known, while calculating the composition of operation and maintenance expenditure, (by summing up the operation and maintenance expenditure of public canal irrigation systems of the states), this part of expenditure has been excluded from the total O&M expenditure.

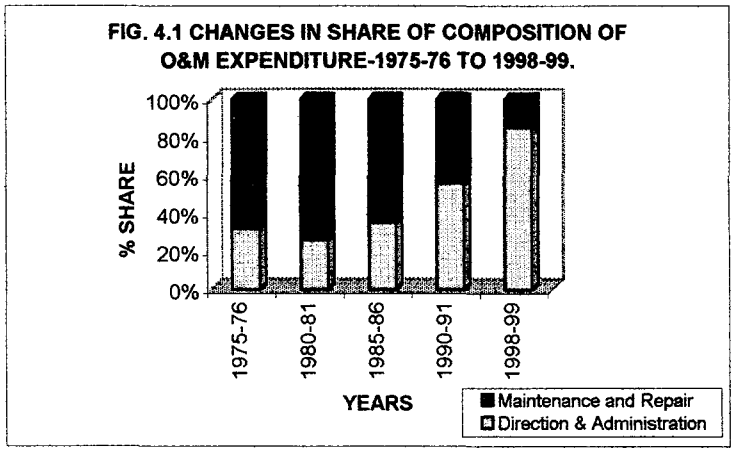
Hence to determine the nature of quality of expenditure at the all India level, five points of time have been selected for analysis. These five reference time periods are: 1975-76, 1980-81, 1985-86, 1990-91 and 1998-99. This analysis is brought out in the following table, illustrated by Fig.4.1.

Table 4.4 Changes in the Quality of Expenditure –1975-76 to 1997-98

Components	1975-76	1980-81	1985-86	1990-91	1997-98
Direction & Administration. (%)	31.78	25.91	35.0	55.67	85.0
Maintenance and Repair. (%)	68.22	74.73	65.0	44.33	15.0

Source: 1.Combined Revenue and Finance Accounts of Union and State Governments (Various years).
2. State Finance Accounts for various states, 1997-1998.

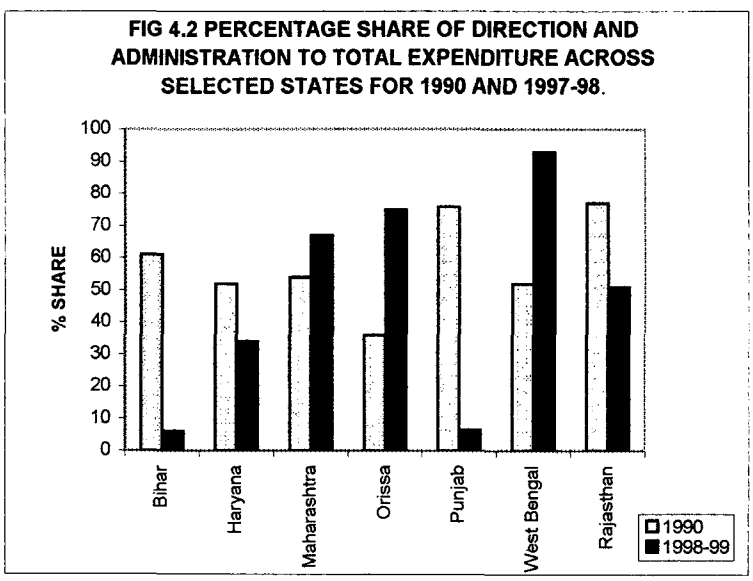
Over the years, the trend indicates that, for India as a whole, there has been a steady increase in the percentage share of Direction and Administration component. This increased by more than double over the twenty years time period. On the other hand, there is observed a consistent decline can be observed in the actual repair and maintenance expenditure during this time period.



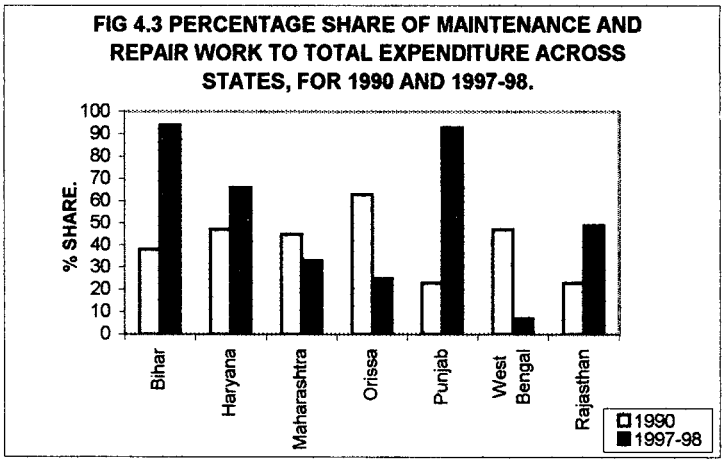
Thus much of the increase in O&M expenditure appears to be lieu of the increase in overheads, payment of wages and salaries and other such heads. Given the constraint in financial resources, the quality of expenditure may have improved, if there was an increasing or at least a constant share spent under Maintenance and Repair expenditure. Unfortunately as we can see, from Fig.4.1 that, consistently with time, the share of establishment cost is increasing at the expense of actual maintenance ad repair work. Such a condition would definitely have serious repercussions on the maintenance and long term sustainability of the projects.

4.4b(2) Structure of Operation and Maintenance Expenditure: A State Level Analysis.

A detailed study of statewise analysis of operation and maintenance expenditure gives a more distinct picture of the qualitative nature of operation and maintenance expenditure. As already mentioned, the data found is in highly disaggregated form. However as adopted in the previous section, a similar form of aggregation of the various components of operation and maintenance cost has been adopted to bring in comparability in the components of O&M expenditure. The findings are indicative of a declining labour productivity in the sector (i.e. lower repair or maintenance expenditure incurred per unit of amount incurred under wages and salaries over time).



From fig.4.2, we can infer that there are certain states in which the situation has improved with respect to quality of expenditure. This is true for states like Bihar, Haryana, Rajasthan and Punjab, over the eight years, under consideration, a considerable decline in the percentage share of Direction and Administration expenditure is observed. On the contrary states like West Bengal, Orissa and Maharashtra the proportion of establishment cost like wages and salaries have increased significantly. Allowing the possibility of non- comparability of data, it appears that in states like West Bengal and Orissa, the total expenditure under O&M has increased largely due to overheads; on the other hand, the relative ranking in terms of the same indicator has gone down in Punjab and Haryana, as these states were in a position to control expenditure under Direction and Administration (refer to 4.4a).



From fig 4.3, we find that, the proportion of maintenance and repair to the total operation and maintenance cost has improved in a few states like, Bihar, Haryana, Punjab and Rajasthan. However its percentage share has declined in states like West Bengal, Orissa and Maharashtra.

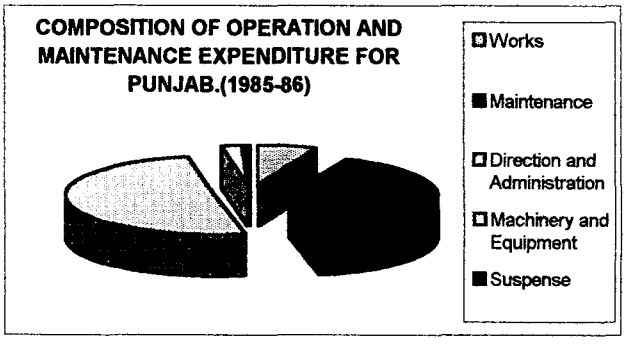
Throughout the 1970s and 1980s, the quality of operation and maintenance expenditure consistently deteriorated. However, after the reform period, a lot of new changes have been introduced, bringing about shifts in budget allocations, directed more towards the maintenance aspect, to ensure sustainability of the canal systems of irrigation. Hence a lot of efforts are now being adopted to ensure quality expenditure on this sector. A positive trend has definitely started in many of the states, like Punjab and

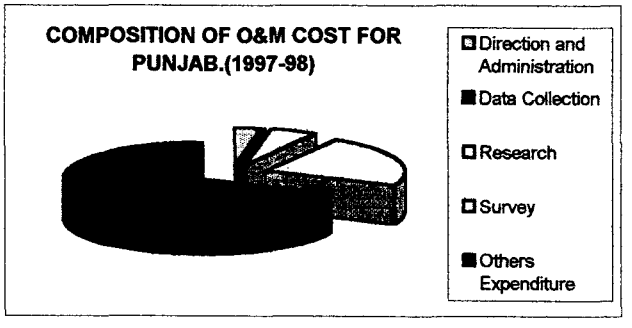
Rajasthan, where the major proportion of the funds are allocated towards the maintenance and repair as evident from fig. 4.2 and 4.3.

In the limited framework of the present research, it is difficult to bring out some other qualitative issues and aspects of expenditure. The issues like delivery of water or the satisfaction level of the farmers are closely related to willingness to pay higher water tariffs and thus to the maintenance of the systems. Though this analysis reveals that a trend is set in most of the states to ensure efficiency in maintenance, questions regarding the satisfaction level of the farmers or efficiency in the delivery of irrigation water can only be answered if a micro level survey is carried out, which however is outside the ambit of the present research.

As already mentioned before, over the years, the budget classification heads have changed, making comparability between the two time periods, a highly difficult task. Nevertheless an attempt has been made to look at the changes in the share of two most important components of expenditure, Direction & Administration and Maintenance & Repair. However a micro level analysis of the sub components of O&M expenditure though restricted in terms of temporal coverage is considered important. Four states have been chosen, on the basis of the proportion of canal irrigated area to the total agricultural land. This has been done for two reference time periods, 1986-87 and 1997-98, to indicate the structural changes within operation and maintenance cost over the years.

