CHAPTER I

INTRODUCTION

1.1 THE PROBLEM

In this dissertation we have tried to analyse the role of irrigation in agricultural production. Inadequate irrigation has often been used as an explanation for low productivity in agriculture. Alternatively, high productivity has been attributed to extended irrigation in an area. While not disputing the importance of irrigation in agricultural production, we intend to counter here the simplistic technocratic view that treats irrigation — the creation of irrigation assets and its utilisation — in purely technological terms, neglecting thereby the importance of the underlying social and economic factors. In our study we have concentrated mainly on the economic factors, that critically determine the impact of irrigation on production.¹ For example, we have tried to show that economic factors ultimately determine the operative efficiency or quality of irrigation² from a given source. No doubt this quality is determined, at the first level, by the technical characteristics of the specific

¹No doubt other elements in social relations such as caste, religion etc. may also influence economic and productive activities and hence the use of irrigation for productive purpose. However, a consideration of these factors is beyond the scope of our study.

²The quality of irrigation is defined in terms of the control of the user over time and quantity of irrigation.
source. The extent to which its technologically feasible quality is actually realised depends however on social conditions. The quality of irrigation actually attained influences in turn the production decisions of the users (e.g. cropping pattern) as well as the level of actual output. This bearing of economic factors on the operational efficiency of irrigation explains also why we often observe a wide range of productivity levels in association with the same technical source of irrigation.

Nor is the mere availability of irrigation facilities by itself a guarantee for its effective utilisation. It is again the social conditions under which production occurs that influence the use of irrigation as much as other complementary inputs. The paradoxical situation of the prevalence of a high degree of under-utilisation of irrigation potential in the country despite the dire need for irrigation calls for a close study of the factors which hinder (or facilitate) the realisation of this potential. Such a study is imperative for designing and assessing policies devised to promote a more productive use of a given irrigation technology or to create new irrigation resources. Our study is an attempt in this direction.

We have tried to illustrate the influence of economic factors by carrying out a case study, investigating into the factors affecting creation and utilisation of the major sources of irrigation in the state of Punjab. The focus is on the post-mid-sixties period, i.e. the time span which coincides with the onset of the Green Revolution in the State.
The irrigation sources considered are canals and shallow tube-wells; while the former are under public ownership, the latter are under private ownership. Part of the data were collected during field work conducted in selected villages of Punjab during 1979-81; the villages having been chosen on the basis of dominant irrigation source on which they were dependent.

1.2 STATISTICAL SOURCES AND METHOD OF EMPIRICAL ANALYSIS

The study is based on the following sources of data: The major secondary sources used are first, the official publications of the Economic and Statistical Organization and the Irrigation Department of Punjab Government, viz. the Irrigation, Flood and Waterlogging Statistics, the Statistical Abstracts of Punjab, and various reports of surveys conducted by these organisations. Secondly, we have used the non-published official documents of the Irrigation Department.\(^3\)

We have also used data from non-official studies to which reference would be made at appropriate places.

Primary data relating predominantly to the utilisational aspects of canals and tube-wells were collected personally during field work conducted in the villages of Punjab between the years 1979 and 1981. These villages were chosen from three sample areas, selected as follows: an area which is currently irrigated predominantly by tube-wells, one which

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\(^3\)I am grateful to the Irrigation Department of the Punjab Government for allowing me to use their official records for the present study.
is irrigated by canals, and finally, a third area where the
cortribution to irrigation by tubewells and canals was approxi-
mately of the same order.\(^4\) Table 1.1 shows the districtwise
figures\(^5\) for the net area irrigated by each source, for the
State of Punjab for 1979-80. Three districts of Ludhiana,
Bhatinda and Amritsar were selected: district Ludhiana is
predominantly irrigated by tubewells, district Bhatinda by
canals, and district Amritsar has roughly equal proportion of
canal and tubewell irrigation. Within each of these districts,
three contiguous villages were selected for data collection
randomly.\(^6\)

The villages selected in district Ludhiana were Katala,
Todar Mal, Birpur; those in district Bhatinda were Ghuddha,
Teena and Bhinda; and those in Amritsar district were Pandori
Takhat Mal, Pandori Rahmana and Nainipur. Map 1.1 shows the
approximate geographical location of these villages. Data
regarding land ownership were collected from all the households
in each of the villages; those regarding the ownership and use
of irrigation sources were collected from sample households.
Detailed data on canal utilisation were collected from the

\(^4\)The proportion of net area irrigated by each source
was taken as an index of the contribution of that source to
total irrigation.

