Chapter 1

Introduction, Objectives and Methodology
1.1 Introduction

"Water is a prime natural resource, a basic human need and a precious national asset; therefore, planning and development of water resources needs to be governed by national perspectives" (National Water Policy, 1987). The growth process and the expansion of economic activities, inevitably leads to increasing demand for water for diverse purposes like domestic, industrial and agricultural use, hydro-power generation, navigation, recreation, etc.

1.2 The water crisis

There are three reasons for the growing worldwide concern for water conservation and the need to increase fresh water availability. There is a perceived inadequacy of water for increased food production for the rapidly growing population. This is coupled with the rapid depletion of ground water aquifers and pollution of rivers and water bodies in developing countries. There are fears of increasing conflicts and competition over sharing water among various classes and regions in the coming years.

India has about 16% of the world’s population, but only 4% of total water resources and 2.45% of the world’s total land area. Further, the distribution of water resources of the country is highly uneven over space and time. Over 80-90% of the runoff in Indian rivers occurs in just four months of the year. There are regions of harmful abundance and acute scarcity existing simultaneously (Goldar, Bishwanath, 2000).

A recent World Water Development Report ranked India as being 133rd among 180 countries in terms of water availability and 120th among 122 countries in terms of water quality (Chandra, Parul, 2003). India Development Report (2002) suggested that India’s water quality indicator value, (based on quality and quantity of fresh water, specially ground water, waste water treatment facilities and legalities like application of pollution regulations stood at a poor minus 3.1 (Goldar, Bishwanath, 2000). There is therefore, an urgent need to focus public attention on these issues.
Water availability across space and time in India is highly uneven. Rajasthan and Kutch are two outstanding examples of extreme disparities with regard to water availability. Gujarat’s water resources even after considering allocated shares from the inter-state rivers are hardly about 2% of the country’s water resources. Further the per capita availability of water in Gujarat is only 40% of the national average. The picture is, undoubtedly, much more dismal in North Gujarat, Saurashtra and Kutch. In contrast to this, per capita availability in Narmada basin is nearly 50% more than the all India figure while it is nearly three and a half times the per capita availability in Gujarat (Patel, C.C., 2001).

1.3 Consumption and Efficiency of Water Use in Irrigation

So far, the principal consumptive use of water has been for irrigation. India’s irrigation potential is estimated to have increased from 19.5 million hectares at the time of independence to about 68 million hectares at the end of 6th Plan. In the total water use in 1990, the share of agriculture was 83%, followed by domestic use (4.5%), industrial use (2.7%) and energy (1.8%). The remaining 8 percent was for other uses including environmental requirements.

Water use efficiency in India is presently estimated to be only 38% to 40% for canal irrigation and about 60% for ground water irrigation schemes. It is estimated that a 10% increase in the present level of water use efficiency in irrigation projects can irrigate an additional 14 million hectares of area from the existing irrigation capacities, involving a very moderate investment as compared to the investment that would be required for creating equivalent potential through new schemes (Iyer, Ramaswamy, 2001). Thus, there is a need to improve the water use efficiency in most of the existing irrigation projects through modernisation, renovation and upgradation to realise optimum benefits on the one hand and mitigate the consequential side effects like water logging etc. on the other (www.upgov.up.nic.in accessed on 15 April, 2004).
Water scarcity can be tackled by increasing irrigation efficiency and water conservation techniques, both in rural and urban areas. This efficiency cannot be achieved only by engineering design reforms, but more importantly by institutional reforms.

1.4 Investment in the Irrigation Sector

Financing of the irrigation sector has been becoming increasingly difficult in recent years due to resource crunch faced by the government at all levels and declining funds from international donor agencies. The World Water Commission (2000) reported that worldwide, an additional investment of $100 billion per year is needed to develop water sources to meet the food and domestic needs of a growing population. At the same time, funding from traditional sources, viz., government budgets and development assistance, is drying up. Increase in demand of water would result in an increase in the future investments in water supply. This investment requirement has been worked out at Rs. 5,000 billion by India Water Partnership (IWP) and Rs. 16,779 billion by Indian National Commission on Irrigation and Drainage (INCID) by 2025. In the report of the India Water Vision-2025, total investment requirements for the water sector have been estimated at Rs. 5,000 billion for the next 25 years, which is about Rs. 200 billion per year (Desai Rohit, 2003).