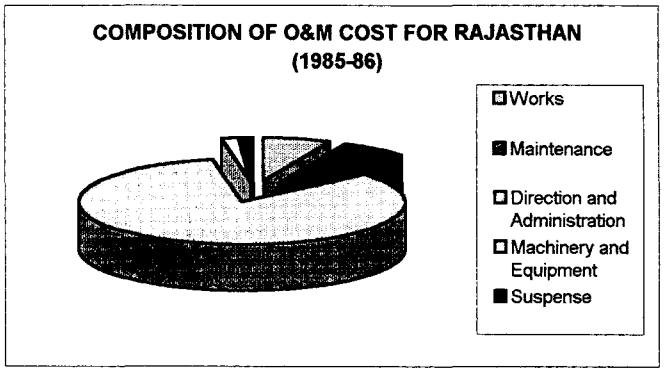
FIG 4.4(a)&(b)

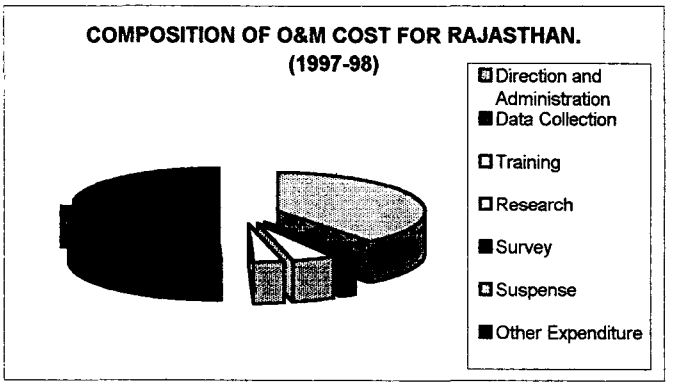




In Punjab, significant structural change under the operation and maintenance head has taken place between the two periods under study. The component of direction and administration, constituted more than 50 percent of total allocation in 1985-86. However for Punjab, we find that over the years, this has changed and now this only constitutes a nominal of 3 percent of the total allocation. The recent data also reveals that a number of new heads have been included like research, training, survey and data collection. The largest share of allocation goes to the head " other expenditure" whose minor components are not accounted for. It is however, not clear here, whether the certain expenditures included under the head of "other expenditure" in the latter period were previously accounted for, under Direction and Administration. (fig.4.4a and b).

FIG4.5 (a)&(b)

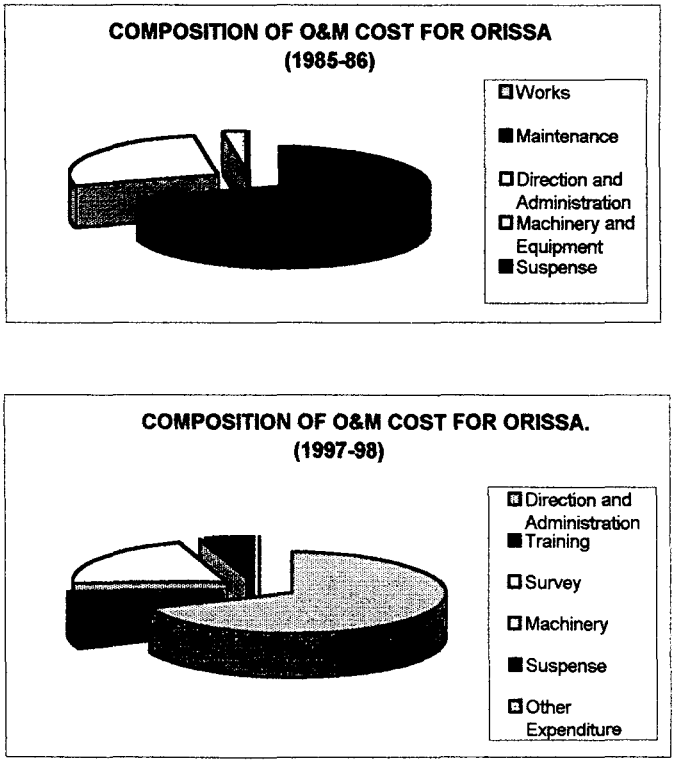




Rajasthan is another important state where public canals irrigate vast stretches of agricultural lands. Like Punjab, in this state too about two decades back, more than 80 percent of the total operation and maintenance expenditure allocations were made on Direction and Administration forming a major share of about 39 percent. A lot of other

new heads have also been added as evident from the recent state budgets. Heads like like, data collection, training, research and other expenditures are new inclusions. Here too we find that a lot of efforts are now being undertaken to allocate more funds for actual operation and maintenance of the systems. We also find that, components like survey and training constitute important shares of allocation. However, another major component is the "other expenditure", whose minor constituents are not clearly accounted for in the budget.

FIG 4.6 (a)&(b)

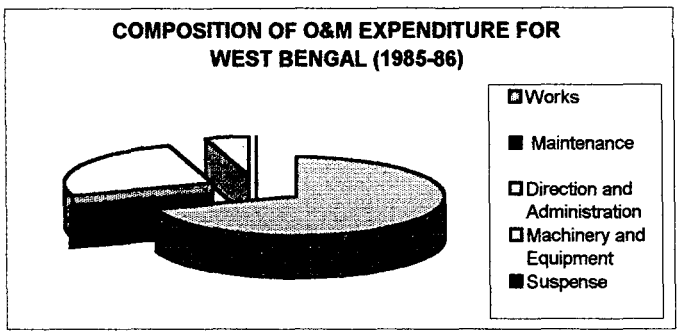


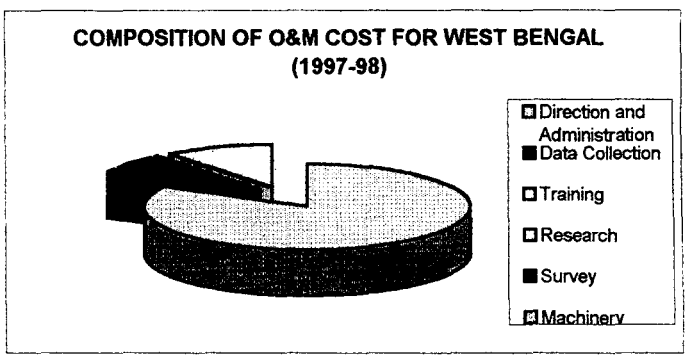
For Orissa in Eastern India, in 1985-86, more than 71 percent of the expenditure was allocated to the maintenance head. This indicated that in this state, the spending was more directed towards the actual work and not towards direction and administration component.(fig.4.6a and 4.6b).

Compared to the 1985-86 figures, the corresponding expenditure in 1997-98 on different heads has changed. The recent data, pertaining to 1997-98, show that the share of direction and administration has increased manifold over the decade (Fig 4.6b). Like Punjab and Rajasthan, in Orissa too a significant proportion of expenditure is made on

Survey. The trend in Orissa however is clearly different from the two states discussed above in terms of changes of shares of expenditure under Direction and Administration.

FIG 4.7(a)&(b)





In West Bengal there is deterioration in the nature of quality of expenditure over the time period. In 1985-86, more than 70 percent of the allocation was meant for the actual work component. Compared to this, in 1997-98, more than 80 percent of the allocation is made on the Direction and Maintenance component. This is portrayed in fig 4.7(a) and (b).

In sum, in all the state budgets, certain new heads have been added. These heads include more of the work and maintenance component. Direction and administration component however has remained a significant component over the years, constituting primarily wages and salaries especially in West Bengal and Orissa, where this component has grown significantly over time. Hence as revealed in the earlier analysis, the recent trends in operation and maintenance expenditure show that the quality of expenditure has improved over the years in some of the canal irrigated states. It must however be reiterated that, even direction and maintenance is an important and necessary part of

operation and maintenance expenditure which cannot be done without. A follow up analysis to this study would be to link up the change in the composition of expenditure to that in the efficiency of the canal system- an issue that can be best tackled on the basis of a micro level primary survey.

The issue of receipts and operation & maintenance expenditure, have been dealt in detail, in the preceding as well as in this chapter. We have found that, the gross receipts from this sector, in almost all the states, have been very nominal; but the escalating O&M cost is in no match with the receipts. However it must be emphasized, that, the focus of the planers should not be only to reduce and recover the O&M cost, but also to ensure quality expenditure for proper maintenance and sustainability of the projects. The massive amounts, spent on Direction and Administration expenditure has implications for labour productivity, particularly in the states where this component's share is increasing over time. This analysis has also brought out the fact that a lot of changes may be interpreted as indicative of a better quality of spending in certain states. However, the impact of additional expenditure on data collection, research, consultancy and other similar heads remains to be seen in the coming years. In certain states with more allocations towards actual repair work, the quality of water delivery is expected to improve. Problems like breaching, salinity, and water logging can be taken care of, if proper repair and maintenance activities are undertaken. This can only be materialized when enough allocations are made on the true operation and maintenance activities.

Conclusion:

Various studies from time to time have looked at the issue of operation and maintenance cost as well as the receipt component for a large number of major and medium irrigation projects across states. Most of these studies came up during the late 1970s and 1980s. These studies showed that, most of the funds allocated for operation, repair and maintenance of the systems were diverted towards the payment of wages and salaries of the employees and for other establishment and other administrative expenses, leaving very little for the actual maintenance of the systems, where Rs.35000 per hectare at 1988/89 prices was kept for operation and maintenance costs, available irrigation potential remained unexploited for lack of small sum of about Rs.300 per hectare

annually for operation and maintenance. (Gulati, Svendsen and Roy Choudhury, 1994). Nevertheless this would not have been a thought provoking issue among the policy framers if the efficiency of these major and medium irrigation systems improved over the time period with increased allocation of funds. Unfortunately, as brought out in our analysis, till the beginning of the 1990s, a considerable share of the allocated finance was spent on the establishment charges comprising primarily administrative expenditures like wages and salaries. However the recent years' data reveal a more promising picture with a large number of states showing a grater share of allocations on maintenance and repair than on direction and administration. In states like West Bengal and Orissa, where till now greater share of O&M expenditure is directed towards direction and administration expenditure, proper 'diagnostic reviews' of such nature of funding must be followed. Preparation and implementation of the action plans to assure adequate funding of field maintenance activities, control on the number of staff to be recruited and control on the construction quality and costs are some of the aspects to be taken care of during the allocation of O&M funds. The World Bank reports emphasize on the need of setting up of annual maintenance budgets, and annual irrigation department financial reports to focus on the issues of concerns and guide improvements. Successful implementation of these reforms should be a major concern for both state governments and the Central government. Hence the suggestion here would be to stop funding new projects if the existing systems are deteriorating and adopt measures to improve the efficiency of expenditure.

CHAPTER 5

FINANCIAL EFFICIENCY OF PUBLIC CANAL SYSTEMS: ADEQUACY OF FINANCIAL INFLOWS VIS-A VIS OUTFLOWS.