\(^5\)We have later pointed out the limitations of these
data categories in reflecting the contribution to irrigation
by any one source.

\(^6\)However, care was taken to avoid a village with any
special peculiarity from socio-economic point of view, e.g.
proximity to a large town, exceptional level of economic
development or backwardness etc.
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STATE BOUNDARY
DISTRICT BOUNDARY
1. KUTALA
2. TODAR MAL
3. BIRPUR
4. PANDORI TAKHATMAL
5. PANDORI RAHMANA
6. NAINIPUR
7. GHUDDHA
8. TEONA
9. BHINDA

MAP 1.1
villages of districts Bhatinda and Amritsar; those relating to

tubewell utilisation were collected from the villages of
district Ludhiana and Amritsar. The selection of samples and
the nature of data collected will be specified as and when we
analyse the data.

It may be noted that although the entire data thus
collected are cross-sectional referring to a single point of
time, they have a general bearing on the on-going situation.
For example, the distribution of the modes of irrigation among
different economic classes for one year is unlikely to change
dramatically in the proximate years, in the absence of any
drastic alteration in the rest of the production conditions.
Similarly, we do not expect the major utilisational problems
relevants to the different irrigation sources to vary vastly,
atleast over a few years. Therefore the conclusions following
from the analysis of these data could be taken to represent
a situation prevalent generally over a longer periods.

Data from the survey were collected mainly by the
questionnaire method. In some cases, intensive case studies
of individual households were carried out to illustrate some
qualitative observations. It may be mentioned that we have
not used any sophisticated econometric techniques in the
study, beyond simple regression analyses of time-series and
cross-sectional data. This was partly dictated by the nature
of our problem where the attempt was to focus on a number of
qualitative aspects of irrigation use.
1.3 CHAPTER OUTLINE

The study proceeds as follows. We begin in Chapter II below, with a historical review of the development of irrigation sources in Punjab. There we try to trace briefly the history of extensive investment in public and private irrigation works in Punjab from the colonial days. Punjab was one of the most favourably placed regions with respect to the availability of irrigation in the colonial period and continues to hold the vantage position. We investigate here how these irrigation sources were utilised by different categories of producers and their consequent implications for overall production and productivity.

Chapter III is devoted to a discussion of the technological characteristics of the two major sources of irrigation, currently used in Punjab i.e. canals and shallow tubewells. The chapter is based mainly on source materials from tracts on irrigation technology and on interviews with officials of the Irrigation Department of Punjab Government. We have tried to point out that, in the first place, tubewell irrigation is potentially more efficient than canals due to certain technical difficulties relating to water regulation in case of the latter. Secondly, the technical problems associated with these two sources arise partly on account of the particular mode of creation and utilisation of these sources. Following this, we have tried to point out that these technical problems,

7 Efficiency is used to denote the quality of irrigation as defined earlier.
imparing the quality of irrigation and hence also its productivity, have their roots in the social structure and are not necessarily or merely associated with the technical aspects of irrigation per se.

In Chapters IV and V, we discuss the utilisation aspects of canals and tubewells respectively and note the prevalence of extensive under-utilisation of both. The discussion is based on the material gathered in our surveys relating to 1979-81. We notice that the efficiency of irrigation from tubewells is higher than that from canals. This is on account of private ownership of the former source which ensures a higher control over time and quantity of irrigation. Secondly, the root cause of utilisational problems for both the sources, was located primarily in the particular pattern of property distribution as reflected in land ownership among the users. From the latter also follows, we shall argue, the scale bias with regard to the effects of under-utilisation, i.e. we find that the larger brunt of the utilisational difficulties falls on smaller farmers.