Many researchers have advocated augmenting investment resources in the water sector through private sector participation. Private sector would invest only if it is sure of adequate return in the medium term. Some states like Maharashtra, Madhya Pradesh and Andhra Pradesh have initiated action for privatisation of irrigation projects on Build Operate Transfer (BOT), Build Own Operate (BOO) and Build Own Operate Transfer (BOOT) basis. The Maharashtra Krishna Valley Development Corporation in Maharastra, Sardar Sarovar Narmada Nigam Ltd. in Gujarat and Krishna Bhagya Jal Nigam Ltd. in Karnataka have mobilized financial resources through issue of bonds in the capital market. It is seen that private sector participation in irrigation and multi-purpose projects is feasible but only if
conditions of sufficient returns on investment are met. It would be possible to attract private sector participation provided the pricing of water is enhanced such that economic returns are assured to the private sector. However, such a venture, though may be able to reduce the immediate financial burden on the state exchequer, it may not be possible to achieve sustainable cost recovery and financial accountability in the long run (Raju, K. V. and Gulati Ashok, 2002). Thus, efforts to increase efficiency in the water sector have to be accompanied by institutional reforms as well. Many new paradigms like Irrigation Management Transfer (IMT), Participatory Irrigation Management (PIM), Privatisation, Financially Autonomous Irrigation corporations; Water User’s Associations (WUAs) etc. have been suggested to bring about betterment in financial performance and service delivery in the water sector as well as the canal irrigation sector. However, it needs to be remembered that institutional reforms must be accompanied by pricing reforms for them to succeed and pricing reforms cannot be undertaken unless the performance of irrigation schemes in terms of user satisfaction is achieved.

1.5 Importance of Conservation of Water in Irrigation

It is clear from the earlier discussion that water as a resource can no longer be taken for granted, as the availability of fresh water resources would become scarcer day by day, due to an increase in demand all over the world, including India. Therefore, water needs to be used with the utmost efficiency and water resources should be harnessed as much as possible. Among the principle uses of water namely, household consumption, industrial use and agricultural use for irrigation, the last happens to be the largest user, and therefore, a major impact could be made if harnessing, utilisation, and management of water in irrigation sector could be improved. In order to convey the scarcity of water to the farmers, pricing of irrigation water should be rationalised, along with an encouragement to water conserving technologies at the micro level.
Since independence, India has invested about Rs. 870 billion in developing irrigation potential in about 90 million hectares. It is widely felt that the country is not getting sufficient returns from the huge investment made in this sector. The annual loss in the irrigation sector nationally is estimated to be Rs. 3.26 billion in terms of receipts against expenditure (Dholakia Archana, 2001). Not only that the returns on these irrigation projects are poor, but also the revenue collected through water rates is so low that these projects individually and collectively as a sector are not even able to meet the annual operation and maintenance costs. There is therefore, an urgent need to frame an appropriate water pricing policy so as to make them productive enough to generate adequate revenue not only to meet operation and maintenance (O&M) expenses but also to generate some surplus as a return on capital investment on these projects in the long run. The unanimous decision of the Committee on Pricing of Irrigation Water (Gol, 1992) was to charge only 1% of historically accumulated capital expenditure with full O&M expenditure of the current year. This perhaps reflects that the rest of the capital expenses have to be borne by the rest of the society may be as a price for food security, to keep food within the reach of the masses. The price of canal water is pathetically low and totally unrelated to the productivity or scarcity value of water, or the cost of delivering it. It accounts for just 8% of cropping expenses and is equal to barely 5% of the average incremental production of irrigated areas over rain fed areas (Raju K. V. and Ashok Gulati, 2004). Moreover, water charges are fixed in nominal terms that remain unchanged for years so that, they have been falling in real terms (Gol, 1988). In most states, the agency levying the water charges and those responsible for its collection (usually the revenue department) are different. The overall loss amounted to about 7% of total Plan expenditure on all irrigation schemes. The inability to recover costs has led to growing state revenue deficit so that currently, irrigation alone is responsible for a third of the revenue deficits of states in India. This further cuts state expenditure on irrigation. A subsidy reduction
of 20% could have helped raise expenditure by at least 20%. Alternatively, a subsidy reduction of even 5% in 1986-87 would have doubled expenditure on O&M of Rs. 4.93 billion incurred that year. The paradoxical situation of rising subsidies to the agricultural sector on one hand, and declining public sector investments in agriculture on the other hand has been clearly depicted by Gulati and Narayanan (2001) in their article. This situation has continued year after year since 1980-81. The only solution to the problem of rising subsidies according to Gulati is rationalizing input subsidies in agriculture and increasing investments in agriculture. The Vaidyanathan Committee (Gol, 1992) observed that attempts to reduce the magnitude of overall subsidies in agriculture and augmenting resources for investment must focus both on improving the efficiency of planning and management (thereby reducing costs) and on increasing collection of user charges and raising water rates as well as more effective enforcement of scheduled rates. The Second Irrigation Commission (1972) spelt out the need to fix up optimum level of water rates so that 5% of gross income for food crops and 12% of gross income for cash crops was recovered.