CHAPTER 5

Financial Efficiency of Public Canal Systems: Adequacy of Financial Inflows vis-a vis Outflows.

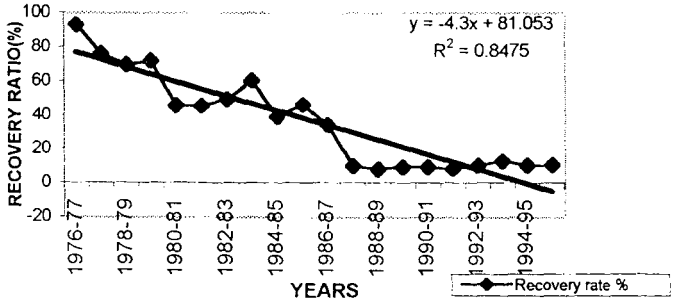
5.1 Introduction:

In the earlier chapters, we have looked into the receipt and expenditure aspects of the major irrigation systems in India. However it is also important to look into the relationship between the two aspects to evaluate the adequacy of financial inflows with repect to the outflows. Recovery Ratio of the irrigation sector is the share of receipts to the total expenditure. It has emerged from the earlier chapters that the receipt composition has been declining over the time period, whereas the expenditure in this sector has been consistently on a rise. This has resulted in a rapid decline in the recovery ratio over time. This chapter would focus on the trends related to the recovery ratio across the states and try to bring out the contributing factors, which can have an effect on it.

5.2 All India Trend in Recovery Ratio from 1974-75 to 1995-96:

The All India figures for recovery ratio indicate a steep fall with time. The data pertaining to the years, 1974-75 to 1995-96 shows that, in the initial years, there was almost about 90 percent recovery ratio. However, with time there has been a steady decline in this ratio, with this value reaching a low of 10 percent in the year, 1995-96. According to the

FIG 5.1 ALL INDIA TRENDS IN RECOVERY RATIO FROM 1976-77 TO 1995-96.



trend analysis, the high R^2 value of .848 indicates little fluctuations in the recovery ratio values, indicating a steady decline in the ratio consistently with time. The beta value of -.921 (which is significant at 1 percent level), which is the trend rate, signifies a steady decline in the recovery ratio on an All India Level over the twenty years time period.

5.2(a) Change in the Relative Position of the States in terms of Recovery Ratios Between 1974-75 and 1995-96.

To analyse the relative change in the position of the states in terms of their recovery ratios over time, the recovery ratios across the states for two points of time, 1974-75 and 1995-96, have been taken for analysis. Accordingly *Spearman's Rank Correlation Coefficient* has been calculated as provided in table A. The value of the calculated *Rank Correlation Coefficient* is .345, which is insignificant at 10 percent level. This shows that, different states have responded differently over time. States like U.P, West Bengal and Bihar, which had high recovery ratios in the initial period, have not been able to maintain their position.

To show the temporal change in the recovery ratios across states, the average annual growth rates of the recovery ratios of the respective states have been calculated as cited in table 5.1.

Table 5.1 Simple Average Annual Growth rate in Recovery Ratio Across States. 1974-75 to 1995-96. (Fig in %)

States	Simple Average Annual Growth Rate (1974-75 to 1986-87)	Simple Average Annual Growth Rate (1986-87 to 1995-96)
Haryana	2.8	3.4
Punjab	7.25	1.11
U.P	16	19.0
Bihar	-6.4	18.4
Orissa	28.5	-2.11
West Bengal	-5.6	-3.7
A.P	8.5	112
Tamil Nadu	19.83	-0.3
Maharashtra	-9.6	-1.3
Rajasthan	17	-14.0

Source: Computed from Water and Related Statistics, CWC, 1989.

Table 5.1, calculates the simple average annual growth rates of recovery ratios for the period, 1974-75 to 1995-96, across selected states. For analysis, the entire period has been divided into two; one from 1974-75 to 1986-87 and the other from 1987-88 to 1995-96. The year 1986-87 has been selected as the benchmark since it was during this year, that, most of the states introduced revision in their irrigation water tariffs. According to table 5.1, in the initial period, the states with high annual average growth in recovery ratios were Punjab, Rajasthan, Orissa and Tamil Nadu. States like Bihar, West Bengal

and Maharashtra exhibited a negative annual growth rates. However with time conditions began to change. From the same table it is evident that, during the period 1986-87 to 1995-96, many other states began to show a deteriorating annual growth rates in recovery ratios. These states are namely, Orissa, West Bengal, Tamil Nadu, Maharashtra and Rajasthan. The growth rate of Punjab too shows a decline, though the growth rates of Bihar and U.P and Andhra Pradesh exhibit increase. From this it can be inferred that in most of the states, there is negative growth in the recovery ratios, which indicates that, in all these states, the states have either not been able to improve the receipt or have failed to curtail the escalating expenditures in spite of the recommendations of various committees provided from time to time.

5.2(b) Spatio-Temporal Analysis of the Relationship of Receipt with Expenditure.

An analysis of trend of recovery ratio at the all India level reveals that there has been a significant decline in recovery ratio over time. For this, a trend analysis has been carried out in this section, both for all India level and across states, for the period 1974-75 to 1995-96.

Table 5.2 Trend Analysis for All India Recovery Ratios

R^2	Beta	t-test	Significance
.848	-.921	-10.0	.000

Source: Computed from Water and Related Statistics, CWC, 1989.

The trend analysis shows that, the recovery ratio is consistently declining as indicated by the negative trend rate or the Beta-value of -.921. This value is significant at 1 percent level. However to get a regional insight of the trends in recovery ratios, a state level trend analysis is carried out.

As evident from table 5.3, in almost all the states barring a few exceptions, the values of R^2 are very high. The high R^2 values indicate a consistent decline in the recovery ratios without much fluctuation. As evident, all the R^2 values are more than 60 percent in most of the states. Again the beta values showing the rate of change in recovery ratios as negative and significant indicate that, with time, there is a steep decline in the recovery ratios in almost all the states except Andhra Pradesh.(Fig 5.2a, b and c).

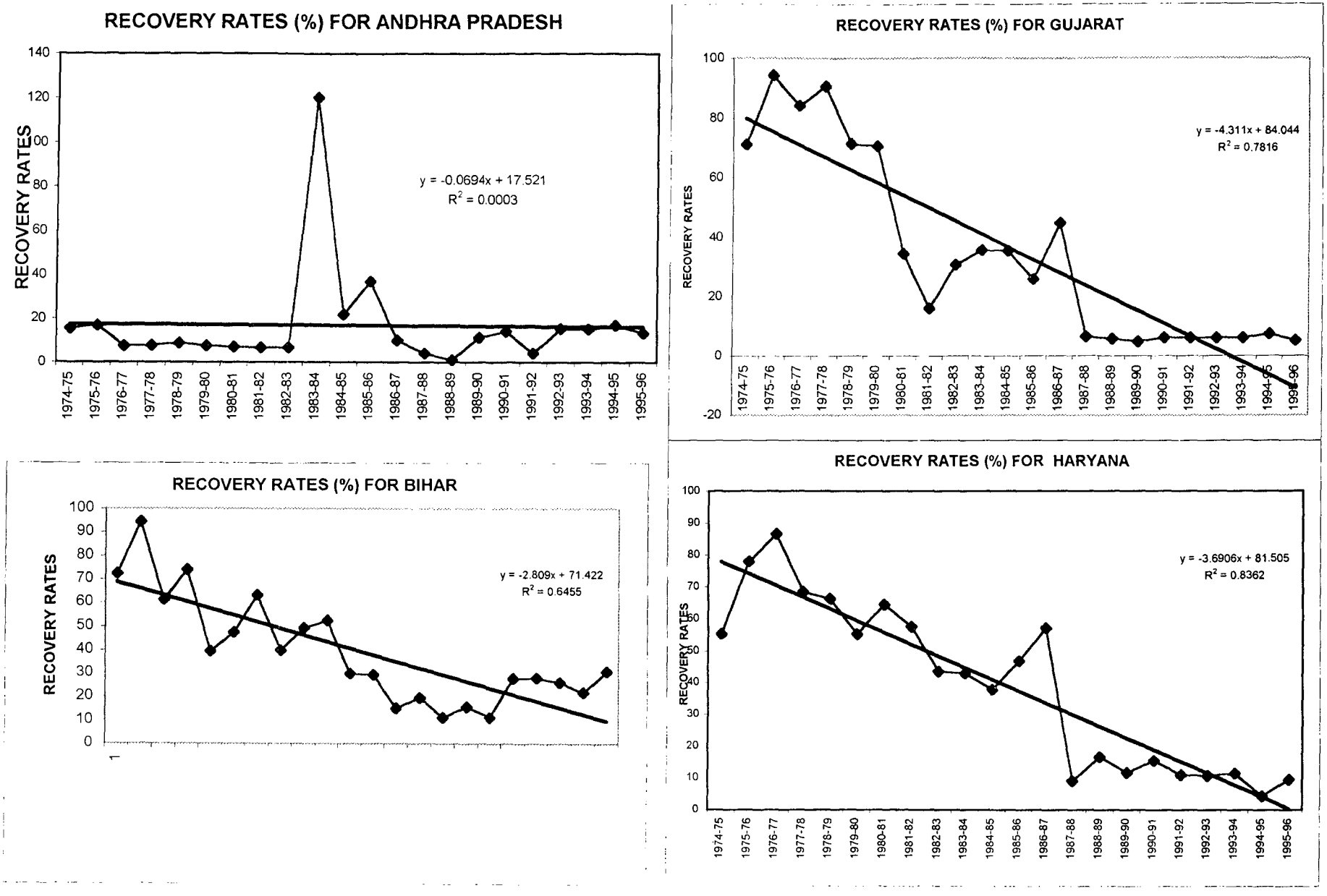

RECOVERY RATES (%) FOR ANDHRA PRADESH
RECOVERY RATES
y = -0.0694x + 17.521
R² = 0.0003
RECOVERY RATES (%) FOR GUJARAT
RECOVERY RATES
y = -4.311x + 84.044
R² = 0.7816
RECOVERY RATES (%) FOR BIHAR
RECOVERY RATES
y = -2.809x + 71.422
R² = 0.6455
RECOVERY RATES (%) FOR HARYANA
RECOVERY RATES
y = -3.6906x + 81.505
R² = 0.8362

FIG. 5-2a.

