CHAPTER I

INTRODUCTION

Investment in modern inputs in Indian agriculture, more particularly in irrigation and fertilizers, has become more profitable during the last decade than before. This has been due to the successful introduction of the high yielding varieties of seeds at the farm level. Besides, a shift in the role of irrigation, from the protective one to productive has also been in evidence in Indian agriculture. Within the different categories of irrigation projects, a project with better control over water supply and its use is preferred at present, which is another feature of the advancing modernization of Indian agriculture. In this context any study analysing the impact of irrigation at the macro level should view the problem from varied angles. In order to develop a framework for such a study it would be worthwhile to inquire into the role of irrigation in the agricultural economy of an area or a State. The present study seeks to
examine the role of irrigation in the development of agriculture in Gujarat.

With a view to pinpointing the importance of this study and providing a useful background to it, a brief review of the research work done in the field of economics of irrigation and agriculture in India has been attempted here. The purpose of this review is only to give an idea of the areas in which the studies erstwhile have been made. The research work appears to be of varied nature. The studies on irrigation can be divided under several heads based on the principal aspects emphasized therein. The studies under the various heads are described in detail below.

EFFECTS OF IRRIGATION

The aspect of effects of irrigation seems to be the most popular one in the studies on irrigation in India. Majority of the studies in India come under the purview of this topic. Evaluation of irrigation projects, emphasising benefit-cost analysis, is an important aspect studied in those research works. The studies by K. N. Raj [1959], NCAER [1959-Part I], N. V. Sovani and Milkanth Rath [1960], Baljit Singh and Shridhar Misra [1965], A. S. Charan [1970], N. V. Sovani [1976], Milkanth Rath [1976], NCAER [1982], Agricultural Refinance and Development Corporation, [ARDDC], Programming and Evaluation Division [1982], J. M. Adhvaryu, A. S. Patel and H. F. Patel [1983], M. T. Pathak, A. S. Patel and H. F. Patel [1984] are
the important studies in this group. In these studies discussion of the criteria for selection of irrigation project, social and economic effects, direct as well indirect are analysed in detail; finally, in some studies benefit-cost ratio on the basis of measurable benefits and costs is also arrived at. These studies are either ex-post or ex-ante evaluations with the principal objective of examining the justification of the execution of the project.

One or more of the different effects of irrigation have been emphasised in details. Effects analysed here include the changes in land use pattern including the aspects of cropping intensity, crop pattern, input use pattern, employment including estimation of additional employment generation due to irrigation, production including yield differential by crops, income including the estimation of additional income generated due to irrigation and in some cases benefit-cost ratios. These studies pertain to all the types and sources of irrigation viz., minor, medium, and major irrigation projects.

Sources of Irrigation

As regards sources of irrigation only few studies have been made. In these studies importance of the different sources of irrigation in different areas including for the nation as a whole, in details has been examined. Special emphasis on the potential of ground water resources is observed here. The studies by Reserve Bank of India [1963], Kanchan Chopra [1982], and D. S. Sinha, Ramesh Chand and J.I. Kaul [1984] can be considered under this head. These studies pertain to macro analysis. While the studies by T.V. Koorti [1976]; Shrikant Singh and A. S. Sirsi [1977];
and A. K. Giri and G. Mallik \(^{[1964]}\) are micro studies.

**Irrigation and Risk and Uncertainty**

Agriculture is an enterprise full of risk and uncertainties, the degree of which is particularly very high because of the importance of the operation of natural forces. Irrigation is a principal measure of reducing risk and uncertainty. Although this aspect is pinpointed in a number of studies on irrigation a particular attention specifying this aspect is made in the studies by B. V. S. Baliga and S. B. Tambad \(^{[1964]}\) and Bashir A. Desai and N. K. Thingalaya \(^{[1965]}\).

**Irrigation and Extension**

For the effective use of scarce water, the importance of extension services cannot be overlooked. Of course in a number of studies, this aspect is attended to, the specific discussion is made in very few studies, one such study, a macro study is by T. K. Jayaraman \(^{[1979]}\).

**Demand for Irrigation**

Eventhough irrigation is one of the important inputs in agriculture, a study of the nature of demand for it has not been attempted specifically in any study. However, a study by B. D. Dhawan \(^{[1973]}\) attempts to study this aspect in brief.
Policy

The development of irrigation has received considerable attention in planning in India, particularly in terms of investment allocation. Yet, the development of irrigation projects and the planning of water use, has not been found to be scientific one. In major cases, at least in the first two decades of planning, no much care seems to have been taken either in creating irrigation potential or in actual water distribution and use at the farm level. Therefore there was a need for sound thinking in respect of irrigation policy.