1.7 The nature of Irrigation Water as a commodity

In earlier times, water was considered as a free good and an abundant bounty of nature. However, in recent times, the nature of water has gradually changed from that of a free good to an economic good. Even though water could be defined as an economic good, and an article of private consumption, nevertheless, it is also a basic necessity for life itself, and therefore, it emerges as a quasi-public good. As far as canal irrigation is concerned, since the benefit of irrigation accrues more to the farmer than to the society at large, it could also be considered as a non-merit good (Musgrave and Musgrave, 1973). The issue of pricing of a quasi-public good is complex in nature and rests on the way in which, the relationship between the consumer and or the user farmer, and the state irrigation department or the seller is understood. It could be a purely commercial relationship between the state and the user farmer as between a buyer and a seller. Conversely, it could also be explained as a purely non-commercial
relationship, whereby, the cost of providing irrigation at the farm level is inconsequential, and irrigation cess could be considered as a sort of a tax, which could be charged according to the individual’s ability to pay.

A whole gamut of concepts in economic theory could be used including the Marshallian utility analysis and the concept of consumers’ surplus, whereby; the correct price for irrigation service provided by the state could be justified. Another approach to fix economically justified water rates is the ability to pay approach from the theory of taxation in the area of public finance. Thus, both the willingness to pay approach and the ability to pay approach could be used in combination to arrive at a logical basis for determining canal water rates in Gujarat.

1.8 Poor management in the irrigation sector

The state run canal irrigation sector in India and particularly Gujarat is fraught with many complex and interrelated problems, like poor financial returns from irrigation projects, insufficient revenue generation, inadequacy of financial resources, huge implicit subsidies, poor state of Operation and Maintenance (O&M), inequity in canal water distribution etc. This generates a vicious circle of low revenues, poor service and still lower revenues which continues to reinforce itself over and over again, resulting in a pathetic state of erosion of invested capital and wide spread apathy and dissatisfaction of the very users, which it was meant to serve.

There is a feeling among many researchers that it is high time that reforms are initiated to salvage the dilapidated state of canal irrigation sector in India. However, no unique and isolated solution could be offered to resolve the issues in the canal irrigation sector. The reforms in this sector have to essentially be multidimensional in nature, concentrating on rationalisation of prices, and at the same time improving institutional management to provide satisfactory service to the user farmers. Number of studies on canal water irrigation charges recovery have focused on the supply side issues, i.e., the cost of irrigation water, and how to recover the same, or, more often, how much under-recovered such charges are (Sangal, S. P.,
1991). Such studies have tended to identify factors such as volumetric supply and pricing for irrigation water, the means to compute water charges based upon an assessment of factors that go into its composition, etc. to improve water tariffs.