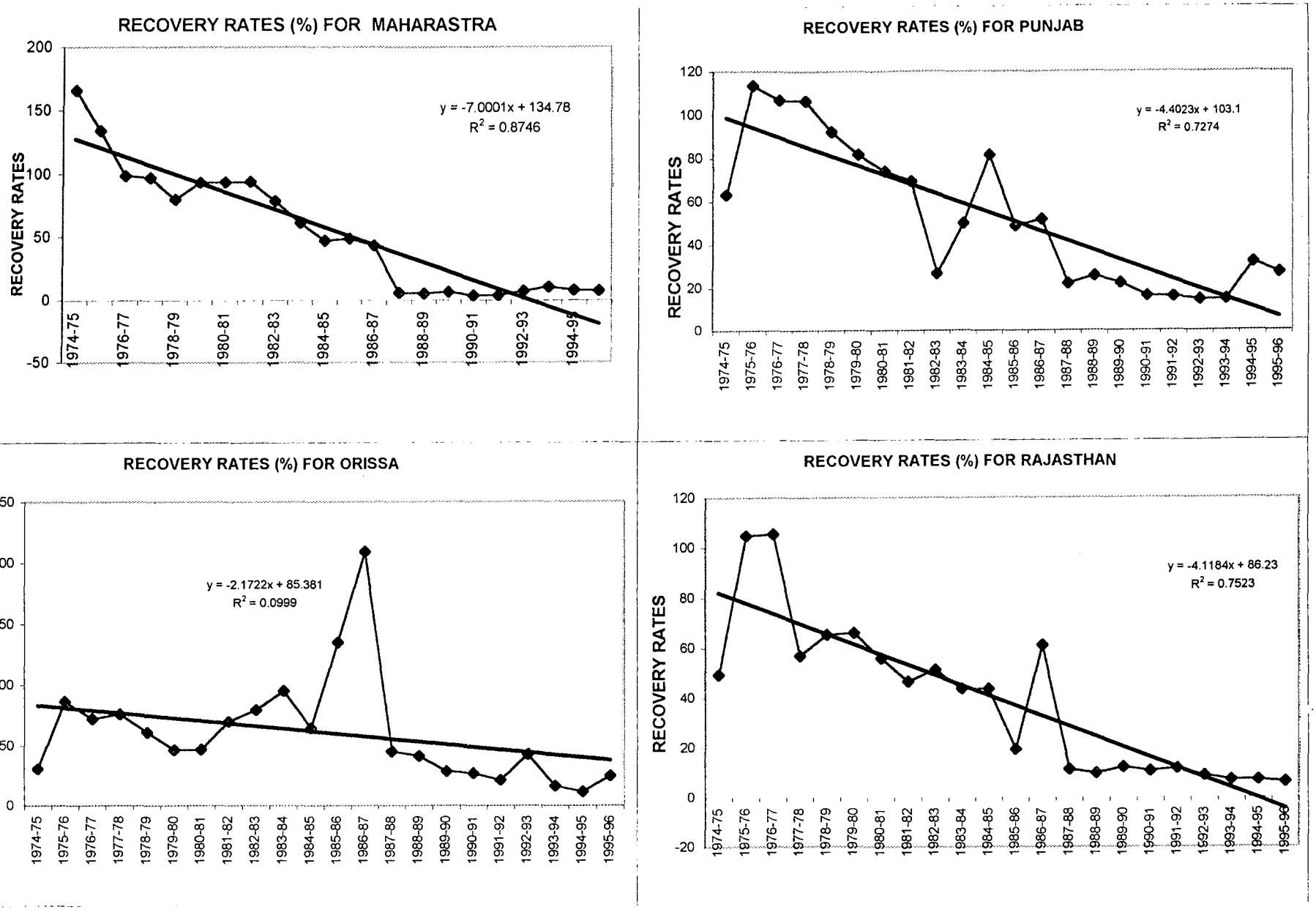
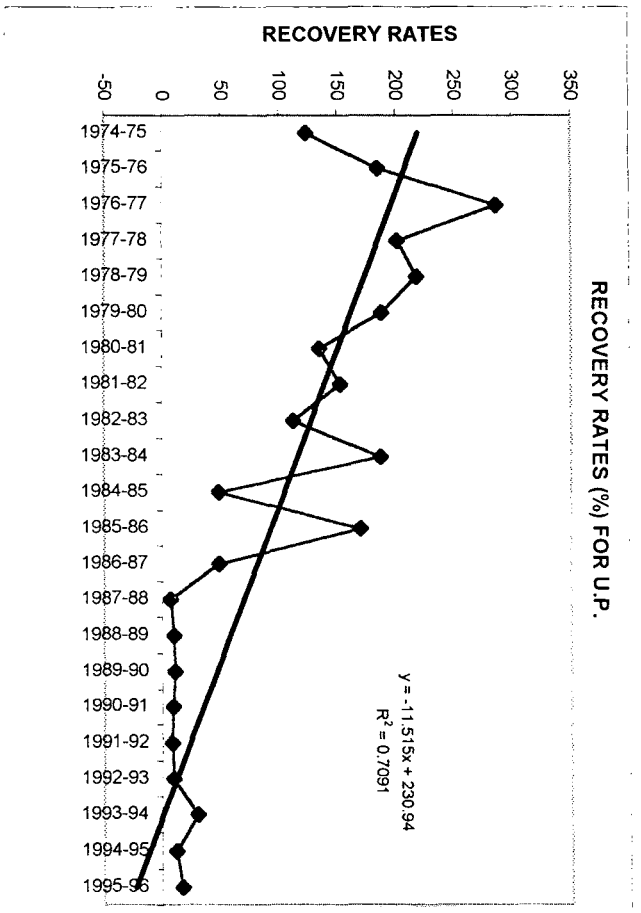
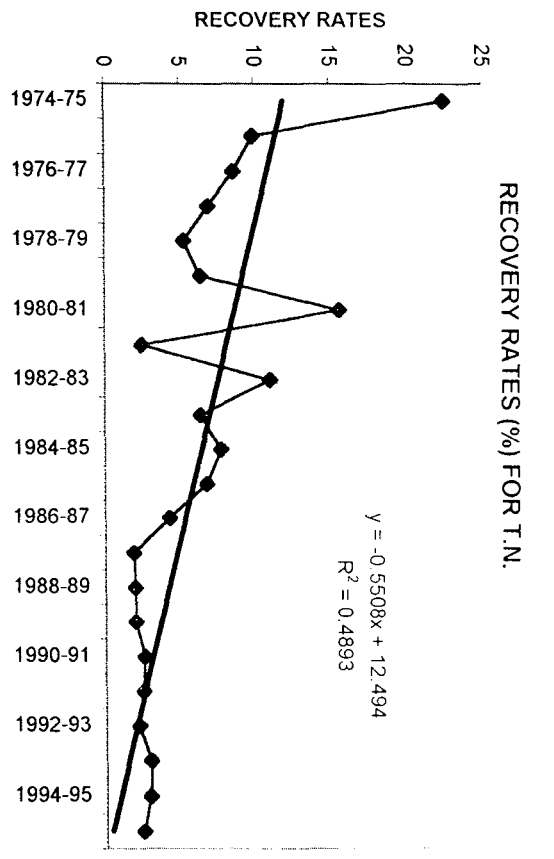

RECOVERY RATES (%) FOR MAHARASTRA
y = -7.0001x + 134.78
R2 = 0.8746
RECOVERY RATES
RECOVERY RATES (%) FOR PUNJAB
y = -4.4023x + 103.1
R2 = 0.7274
RECOVERY RATES
RECOVERY RATES (%) FOR ORISSA
y = -2.1722x + 85.381
R2 = 0.0999
RECOVERY RATES
RECOVERY RATES (%) FOR RAJASTHAN
y = -4.1184x + 86.23
R2 = 0.7523
RECOVERY RATES

FIG. 5.2 b.


RECOVERY RATES
-50
0
50
100
150
200
250
300
350
1974-75
1975-76
1976-77
1977-78
1978-79
1979-80
1980-81
1981-82
1982-83
1983-84
1984-85
1985-86
1986-87
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
y = -11.515x + 230.94
R² = 0.7091
RECOVERY RATES (%) FOR U.P.


RECOVERY RATES
0
5
10
15
20
25
1974-75
1976-77
1978-79
1980-81
1982-83
1984-85
1986-87
1988-89
1990-91
1992-93
1994-95
y = -0.5508x + 12.494
R² = 0.4893
RECOVERY RATES (%) FOR T.N.

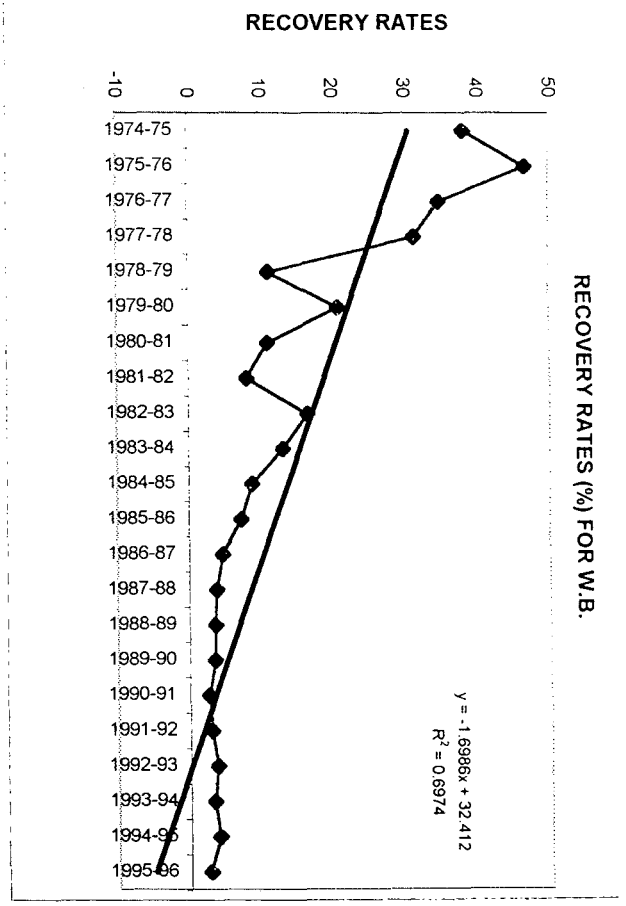

RECOVERY RATES
-10
0
10
20
30
40
50
1974-75
1975-76
1976-77
1977-78
1978-79
1979-80
1980-81
1981-82
1982-83
1983-84
1984-85
1985-86
1986-87
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
y = -1.6986x + 32.412
R² = 0.6974
RECOVERY RATES (%) FOR W.B.