In this respect, although different studies have emphasised this issue, specific and pointed views are expressed by only a few researchers. V. N. Rao's work [1979] makes important contribution in this field. Other studies in this field are by R. Ghosh [1976], B. B. Vohra [1976], C. H. Nanumanta Rao [1976], K. Puttaswamiah [1977], Robert Wade [1978], V. M. Rao [1979], and Baswan Sinha and Ramesh Bhatia [1982]. A publication of the Indian Society of Agricultural Economics, Seminar Series No. 13, [1976] also focuses attention on this aspect.

Water Rate

The huge investment made on irrigation projects by the Central as well as the State Governments during the last three decades and a half has not been economical as even the operation and maintenance costs of the projects have not been
The issue of water rate, therefore, is a crucial one. It is a widely discussed aspect in the literature on irrigation. As a major issue this aspect has been emphasised in the studies made by NCAER [1959 - II part], B.D. Kanetkar [1960], Agro-Economic Research Centre, Madras, [1961], G. Thimmaiah [1967], N. Ansari [1968], V. N. Asopa [1977], U. M. Jha [1984], Mahesh Pathak, V. B. Patel and H. P. Patel [1985], A. S. Charan and S. V. L. S. Rao [1985] and V. S. Pandya [1985].

Command Area Development

Command area development approach is a recent phenomenon in the field of irrigation development. This aspect is discussed and highlighted in the studies by V. Asopa and B.L. Tripathi [1975], D.M. Brahmbhatt [1976], Lalit K. Sen [1976], P.R. Dubhashi [1976] and Damodar Tripathy [1984]. In the above context a number of benchmark socio-economic surveys have been undertaken for the command areas of various irrigation projects. Mention may be made here of the studies by B.M. Desai [1964], R. G. Patil, S. D. Suryawanshi and P.M. Kapase [1978, 1980], and J. H. Adhvaryu and A. S. Patel [1979 to 1984].

Efficiency, Equity and Management

The problem of waste of water is one of the important problems faced in India. The problem of equity in distribution is also a problem which deserves adequate consideration. These

Utilization and Other Problems

In India it is the general observation that the development of irrigation potential is far from satisfactory. Even more general observation refers to the fact that the created potential is not fully utilized. This particular
problem of under utilisation applies mainly to medium and major irrigation schemes and to some extent to minor irrigation schemes. Almost all of the researchers in the field of irrigation economics have noted this issue. However, as a major issue, this problem was analysed in detail by Y.K. Murthy (1976), P.R. Michael (1976), V.N. Asopa and B.L. Tripathi (1976), R. Ghosh (1976), T.S. Khupse and G.K. Sawant (1979), B.D. Dhawan (1971, 1980), C.R. Kaushik and A.C. Gangwar (1980), and Miranjan Pant (1981).

Besides the problem of utilisation of irrigation potential, the other problems of irrigation including concept of irrigation and problem of measurement, not covered under the topic discussed above are specifically explained by C.H. Shah and others (1961), H.B. Shivamaggi (1961), J.P. Bhati and V.C. Shukla (1969), C. Gopinath (1976), and J.S. Sharma (1976).

Irrigation Development - Macro Analysis

Irrigation development and its impact at the aggregate level are discussed in a few studies. M.K. Shingrey and R.E. Waghmare (1968); V.K.K.V. Rao (1976); Charles Clift (1977); B.D. Dhawan (1979) and R.K. Mahajan and D.K. Aggarwal (1979) analysed the growth of irrigation and covered such aspects as crop-wise irrigated area and regional differences in irrigation growth. There is one study by B.D. Dhawan (1985) where he in the performance of irrigation in
terms of its impact, particularly in drought period has been examined in detail for seven States, viz., Andhra Pradesh, Bihar, Gujarat, Madhya Pradesh, Haryana, Punjab and Tamilnadu. M.V. Nadkarni [1979] and M.P. Khare [1979] analysed in their separate studies irrigation development and its impact at the macro level.

The above brief review of the studies on irrigation clearly indicates that a majority of the studies pertain to the impact of irrigation covering a varied nature of its effects. Almost all these studies are micro ones. A macro study at the State level is rather rare in this particular field, as also in the other fields of studies indicated above. Two recent studies for Maharashtra and Karnataka can be considered as macro ones. However, the one for Maharashtra is very much limited in its coverage. A district-wise analysis attempted for Maharashtra covers the aspects of nature of growth of irrigation. Although the study for Karnataka is wider in its scope, it still cannot be considered as a full fledged study for the State. In this context the study attempted here merits attention in two ways. One it is a macro study at the State level and two it attempts to study all the types of impact in detail. Through analysis of micro level data it also incorporates the aspects of efficiency of irrigation use at the farm level. Thus, the present study is concerned with the aspects of the economics of irrigation in Gujarat specifically, the study covers the following objectives.
Objectives of the Study

1: To examine the variations in irrigation facility available and utilized in various districts and to review the growth of irrigation in the Gujarat State during 1939-50 to 1980-81.

2: To study the impact of irrigation on land use pattern and intensity of cropping in Gujarat.