1.9 Need for the study

The past studies have examined the situation of poor cost recovery in the canal irrigation sector in India. They have argued mainly from supply side considerations and suggested that the pricing reforms in the canal irrigation sector are essential in order to meet the increased cost of providing irrigation at the farm level. However, the studies have tended to overlook the issues that concern the demand side, i.e., those concerning the consumer, the farmer in this case. Very few studies (Singh, Katar and Ghatak (1995) and Jairath, Jasween (1998)) have tried to examine, the demand side of the problem and tried to find out the factors responsible for the farmers' unwillingness and lethargy to pay canal water cess.

One argument which has always been put forward to defend low cost recovery and huge implicit subsidies in the canal irrigation sector is that upward revision of canal water rates is not justified because majority of the farmers are poor and therefore, may not be able to bear the burden of increased water rates. This argument has been repeated time and again, even as evidence emerges that farm incomes have grown due to growth in prices of agricultural output (Gol, 1988), supported by interventions such as the Minimum Support Price (MSP), and also, market forces of demand, which is continuously rising, and supply, which is often erratic.

Moreover, the farm input cost has been continuously rising with an increase in prices of almost all agricultural inputs like chemical fertilizers, seeds, agricultural equipment, hired labour, pesticides etc. Considering this fact, it is appropriate that the price of water, which is an essential input in agriculture, is also increased, in order to meet the increased cost of providing irrigation at the farm level.
However, how much of a percentage of escalation of costs in the canal irrigation sector is due to the genuine rise in prices of inputs, and how much of it could be attributed to the inefficiency of management and operation in the government run canal irrigation schemes, is a hotly debated issue (Champati M., and S.C. Patnaik, 1984). In any case, it would be impossible to quantify the cost overruns that have erupted from such inefficiency in the state run irrigation schemes. Therefore, it would be appropriate to put aside that line of thinking for a while and look at the demand side dynamics of the price mechanism of canal irrigation (Jairath, Jasween, 1998).

Thus, the water rates policy or recommendations thereof, needs to consider not only the supply side of the price mechanism, i.e. the rising cost of canal irrigation in view of the overall escalation of prices in the economy, but also investigate into issues on the demand side like ability and willingness of the user farmers to pay for canal irrigation and the causes of the wide spread dissatisfaction of the users with the irrigation service provided by the state run irrigation sector, which manifests itself in apathy and lower willingness to pay irrigation charges.

The willingness of any consumer to pay for a service or a good is a dependent upon the marginal utility of that service or good. Thus, in this case, farmers would be willing to pay the current water charges levied by the irrigation authority; provided the incremental value added by the use of water in terms of the income from the crop is more than the incremental cost of irrigation, i.e. canal water charge (Singh Kartar, 1978). However, it needs to be remembered that the focus of the issue is the user farmer himself, who, if finds the irrigation service useful, satisfactory and worth paying for, would definitely show an inclination towards paying his irrigation dues (Singh Katar and R.N. Ghatak, 1995). It would be interesting to find out what is the value attached by the farmers to irrigation service provided by state-run irrigation schemes. What do the farmers feel about the increase in water rates and up to what extent would they be willing to tolerate an increase in canal water charges etc. Therefore, there is a need to investigate into the demand side factors and generate an empirical
evidence of ability and willingness of the farmers' to pay higher water charges.

It is of significance that in those irrigation schemes where Participatory Irrigation Management (PIM) is in practice in Gujarat, and irrigation water management at the farm level in respect of distribution of water and collection of water tariffs has been entrusted to Water Users' Associations known as "piyat manadalis", water charges recovery is said to be much higher. Higher conformance to rules and willingness to pay higher irrigation charges has been observed. (Singh Katar, 1994 and Chaturvedi Vaibhav, 2003). Reasons for the better compliance of farmers with the water rates levied by WUAs also need to be probed. The linkages between better recovery performance of WUAs and better irrigation service delivery to farmers under this set up also need to be established.

If the user is satisfied with the service, collection rate would improve, financial situation of the irrigation authority would improve, whether it is in the private or the government sector, this would further reinforce better operation and maintenance and investment flow in this sector. Thus, by appropriate pricing reforms, a positive chain reaction can be initiated in this sector.