FIG.5.2.c.

Table 5.3 Trend Analysis to Show the Temporal Pattern of Change in Recovery Ratios Across States.

States	R^2	Std Error	Beta	t-test	Significance
Haryana	.836	.365	-.914	-10.10	.000
Punjab	.727	.603	-.853	-7.3	.000
U. P.	.709	1.649	-.842	-6.982	.000
Bihar	.646	.465	-.803	-6.035	.000
Orissa	.1000	1.458	-.316	-1.490	.158
W. B.	.697	.250	-.835	-6.789	.000
A. P.	.000	.836	-.018	-.083	.935
Karnataka	.734	.698	-.857	-7.423	.000
Kerala	.508	.943	-.713	-4.546	.000
T. N.	.489	.126	-.700	-4.378	.000
Maharastra	.875	.593	-.935	-11.813	.000
Rajasthan	.752	.528	-.867	-7.794	.000

Source: Computed from Water and Related Statistics, CWC, 1989.

In states like Haryana, Punjab, U.P., Bihar, West Bengal and Rajasthan, the beta values are not only negative but also significant at 1 percent levels. Orissa and Andhra Pradesh however show insignificant trend of recovery ratio, though the slope coefficient is negative. Most of these states show a steady and steep declining trend in recovery ratios, over the years. The near uniform decline in ratio of receipt to expenditure is thus indicative of deteriorating financial health of the public canal systems almost in all the states of India. It may be noted here that, the declining recovery ratio is evident inspite of an increase in receipts in most of the states, particularly after the post recommendation period. Thus in this context, the changes in both the quantum and quality of expenditure in the canal command is of utmost importance. In other words, the extent of returns to the O&M expenditure incurred resulting in increased efficiency in the water delivery system in turn leading to higher productivity levels can only justify a low recovery ratio.

5.3 Factors affecting recovery ratios:

Another important part of this analysis would be to focus on certain factors, which can impact on the changing recovery ratios.

Recovery Ratios depend primarily on the following factors:

1. Low Water Rates.
2. Lack of regular revision.
3. Low collection efficiency.

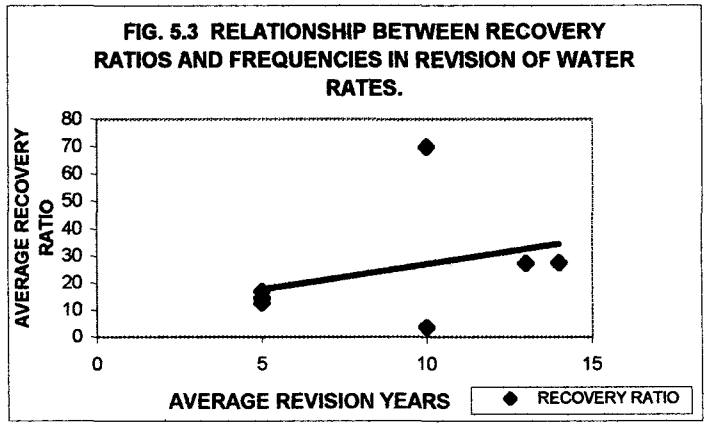
4. High growth in Expenditure particularly under Direction and Administration without corresponding increase in Repair and Maintenance.

Depending on these factors, the states too can also be grouped as good, moderate and low performing states. In this section of analysis, scatter diagrams will be drawn to show the relationship of recovery ratio as the dependent variable with other independent variables for selected canal irrigated states over time.

Table 5.4 Relationship between recovery ratio and other factors affecting it.(1995-96)

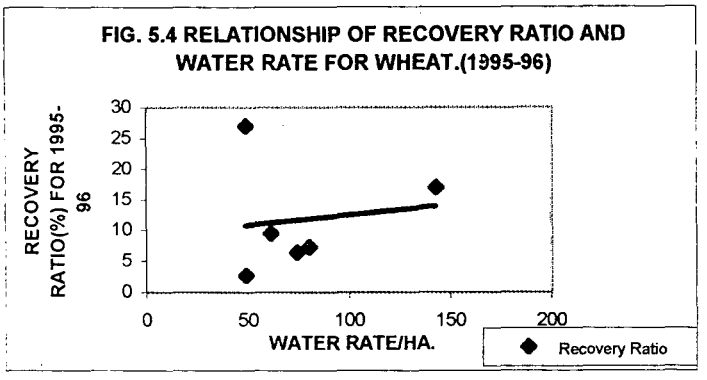
States	Recovery Ratio	Water Rate-Paddy	Water Rate-Wheat	Average Years of Revision	Collection Efficiency (%)	Growth in Expenditure(%)		% of Demand to Expenditure
						Total	D&A	
Bihar	30.9	89	-	7	60	-24.54	-89	31.87
Haryana	9.5	74	61	15	95	199	-62	33.39
Orissa	24.7	39	32	8	2.0	-	108	-
Punjab	27	29	49	14	40	32	-97	26.12
Rajasthan	6.4	98	74	7	3.2	-	15	-
U.P	17.0	143	143	6	13.2	33	-	63.29
W.B	2.7	125	49	10	30.0	59.60	60	9.52

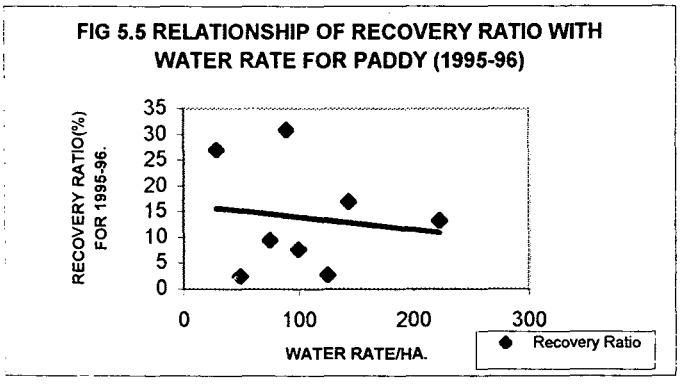
Source: 1. Report of the Pricing of Irrigation Water, Planning Commission, 1992.
2. Combined Finance and Revenue Accounts of Union and State Governments, 1997-98.



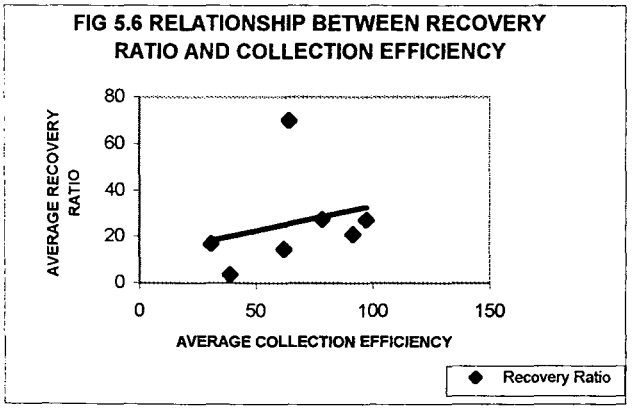
An important factor determining recovery ratio is the rate or frequencies in the revision of the water rates. Different states have revised their water rates at different times. Hence to find out the relationship between recovery ratio and the frequencies in revision of water rates, the following scatter diagram may be referred to. According to fig.5.3, the average recovery ratio for the period has been plotted on the y-axis and the corresponding figures for the average years taken for the revision of water rates have

been plotted in the x- axis. From this figure, we find that, a positive relationship exists between the two variables i.e. with more frequent revision in water rates, the recovery ratios too show an increasing trend.





In fig. 5.4 and 5.5, the relationships between recovery ratios and water rates for wheat and rice have been established for the year 1995-96, across selected states. As represented through the scatter in fig. 5.4, the relationship established between recovery ratio and per hectare water rate for wheat, is positive. This indicates that, with more increase in water rates, the recovery ratio will improve. However it must also be remembered that, the recovery ratio is also affected by expenditure component. It is for

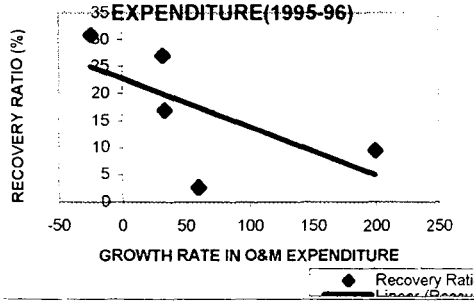


this reason that in figure 5.4, we notice a negative relationship between recovery ratio and water rate for paddy. This indicates that, with more increase in water rates, though the receipts increase, nevertheless the expenditures in these states are also on a rise. Hence the scatter shows a negative relationship between the two.

Another important factor determining recovery ratio is the collection efficiency. Here in the scatter diagram in fig.5.6, we find that, there is a positive association between the average collection efficiency for the states and the average recovery ratio for the same time period i.e. from 1986 to 1991. Hence we can say that, it is imperative to improve the collection efficiencies of the water rates to improve the recovery ratios, as by improving the former, the overall receipts would increase, thereby bettering the recovery ratio.

The other relationship that has been examined here is that between recovery ratio and growth rate in operation and maintenance expenditure (O&M). Here the recovery ratios of the period 1995-96 have been plotted on the y-axis as the dependent variable and the annual average growth rate in O&M expenditure has been plotted as the independent variable on the x-axis. According to the scatter in fig.5.7, we find that, there is a negative relationship between the two variables. This however is a very interesting finding as this shows that in the given period, with the rising O&M cost, which is a part of expenditure, the corresponding receipts are decreasing, hence explaining the cause of fall in the recovery ratio.