3: To assess the impact of irrigation on the cropping pattern in the State.

4: To assess the impact of irrigation on input use in Gujarat.

5: To examine the inter-district variations in stability and growth of agricultural production and productivity in Gujarat.

6: To assess the impact of irrigation and rainfall on the stability and growth of the agricultural productivity of the principal crops of the State.

7: To study the water use efficiency at the farm level.

Sources of Data

The study is based upon available data from secondary sources. The different types of required information have
been collected from (1) various publications of the Directorate of Agriculture, Gujarat State, Ahmedabad. The sources are:
(a) Area, Production and Yield Per Hectare of Important Food and Non-Food Crops in Gujarat State from 1949-50 to 1982-83 published in Marg Darshika
(c) Statistics of Area, Production and Yield for the Period 1960-61 to 1973-74 (district-wise data).
(d) Gujarat Agriculture Compendium from 1960-61 to 1983-84.
(e) Various published Season and Crop Reports of Gujarat State, yearly publication from 1960-61 to 1975-76.
(f) Unpublished Season and Crop Reports of Gujarat State, obtained from the Directorate of Agriculture, Ahmedabad for the years 1977-78 to 1980-81.
(g) District-wise Area, Production and Yield Per Hectare of Important Food and Non-Food Crops in Gujarat State from 1980-81 to 1982-83 based on Final Forecast Reports.

(a) Annual Publications on Socio-Economic Review - Gujarat State up to 1983-84 and
(b) Statistics Relating to Primary Sector in Gujarat from 1961-62 to 1971-72.

(4) Various issues of 'Area and Production of Principal Crops in India', Directorate of Economics & Statistics, Ministry of Agriculture, New Delhi.

(5) Indian Agriculture in Brief, different editions, Ministry of Agriculture, New Delhi.

(6) Various issues of Fertilizer Statistics; The Fertilizer Association of India, New Delhi 110 067; and

(7) Farm Survey data with reference to irrigation have been collected in the Irrigation Research Cell, Department of Economics, Sardar Patel University, Vallabh Vidyanagar, for the reference periods varying from 1976-77 to 1980-81. The details of the informations used along with the sources are mentioned at respective places in the discussion in this study. The data are statistically analysed to find out the important relationship as also to determine the role of irrigation in the growth of agricultural production in Gujarat. The study has been divided into seven chapters.

Chapter Scheme

Chapter I: The present chapter briefly reviews different studies on the economics of irrigation in India. It also presents the objectives of the study, sources of data and chapter scheme of the study.
Chapter II: In this chapter a detailed analysis of growth of irrigation in Gujarat since 1950-51 is presented. It covers such aspects as the importance of irrigation in Gujarat and India, development of irrigation in India, creation of irrigation potential, its utilisation, sources of irrigation, progress of irrigation at the district level - net irrigation ratio, gross irrigation ratio - rainfall and irrigation.

Chapter III: This chapter analyses the relationship between irrigation and land use pattern with particular emphasis on the influence of irrigation on crop pattern. It covers aspects such as net sown area and irrigation; gross sown area and irrigation; cropping intensity and irrigation; cropping pattern - an overview of crop pattern in Gujarat, growth rates of area under crops, regional variations in cropping pattern, cropping pattern in irrigated area and rainfed area, inter-district variations in cropping pattern in irrigated area and rainfed area, HYV crops and irrigation. Different propositions and hypotheses pertaining to irrigation and net sown area, gross sown
area, cropping intensity, cropping pattern are tested in this chapter by analysing the available data both for the State as a whole as also at the district level.

Chapter IV: This chapter presents a detailed analysis of the impact of irrigation on input use at the farm level. It covers the aspects such as expansion of the use of fertilizers in Gujarat, the use of manure, the use of pesticides, human labour and total farm input expenditure.

Chapter V: In this chapter the overall influence of irrigation on the growth pattern of agriculture is analysed. It also covers the aspects such as growth of agricultural production in Gujarat vs. that in India, instability in the growth of agricultural production in Gujarat, contribution of individual crops to total agricultural production; relative contribution of different factors to aggregate agricultural production growth; growth of agricultural productivity of major crops, extent of instability in the growth of productivity of major crops. It also discusses yield uncertainty cropwise analysis, yield uncertainty under irrigated and unirrigated conditions, yield uncertainty under irrigated and unirrigated wheat at the district level;
growth of aggregate agricultural productivity; sources of growth of agricultural productivity and instability - role of irrigation, and growth and instability in aggregate agricultural productivity at the district level.

Chapter VI: This chapter analyses the important issues of efficiency of water use at the farm level. The aspects covered in this chapter are extent of irrigation on the sample farms, existing irrigation potential, utilization ratio, net and gross irrigation ratio, cropping intensity, inter-farm variations in the use of irrigation water, productive efficiency of irrigation and allocative efficiency of water use.

Chapter VII: This final chapter presents concluding observations and policy implications of the study.