On the other hand, the dissatisfaction to the user farmers in terms of efficient service would reduce the willingness to pay canal water cess, reduce revenues for the irrigation department, reduce flow of funds for proper operation and maintenance of the physical system, deteriorate water delivery service to the farmers, and in turn, reduce further, the willingness to pay canal water charges.

Improved user satisfaction also increases agricultural productivity and incomes individual farmers, and at the same time ensures the optimum utilisation of this scarce and valuable resource.

Therefore, there is a need to examine as to what are the reasons behind the dissatisfaction of the farmers' with the management state run irrigation
schemes. Thus, water rates recovery in government run canal irrigation schemes is a complex issue.

With a view to finding a resolution of these issues and identifying the areas in which improvement in canal irrigation management is required, many new institutional paradigms like formation of Water Users' Associations, privatisation of water delivery and collection etc. have been suggested (Saleth, R. Maria, 1999). The study makes an overview of these set ups and their impact on the situation of water rates recovery.

Thus, the present study attempts to examine the factors which are important in evolving a rational pricing strategy for canal irrigation in Gujarat and assessment of factors responsible for positively affecting the ability and willingness of farmers to comply with the pricing reforms and pay canal water charges, so that an improved financial performance for state run irrigation projects of Gujarat could be ensured.

The study was undertaken with the following broad objectives.

1.10 Objectives of the Study

- To take an overview of the scenario of the water sector in India as well as in the state of Gujarat, with respect to requirements and availability of water.

- To trace the requirement, availability and sources of investment for the water sector in India

- To bring out the importance of irrigation in the water sector and understand the problems existing in the state-run canal irrigation sector in India, particularly in Gujarat and review the various institutional paradigms that have been suggested in order to improve the performance of irrigation management and cost recovery in the canal irrigation sector.

- To establish a theoretical basis for the correct pricing strategy for canal irrigation in Gujarat.
• To make an empirical inquiry to identify the factors affecting the payment behaviour of farmers with respect to canal water charges in Gujarat.
• To make suggestions and recommendations emerging out of the study, for the improvement of cost recovery and better user-satisfaction in the canal irrigation sector in Gujarat.

1.11 Scope of the Study

This study is confined to the canal irrigation sector in Gujarat state. It takes an overview of the financial issues in the water sector in Gujarat. Also, an overview of the specific financial and management issues plaguing the functioning of the canal irrigation sector in Gujarat has been taken. An attempt has been made to make an empirical enquiry into the payment behaviour of user farmers, with respect to canal irrigation in Gujarat, through a micro-level survey of ten villages of the Fatewadi Command Area, in Ahmedabad district of Gujarat.

In the study, an attempt has been made to understand the interface between user satisfaction and willingness to pay irrigation water prices, in order to bring about financial viability into the canal irrigation sector.

Ten villages of the Fatewadi canal command area, out of which five are located in the head region and five in the tail region, have been selected for the primary survey of user farmers in order to find out the factors determining their willingness and ability to pay canal water charges. The reasons for their apathy and dissatisfaction with the irrigation service provided by the state, which is reflected in the poor situation of recovery of water charges, have been investigated.

1.12 Broad Methodology and framework of the Study

In the study, both primary as well as secondary data has been used. Studies obtained from various books on economic theory, research journals and studies conducted by independent researchers have been utilised. Data pertaining to cost and recovery etc. have been collected from Circle
office and Sanand and Bavla sub-division offices of Ahmedabad Irrigation Circle. Apart from this, various government reports published by both Government of India and Government of Gujarat have been used to enhance the understanding and evaluation of various issues concerning the recovery of user charges in the canal irrigation sector in Gujarat. The secondary data has been used mainly to present an overview of the financial issues involved in the canal irrigation sector.

In order to understand the payment behaviour of farmers with respect to canal irrigation charges at micro level, it was decided to carry out a sample survey of 100 respondent farmers. The Fatewadi Canal Command Area of Ahmedabad Irrigation Circle was selected as the study area. Ten villagers from the Bavla and Sanand sub-divisions of the Circle were selected, out of which five villages were located in the head reaches if the canal network and five were located in the tail reaches. A total sample of 100 respondent farmers (with 10 farmers from each selected village) was selected on a random basis and contacted personally. This was done, keeping in mind, limitations of time and cost. A questionnaire was administered to the respondents, which was designed to collect quantitative as well as qualitative information, which was recorded in the questionnaire.