FIG 5.7 RELATIONSHIP OF RECOVERY RATIO AND GROWTH RATE OF O&M EXPENDITURE(1995-96)



Hence from the analysis of this part we can conclude that, as presumed earlier, the results too show the fact that the recovery ratio is intricately related to factors like operation and maintenance expenditure, collection efficiency and timely revision of water

rates. However it must be borne in mind that, only by reducing the expenditure or by bettering collection efficiency would not solve the problem. Recovery ratios are also directly related to the willingness of the farmers to pay for the irrigation water to be used by them. There is definitely a strong linkage between recovery ratio and water delivery efficiencies. If the delivery system in an area is efficient and if because of this, there is increased yield and productivity, the receipts collected from the beneficiaries would also be high, thereby improving the recovery ratio of that area. However to analyse the impact of this aspect on the recovery ratio, a micro level survey has to be undertaken which is beyond the ambit of the scope of the present study.

CHAPTER 6

SUMMARY AND CONCLUSION

CHAPTER 6

Summary and Conclusion

The once plentiful funds for canal irrigation are now drying up in response to the changing priorities of the policy makers (Ahluwalia, 1996). The driving forces behind this shift include relatively favourable food balance currently prevailing in India, historically low prices of food grains, the rising costs in canal construction and the heavy external debt.

The financing of the irrigation sector has been in tune with the overall macro economic scenario of the country. The recent trends show that, in almost all the sectors of the economy, there has been a steady decline in capital expenditure. "The New Economic Policy is not against public investment in agriculture but it does require that higher levels of public investments must be achieved within the macro economic constraints of fiscal prudence"[1]. In other words the desirable increases in the public investment in agriculture cannot be simply financed by the increasing fiscal deficit. Hence, the major contribution towards sustained financing even in the irrigation sector must be generated from within the sector and should aim at achieving higher revenues and reduce the current expenditures. Since the capital expenditure in the Indian economy is decreasing (from 4.4% of GDP in 1990-91, to 2.2% in 2000-01), it would not be unreasonable to expect a similar decline in investments towards new irrigation projects, particularly for the larger projects. The efficiency of the existing canal systems thus is of crucial importance. It is therefore in this context that the operational and maintenance aspects of the canal systems assume special significance. The present study, dealing with financial aspects of public canal systems, has made an attempt in this direction.

This study specifically focused on the analysis of regional variations in the systems of pricing of canal irrigation water and examined the rationale of the existing pricing mechanism prevailing across the states. It also attempted to assess the nature of the spending on operation and maintenance activities at the state level and looked at the adequacy of revenue of the irrigation sector to finance O&M expenditure. Finally this

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[1] Ahluwalia, M. "New Economic Policy and Agriculture: Some Reflections" Indian Journal of Agricultural Economics, pp. 412,Vol. 57, No.3, July-Sept, 1996.

study evaluated the adequacy of financial inflows from the canal systems vis-a vis the expenditure incurred for operating & maintaining them. In this context the relationship between recovery ratio and other factors like collection efficiency, frequency in the revision of water rates, the existing water rates per hectare of irrigated land, affecting it have been examined. For analysis, statistical tools like Rank Correlation and Trend Analysis have been used. The major difficulty with the available data was their non-comparability across time as the data sources varied for different points of time. Hence to bring in continuity in them, method of aggregation has been adopted, which could have, to a certain extent, brought in an element of biasness in the data.

In Chapter 2, an overview of different institutions prevailing in India has been provided. The institutions play a unique role in the management of the canal systems in India. The concept of the farmers' groups as the pivot of management activities, which has gained importance in recent times, however is not new. Systems like the rotational supply of water and the Warabandi systems have been in existence since a long time and such supply systems have involved a large number of beneficiaries for their operational activities. Today, a lot of importance is given to the formation of farmers' cooperatives for the actual management of these systems. A large number of Water Users' Associations have been set up in almost all the major canal irrigated states to involve the actual beneficiaries in the working of these systems and to improve their efficiency.

The chapter on receipts and pricing of irrigation water has revealed that though the receipts have been increasing over time, nevertheless, they are inadequate in the proper maintenance of the systems. Various commissions and committees recommended from time to time the basis of fixing norms for the levying of irrigation charges. Unfortunately, most of the states have not adhered to such recommendations. The recommendations of the two Irrigation Commission's norm for fixing water rates at the rate of 6-12 percent of the gross value of the crops have not been adopted by any of the states. Infact, an analysis in this aspect for the 1970s period, the pre-recommendations period of 1985-86 and for the post-recommendation period for 1998-99, clearly indicate that the situation over the years has not improved but only deteriorated.

Another important revelation of this study has been that, in respect to the cost of cultivation, the farmers pay the lowest for irrigation charges. This is primarily because of

the fact that, the farmers perceive irrigation charge as a kind of 'tax'. They cannot afford to minimize their cost on aspects like buying of bullocks, fertilizers, insecticides or pesticides, as these have direct bearing on productivity and thereby on their income. This is not in the case of irrigation charges. It has also been brought out that, the present system of pricing of irrigation water is not rational as the implicit water rates for less water consuming crops like coarse cereals and pulses are high. The chapter also gives special emphasis on the aspect of collection efficiency as in many of the states, it is found that the problem is not with the low water rates, but with low collection rates.

However it can be said that, though the receipts have increased over the years, it is also important to analyse and look into the expenditure aspects to determine the adequacy of the funds for true operation and maintenance of the systems.

In most of the reviewing committees, flat recommendations regarding repair and maintenance have been made, which is not desirable. The states have seldom followed those norms while fixing the O&M expenditure per hectare of irrigated land. It can be however concluded that, such fixing of flat rates may not be feasible as different areas have different agro-climatic and ecological settings. Again the nature, age and type of projects are important considerations in allocating O&M funds.

The trend in expenditure at the all India level clearly indicates a much higher growth rate compared to the receipts. However, the total expenditure may not signify the true quality of expenditure. When the receipts are less than expenditure, the general observation that can be made is that, the quality of expenditure suffers. In the pre reforms period, in almost all the states, we observe a steady decline in actual repair and maintenance expenditure, at the expense of rising direction and administration cost, comprising mostly of wages and salaries. However following the reforms, in most of the states, namely in Punjab, U.P and Haryana, the quality of expenditure seems to have bettered with a major share of expenditure being allocated for better operation and maintenance activities. In the recent finance accounts of most of the states, there have been inclusions of a variety of new heads, not existing before, like consultancy, data collection and training. All these heads have been created to divert more funds towards actual repair and maintenance of the irrigation systems. Another important head that has

been included in most of the recent state budgets is that of "other expenditure" though the sub components of this head have not been specified in them.

A logical follow up of this would be to analyse the receipt and expenditure separately and look at the relationship of adequacy of financial inflows vis-a vis outflows. The recovery ratio or the share of receipt to expenditure is seen to be declining consistently over the decade in almost all the states, barring Andhra Pradesh. Here certain contributing factors like the water rates, frequency of revision of these rates, the growth rates of O&M expenditure have been analysed separately. Nevertheless all these factors work collectively to determine the recovery ratios. Hence improvement in one of these factors may not bring out an observable change in recovery ratio.

Present study attempts to make a contribution towards the issue of increased efficiency of the existing canal systems. Over all, the study implies a deteriorating financial health of the existing canals which is expected to have its bearing in future returns. Even within the existing state of financial conditions, there is a definite scope for efficiency enhancement as has been demonstrated by certain states in this study. Even without an improvement in the ratio of expenditure under repair and maintenance to the total O&M expenditure or a real increase in the per hectare spending on the same head, it could be possible to reallocate the limited financial resources in a qualitatively better way within the same head.

Based on these findings it is also an important task to formulate certain **policies** for carving out strategies for the future.

The concept of subsidization of irrigation waters can be justified if it results in increased income of the farmers. Their increased income would also affect their willingness to pay. However this can only happen when they are assured of a timely delivery of water, availability of adequate water depending on the crops grown and perceive that the system has flexibility to ward off drought for a longer period of time.

On paper, the concept of volumetric pricing as well as an ecologically sustainable system of pricing across crops has been reiterated since the 1970s. However this study shows that till now it has not been fully implemented. One of the major problem with such a pricing structure is the high rate of cost involved in measuring the discharge of water and monitoring the flow of water to the farmers' fields. For this, without employing

more staff, the users of these systems or the actual beneficiaries can be handed over such responsibilities. Again adequate attention should also be given for the timely revision of water rates. An important aspect to be kept in mind by the policy framers is to fix the water rates keeping in mind agro-climatic regime of the various states. Varying water rates should prevail depending on the season in which the crops grow. For crops grown during the Kharif season, the water required from irrigation would intrinsically be related to the available rainfall during a season. The rates for crops grown in the dry seasons could be more comparable across the states as their water demand would then vary, primarily depending upon the water retention capacity of the soil.

Systematic norms for the fixing of operation and maintenance cost is required, keeping in mind the age and type of the projects, the ecological and geographical setting of the area and other such factors.

This study has shown that many of the states are now experiencing relative reduction of expenditure in direction and administration component and has felt the need to increase the allocation on repair and maintenance component to ensure sustainability in the systems. However an immediate curtailment in the establishment cost to increase the maintenance and repair expenditure is neither feasible, nor desirable, given the existing unemployment scenario in almost all the states. However the way in which the limited funds or resources are to be spent needs special attention. The return in terms of the increased efficiency of water delivery system for each of the components of expenditure incurred under repair and maintenance component has to be looked into in great detail. Regular monitoring of the project structures is very important. As it appears from the study that, there are little or no constraints in so far as availability of manpower in this sector is concerned. It can therefore be suggested that, the excess labour can be used in the effective monitoring and locating the sources of inefficiency within the canal command.

The decision regarding the significance of the type of expenditure incurred can only be achieved at the grass root level. It is here that a strong local institution with active participation of the beneficiaries can play crucial role. This would thereby ensure improvement in collection of irrigation dues, distribution of water and ensure efficiency in the overall irrigation sector. It is in this way that, the water tariff and the efficiency of

the irrigation systems can be linked up. Realizing the potential of the actual beneficiaries in the management of the irrigation systems in India, bold steps are being taken in a number of states, to organize water users' associations for the effective implementation of the plans.

Table 6.1 Efficiency Indicators and Farmers' Institutions

Efficiency Indicators	High/Moderate/Low	States	Remarks
Collection Efficiency	High	Gujarat, Maharashtra, A.P *	Strong farmers' institutions exist thereby bettering the collection efficiency.
Collection Efficiency	Low	U.P, Rajasthan, Orissa**	Weak institutional set ups; need to be strengthened.
Ratio of Demand to Expenditure	Low	Bihar, Haryana**	Upward revision of water rate is required. The role of the farmers' groups would be to introduce the revised water rates.
Efficiency in timely water distribution.	Moderate	A.P, Gujarat, Tamil Nadu, Maharashtra	The local cooperatives have introduced in many cases the basis for volumetric supply of water.

*1991 fig, **1997-98 fig.

As evident from table 6.1, some of the micro level problems have been solved in states where strong institutional systems exist. Efficiency in collection of the dues, reduced cost of collection and ensuring adequate irrigation water even to the farmers at the tail end, are some of the functions, which the farmers' groups can play. Hence the policy makers should try to strengthen the local institutions and make them autonomous to ensure positive outcomes in the future.

In the end it is also important to categorise the states based on certain criteria for proper policy formulation. Based on the findings, which have emerged from this study, the states can be categorized as tabulated in table 6.2.

Table 6.2 Categorisation of the states for future policy formulations.

CATEGORIES	1997-98
Immediate need to improve collection efficiency	U.P, Rajasthan, Orissa
Need to hike the water rate.	Bihar, Haryana,
Both need to be revised	Punjab, West Bengal

- Where there is no immediate need to increase the water rates, but collection efficiency needs to be improved, example in U.P., Rajasthan and Orrisa.
- States which have satisfactory collection efficiency, but the demand itself is not sufficient to cover the expenditure, example in Bihar and Haryana.
- States, where an urgent need exists in both revising and increasing the existing water charges and in improving the collection efficiency, example in Punjab and West Bengal.

The uniform decline in the recovery ratio of receipt to expenditure is thus indicative of deteriorating financial health of the public irrigation systems in India. Though the expenditures are rising much faster than the receipt, it is the quantum and quality of expenditure in the canal command, which are of special importance. In other words, extent of returns to the O&M expenditure incurred, resulting in increased efficiency in the water delivery systems, in turn leading to higher productivity levels can only justify a low recovery ratio. The problems in all the states are not the same. Problems in this sector tend to be region specific. Hence effective implementation of policies and plans as suggested here should be made, keeping in mind the larger interests of the beneficiaries.

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APPENDIX

APPENDIX

Table A.3.1 Break up of Cost of Cultivation for Paddy, Wheat, and Sugarcane-1995-96.

Paddy	Operation Cost	Irrigation charges	Total cost	% of irrigation charge to the total cost
Andhra Pradesh	13514.09	640.13	20937.09	3.05
Haryana	11434.73	2035.5	18622.34	10.93
Orissa	6597.66	142.19	10309.96	1.37
Punjab	10194.66	275.52	17966.85	1.53
Uttar Pradesh	7044.55	145.46	11300.99	1.28
West Bengal	10890.37	236.33	16929.63	1.39
Wheat	Operation Cost	Irrigation charges	Total cost	% of irrigation charge to the total cost
Haryana	9604.43	1061.7	17081.6	6.21
Madhya Pradesh	5648.24	529.69	9365.52	5.65
Punjab	8730.13	2151	17333.89	12.40
Rajasthan	9340.92	1086.58	14266.69	7.61
Uttar Pradesh	8465.09	1762.21	13970.78	12.61
Sugarcane	Operation Cost	Irrigation charges	Total cost	% of irrigation charge to the total cost
Maharashtra	26593.24	2804.62	35804.34	7.83
Uttar Pradesh	11764.8	870.38	21311.13	4.08
Andhra Pradesh	22150.44	2771.52	38989.73	7.10
Haryana	11164.77	846.4	25203.63	3.35
Tamil Nadu	24635.49	1486.07	33132.09	4.485

Source: Report of the Commission on Agricultural Costs and Prices, 1999-2000.

Table A.3.2 Years of Last Revision of Water Rates till 1988.

States	Years last revised
Punjab	1974
Haryana	1975
Bihar	1983
Uttar Pradesh	1983
West Bengal	1977
Tamil Nadu	1963
Andhra Pradesh	1986
Madhya Pradesh	1984
Maharashtra	Once In every 5 years
Orissa	1981
Karnataka	1985

Source: Report on the Pricing of Irrigation Water,1992

Table A.3.3 Gross Receipts and Working Expenses from 1976-77 to 1995-96.

(At 1980-81 prices)

Years	Capital outlay (crores)	Gross receipts (crores)	Working expense (crores)	Recovery rate %
1976-77	991.9	152.7	164.4	36.4
1977-78	1197.3	134.4	176.4	76.2
1978-79	1345.6	149.9	215.2	26.3
1979-80	1328.2	119	166.1	23.3
1980-81	1256.7	103.4	225.7	19.6
1981-82	1316.2	110	242.7	17.7
1982-83	1384.3	104.5	212.1	10.5
1983-84	1402.1	134.5	223.2	19.7
1984-85	1420.3	98.6	254	13.4
1985-86	1469.1	161	350.3	19.2
1986-87	1544.8	114	334.7	12.3
1987-88	1444.3	88.1	889.1	9.9
1988-89	1473.1	98.4	1258.4	7.8
1989-90	1370	114.6	1227.9	9.3
1990-91	1461.9	117.6	1271.9	9.2
1991-92	1374.4	102.2	1222	8.4
1992-93	1333.4	126.5	1245.8	10.2
1993-94	1432.2	169.6	1323	12.8
1994-95	1581.2	145.8	1432.9	10.2
1995-96	1658.6	151.8	1464.4	10.4

Source: Water and Related Statistics, CWC, 1998.

TABLE A.3.4 Receipts / Ha. For 1984-85 and 1995-96.(in current prices)

STATES	GROSS RECEIPTS/HA (1984-85)	GROSS RECEIPTS/HA (1995-96)
A.P	27.00	38.00
Bihar	33.00	111.00
Haryana	70.00	199.00
Maharashtra	140.00	445.00
Orissa	66.00	1.10
Punjab	53.00	76.00
Rajasthan	93.00	73.00
Tamil Nadu	9.00	6.00
U.P	111.00	98.00
W.B	7.00	19.00

Source: Water and Related Statistics. 1998.

Table A.4.1 Composition of O&M Cost For the Selected States, 1985-86 and 1997-98.

1985-86	%	1997-98	%
PUNJAB		**PUNJAB**	
Works	6.3	Direction and Administration	0.08
Maintenance	40	Data Collection	
Direction and Administration	50	Research	5.6
Machinery and Equipment	2.2	Survey	22
Suspense	0.68	Others Expenditure	69
1985-86		**RAJASTHAN**	
RAJASTHAN		Direction and Administration	39
Works	6.67	Data Collection	1.9
Maintenance	6.92	Training	4.6
Direction and Administration	83.5	Research	3.3
Machinery and Equipment	1.65	Survey	27.7
Suspense	1.1	Suspense	0
		Other Expenditure	22.17
ORISSA			
Works	0		
Maintenance	71	**ORISSA**	
Direction and Administration	27.54	Direction and Administration	75.9
Machinery and Equipment	2.4	Training	6
Suspense	-0.1	Survey	23
		Machinery	0
WEST BENGAL		Suspense	5.4
Works	71	Other Expenditure	0.13
Maintenance	0		
Direction and Administration	26		
Machinery and Equipment	4.9	**WEST BENGAL**	
Suspense	0	Direction and Administration	83
		Data Collection	0.03
		Training	0.2
		Research	1.06
		Survey	4.71
		Machinery	0.2
		Other Expenditure	10.83

Source: State Finance Accounts, 1986-87 and 1998-99.

TABLE A.4.2 MAINTENANCE EXPENDITURE PROVIDED FOR MAJOR AND MEDIUM IRRIGATION (Rs.in Lakhs)

STATES	2000-01	20001-02	2002-03	2003-04	2004-05	TOTAL(2000-05)	GIA in 000'ha
ANDHRA PRADESH	14145	14937	15797	16697	17639	79215	5782
ARUNACHAL PRADESH	0	0	0	0	0	0	-
ASSAM	868	912	957	1005	1055	4798	-
BIHAR	19233	20194	21204	22264	23378	106274	4664
GOA	648	680	714	750	787	3580	-
GUJARAT	16859	17702	18587	19516	20492	93156	3643
HARYANA	9295	9818	10388	11059	11685	52244	4785
HIMACHAL PRADESH	137	143	150	158	166	754	-
JAMMU & KASHMIR	1035	1108	1179	1256	1329	5907	-
KARNATAKA	8303	8771	9279	9809	10365	46526	-
KERALA	2622	2790	2972	3162	3341	14887	-
MADHYA PRADESH	20377	21396	22466	23589	24769	112598	-
MAHARASHTRA	18072	18975	19924	20920	21966	99857	3149
MANIPUR	932	979	1028	1079	1133	5152	-
MEGHALAYA	0	0	0	0	0	0	-
MIZORAM	0	0	0	0	0	0	-
NAGALAND	0	0	0	0	0	0	-
ORISSA	7507	7875	8330	8776	9494	41983	2263
PUNJAB	12154	12791	13482	14154	14953	67534	7377
RAJASTHAN	13475	14148	14856	15599	16379	74456	6741
SIKKIM	0	0	0	0	0	0	-
TAMIL NADU	15665	16448	17271	18134	19041	86559	3347
TRIPURA	12	13	14	14	15	68	-
UTTAR PRADESH	40906	42951	45099	47354	49721	226031	17467
WEST BENGAL	8928	9375	9843	10335	10852	49334	2491
All India Total	211172	222008	233539	245631	258559	1170910	73275

Source:Report of the Eleventh Finance Commission for 2000-2005

Table A.4.3 Quality of Expenditure on Operation and Maintenance Cost (1974-75 to 1986-87). (Fig. In %)

Years	Direction & Administration	Machinery	Suspense	Extension & Improvement	M&R	Others	Total
1974-75	33.9	1.08	2.45	13.59	46.02	2.9	100
1975-76	31.78	1.29	0.03	8.62	51.38	6.8	100
1976-77	30.20	1.54	1.23	4.61	63.02	1.8	100
1977-78	29.6	1.18	0.86	6.36	56.47	7.0	100
1978-79	29.57	1.22	1.00	3.01	50.49	14.76	100
1979-80	30.91	1.20	1.43	2.9	57.57	5.95	100
1980-81	25.91	1.61	0.34	3.05	42.85	26.88	100
1981-82	27.94	1.01	1.34	3.41	41.24	25.02	100
1982-83	40.6	1.21	3.2	3.55	51.44	12.52	100
1983-84	36.78	2.19	2.8	2.44	46.04	9.66)	100
1984-85	31.71	0.94	1.63	2.5	45.69	17.41	100
1985-86	35.7	0.57	0.81	28.8	24.11	9.8	100
1986-87	42.84	0.77	1.80	11.36	36.35	6.85	100

Source: Combined Revenue and Finance Accounts of Union and State Governments (various issues), New Delhi.