Besides, focus group discussions with leading farmers of the command area, officials of the Circle and sub-division offices of Ahmedabad Irrigation Circle, researchers, experts on the subject, academicians, officials of the Sardar Sarovar Narmada Nigam Ltd. and office bearers of various NGOs were also conducted in order to consolidate, verify and seek clarifications about the data gathered during the sample survey. Personal visits were undertaken to villages where Water Users' Associations were functioning, in order to understand the structure of working and situation regarding water rates recovery.

In order to get a feel of the ground realities, group meetings were also held in all the sample villages, where certain qualitative answers were sought and views of a cross section of farmers were discussed and recorded.
In order to get and understand the official view on matters in question and form a neutral opinion about the issues, senior officers and engineers, field staff, recovery and work Assistants in the Ahmedabad Irrigation Circle Office and sub-division offices, were also contacted personally and their opinions and clarifications on various issues were sought. The responses were scrutinised and fed into the computer for compilation and tabulation.

1.13 Limitations of the Study

All available and accessible sources of secondary data have been used in this study. However, this may not form the whole gamut of studies undertaken in this field of research.

Since secondary data has been used in the study to a substantial extent, all the limitations faced by the primary investigators of those studies, form the limitations of this study as well.

The sample size, which has been selected for the primary survey, is very small. This is due to cost and time considerations. All the statistical limitations associated with such a small sample size, therefore, apply to this study. However it is felt that the outcome of the study would not be significantly different, had the sample size been enlarged, as the variability in answers of the respondents was not found to be high.

1.14 Chapter Scheme

The present study has been divided into five chapters.

The first chapter presents an introduction to the subject matter i.e. the water sector in general and the canal irrigation sector in Gujarat in particular. The importance of pricing policy for the proper functioning of this sector has been highlighted. Many researchers have explored the supply side of the price policy of the canal irrigation sector in the past. However, there is a need for understanding and exploration of the demand side mechanism of this issue, which is attempted in this study. The major objectives, methodology and scope of the study have been discussed in this chapter.
The second chapter presents a discussion on problems of the water sector at international as well as national level, particularly in the state of Gujarat. It has been tried to list the main issues, including financial issues in canal irrigation sector at national level and particularly in the state of Gujarat.

The third chapter concentrates on the theoretical aspects of the issue. Water has been defined as an economic good, nevertheless, it is also a basic necessity for life itself, and therefore, it emerges as a quasi-public good. Irrigation, in a similar fashion, has been defined as a quasi-public, non-merit good. The relationship between the state and the user farmer has been explained with two points of view, i.e., as a seller and the buyer; and as a subject and a welfare state. Similarly, irrigation water charge has been explained as a price of the good or a user charge, as well as a sort of a tax. This chapter explores economic theory and uses the Marshallian utility analysis and the concept of consumers' surplus, whereby; the correct price for irrigation service provided by the state could be justified. Another approach to fix economically justified water rates is the ability to pay approach from the theory of taxation in the area of public finance. Thus, both the willingness to pay approach and the ability to pay approach could be used in combination to arrive at a logical basis for determining canal water rates in Gujarat.

The fourth chapter concentrates on the various aspects of canal irrigation like pricing, funding, costing, cost recovery and management, as well as discussion on the new institutional paradigms for better operational efficiency, customer satisfaction, water charges recovery and economic viability of the irrigation sector in India. Thus, in this chapter, it has been tried to trace out the various ills affecting the canal irrigation sector in India and understand the possible reasons for the same, as explored and explained by numerous studies made in this area.

In the fifth chapter, discussion about a micro-level primary survey has been done in order to make an assessment of the factors affecting the ability and
willingness of the farmers in the Fatewadi Canal Command Area to pay canal irrigation charges.

The sixth and final chapter consists of a summary of the whole study, major conclusions emerging from the study and recommendations and policy prescriptions, which can be made on the basis of the conclusions of the study.

A list of references has been appended at the end.