Table A.4.4 Quality of expenditure on operation and maintenance cost –1974-76 to 1986-87.

Years	D&adm	Machinery	Suspense	Extension &Impt	M&repair	Others	Total
1974-75	1880.25(33.9)	60.3(1.08)	136.02(2.45)	753.56(13.59)	2550.9(46.02)	161(2.9)	5542.25(100)
1975-76	1948.8(31.78)	79.36(1.29)	2.28(0.03)	528.65(8.62)	3150.9(51.380	421(6.8)	6131.84(100)
1976-77	2150.49(30.20)	110.21(1.54)	88.04(1.23)	328.66(4.61)	4487.9(63.02)	131(1.8)	7120.74(100)
1977-78	2390.39(29.6)	95.5(1.18)	69.61(0.86)	513.83(6.36)	4559.4(56.47)	444(7.0)	8072.91(100)
1978-79	2716.26(29.57)	112.87(1.22)	92.52(1.00)	276.683(3.01)	4638(50.49)	1348(14.76)	9185(100)
1979-80	3027.43(30.91)	117.89(1.20)	140.92(1.43)	284.41(2.9)	5638(57.57)	583(5.95)	9792.69(100)
1980-81	4079.23(25.91)	254.5(1.61)	53.66(0.34)	480.66(3.05)	6745(42.85)	4232(26.88)	15738.2(100)
1981-82	4882.65(27.94)	176.74(1.01)	235.21(1.34)	596.93(3.41)	7207(41.24)	4372(25.02)	17472(100)
1982-83	5786.53(40.6)	172.87(1.21)	468.02(3.2)	505.99(3.55)	7327(51.44)	1784(12.52)	14243.5(100)
1983-84	5986.02(36.78)	356.83(2.19)	465.02(2.8)	398.61(2.44)	7492(46.04)	1572(9.66)	16271.5(100)
1984-85	6974.75(31.71)	206.9(0.94)	358.94(1.63)	570.61(2.5)	10047(45.69)	3829(17.41)	21988.6(100)
1985-86	11963.8(35.75)	161.21(0.57)	272.55(0.81)	9634.6(28.80)	26	8298(10.1)	32548.2(100)
1986-87	12588.5(42.84)	229.16(0.77)	529.75(1.80)	3337.9(11.36)	10682(36.35)	2015(6.85)	29382.8(100)

Note: Fig. in brackets indicate the percentage share of each to the total expenditure.

Source: Combined Revenue and Finance Accounts of Union and State Governments (various issues), New Delhi.

Table A.4.5 Qualitative analysis of operation and maintenance cost across a few states - 1986-87 to 1990-91.

States	Years	estb.cost	actual work	total	%est cost to total	%of actual to total
Bihar	1986-87	1031	650	1681	61.33	38.66
	1987-88	1624	1237	2861	56.76	43.23
	1988-89	1997	1525	3522	56.70	43.29
	1989-90	2591	1565	4156	62.34	37.65
	1990-91	3096	1550	4646	66.63	33.36
Haryana	1986-87	1296	1183	2479	52.27	47.72
	1987-88	1585	1047	2632	60.22	39.77
	1988-89	1738	1002	2740	63.43	36.56
	1989-90	2133	934	3067	69.54	30.45
	1990-91	2311	1158	3469	66.61	33.38
M.P	1986-87	313	938	1251	25.01	74.98
	1987-88	313	940	1253	24.98	75.01
	1988-89	330	990	1320	25	75
	1989-90	363	1088	1451	25.01	74.98
	1990-91					
Maharashtra	1986-87	728	1639	2367	30.75	69.24
	1987-88	913	2160	3073	29.71	70.28
	1988-89	2858	2349	5207	54.88	45.11
	1989-90	3350	2710	6060	55.28	44.719
Orissa	1989-90	107	189	296	36.148	63.85
	1990-91	121	215	336	36.01	63.98
Punjab	1986-87	1727	795	2522	68.47	31.52
	1987-88	2016	908	2924	68.94	31.05
	1988-89	2280	847	3127	72.91	27.08
	1989-90	2995	991	3986	75.13	24.86
	1990-91	2920	874	3794	76.96	23.03
U.P	1987-88	857	3631	4488	19.09	80.90
	1988-89	4745	3992	8737	54.30	45.69
	1989-90	3197	5208	8405	38.03	61.96
	1990-91	4739	5414	10158	46.65	53.29
W.B	1986-87	670	965	1635	40.97	59.02
	1987-88	700	915	1615	43.34	56.65
	1988-89	842	1057	1899	44.33	55.66
	1989-90	1104	1142	2246	49.15	50.84
	1990-91	1463	1308	2771	52.79	47.20

Table A.5.1 Per Hectare Working Expenses and Receipts for Major and Medium Irrigation Systems Across States. (1993—94)

States	Working Expense	Gross Receipts	Total Profit	Recovery of Expenditure through Receipts (%)[a]
A.P.	1769	268	-1501	15.1
Bihar	292	76	-216	26.0
Gujarat	4593	276	-4317	6.0
Haryana	972	112	-860	11.52
Karnataka	2056	109	-1947	5.30
Kerala	720	61	-659	8.47
Maharashtra	6926	716	-6210	10.33
Orissa	249	40	-209	16.0
Punjab	476	70	-406	14.7
Rajasthan	1479	104	-1375	7.06
Tamil Nadu	787	24	-763	3.04
U.P.	897	274	-623	30.5
West Bengal	541	30	-511	5.54

Source: Water and Related Statistics, CWC,

[a] = Gross Receipt / Working Expense*100.

Table A.5.2 Percentage shares of Working Expenses, recovered through Receipts in the Northern States (1974-75 to 1995-96).

Years	Haryana	J. & K.	Punjab	U.P.
1974-75	55.3	6	63.2	123.3
1975-76	77.9	2	113.4	184.9
1976-77	86.6	3.2	106.7	286.4
1977-78	68.4	4.1	106.5	201.7
1978-79	66.2	3.1	92.3	218.2
1979-80	55.2	2.2	81.8	187.7
1980-81	64.4	1.8	73.8	134.4
1981-82	57.5	1.5	69.3	152.7
1982-83	43.5	1.9	26.6	111.7
1983-84	42.9	0.6	50	186.9
1984-85	37.7	5.8	81.5	48.4
1985-86	46.8	8	48.3	169.8
1986-87	57	13.7	51.5	48.8
1987-88	9.1	4.9	21.9	6.8
1988-89	16.6	6.3	25.5	10
1989-90	11.7	4.7	22.2	10.4
1990-91	15.5	3	16.2	9
1991-92	11	3	15.9	8
1992-93	10.7	4.6	14.5	9.2
1993-94	11.5	2.8	14.7	30.5
1994-95	4.4	4.7	31.6	11.6
1995-96	9.5	14	27	17

Source: Water and Related Statistics, CWC, 1998.

Table A.5.3 Percentage shares of Working Expenses recovered through Receipts in the Eastern region (1974-75 to 1995-96)

Years	Bihar	Orissa	W.B.
1974-75	72.5	30.7	38.2
1975-76	94.4	86.4	46.8
1976-77	61.2	71.9	35
1977-78	74	75.7	31.5
1978-79	39.5	60.9	11.2
1979-80	47.4	46.3	20.8
1980-81	63.2	46.8	11
1981-82	39.8	69.8	8.1
1982-83	49.3	79.3	16.5
1983-84	52.4	95	13.1
1984-85	29.8	64.3	8.8
1985-86	29.3	134.9	7.3
1986-87	15.1	209	4.6
1987-88	19.6	45.2	3.8
1988-89	11.3	41.4	3.6
1989-90	15.9	28.3	3.5
1990-91	11.2	26.8	2.7
1991-92	27.9	21	3
1992-93	28	42.6	3.8
1993-94	26.1	16.2	3.3
1994-95	21.8	11.6	4
1995-96	30.9	24.7	2.7

Table A.5.4 Percentage shares of working expenses recovered through receipts in the Southern region (1974-75 to 1995-96).

Years	A.P.	Karnataka	Kerala	Tamil Nadu
1974-75	15.5	97.6	51.2	22.5
1975-76	16.9	129.2	69.6	9.9
1976-77	7.5	83.4	50.8	8.6
1977-78	7.7	76.4	135.9	6.9
1978-79	8.7	95.5	58.7	5.3
1979-80	7.6	85.9	139.2	6.4
1980-81	7	7.6	49.5	15.6
1981-82	6.6	77.3	24.4	2.5
1982-83	6.6	33.2	32	11
1983-84	120	50.9	82.9	6.4
1984-85	21.8	29.7	37.8	7.7
1985-86	36.9	6.8	24.9	6.8
1986-87	10	38.7	16.5	4.3
1987-88	4	10.4	12.5	1.9
1988-89	1.1	10.3	11.8	2
1989-90	11.2	10.5	16.9	2
1990-91	14	10	9	2.6
1991-92	4	15.4	7.5	2.5
1992-93	15.3	7.4	6.3	2.2
1993-94	15.1	5.3	8.3	3
1994-95	16.9	4.4	5.4	2.9
1995-96	13.3	4.9	7.7	2.5

Table A.5.5 Percentage share of working expenses recovered through receipts in the Western region (1974-75 to 1995-96).

Years	Maharastra	Rajasthan
1974-75	166	49.6
1975-76	134.4	104.9
1976-77	98.8	105.7
1977-78	97.2	57.0
1978-79	79.8	65.5
1979-80	93.5	66.0
1980-81	93.8	55.9
1981-82	94.1	46.5
1982-83	78.7	51.2
1983-84	61.1	43.7
1984-85	47.3	43.6
1985-86	48.9	19.3
1986-87	43.3	61.1
1987-88	5.9	11.3
1988-89	5.2	9.7
1989-90	6.3	12.3
1990-91	3.6	10.7
1991-92	3.7	11.6
1992-93	6.9	8.9
1993-94	10.3	7.1
1994-95	8	7.1
1995-96	7.3	6.4