This is brought out more clearly in Chapter VI where we discuss the distribution of the modes of irrigation over different categories of farmers, using our field survey data for 1979-81. A mode of irrigation is defined as the irrigation arrangement faced by the user. That is, it encompasses not only the technical source of irrigation but also the conditions of access to the same for the user.\(^8\) From an

\(^8\) Three typical modes of irrigation were identified for each of the sources, in the case of Punjab.
analyses of the distribution of these modes we find that the inefficient⁹ modes, in case of both canals and tubewells, were more in vogue among the poorer farmers¹⁰ owning small plots of land. Following from this, we argue that the effective utilisation of a given technical source of irrigation depends on the resource endowment of producers in the region.

In Chapter VII, we conduct a comparative inter-district analysis of the growth of irrigation and production variables, using time series data from mid-sixties to late seventies. There we try to show that the districts which have a preponderance of large land-owners tend to use the available technical source of irrigation in a more productive manner, whereas those districts which are dominated by small holdings, show poorer productivity performance inspite of the availability of technically superior source of irrigation. It is broadly inferred that it is not merely the overall availability of irrigation (albeit of superior variety) that necessarily leads to higher production. What is equally critical is the existence of suitable conditions¹¹ ensuring

⁹That is, of poor quality as defined earlier.

¹⁰Throughout the present thesis, we have used the land owned by a producer, as an index of his socio-economic status.

¹¹The entire data for the chapter was collected from Statistical Abstracts of Punjab, and Irrigation, Flood, and Waterlogging Statistics of Punjab.
access to the source which influences the utilisation of the available source and hence its impact on yield.

In Chapter VIII using field data from Amritsar\textsuperscript{12} district we discuss the implications of conjoint use of public (i.e. canals) and private (i.e. tubewells) sources of irrigation. We observe how the emergence of private tubewells in a canal irrigated area led to a forced disuse of canals by the majority of the farmers (largely small land owners). This compelled them to adopt alternative irrigation modes which were more hazardous. Finally a situation emerged wherein we find a simultaneous existence of under-utilised tubewells and canals along with a section of producers without access to either of these sources. Public and private investment in irrigation in this case, therefore, was found to be competitive and not complementary, leading to a highly irrational allocation of resources from an overall social point of view. In addition it resulted in deterioration of the position of small farmers with respect to their access to irrigation.

In Chapter IX we present a critique of the production function method of analysing the role of irrigation as a technical input in production. We focus on the problems encountered by that approach in handling complementarities and externalities of inputs and in correctly specifying the function. Problems arise due to the technocratic basis of

\textsuperscript{12} As pointed earlier, this was the only area in our field survey where there was conjoint use of public canals and private tubewells.
this methodology, which fails to consider directly, the social
determinants of the use of technology. In fact, this weakness
underlies most conventional approaches to the analysis of
irrigation and the policy implications following from them
are bound to be less meaningful. In our study we have located
the source of utilisational problems of public and private
irrigation in the relatively weaker economic position of some
households and examined the relative advantages of the two
sources. The policy recommended however is not one of
advocating higher private investment as against public invest-
ment\footnote{We have argued in Chapter V that private source is
more efficient than the public one.} or of favouring a concentration of land holdings.\footnote{We have assumed that small holders have poor produc-
tive potential, and hence are incapable of exploiting the full
potential of available irrigation (see Chapter VII).}
Rather we favour an attempt to go in for a co-operatively
planned use of the irrigation source by the small holders to
overcome the limitation of small holdings and ensure better
coordination and planning of water-use.

In Chapter X are presented the main conclusions of
our study.

A word about the mode of presentation. Each chapter
is divided into various sections and subsections which are
numbered as follows. The first figure indicates the chapter,
the second indicates the section and the third indicates the
sub-section. Further divisions of the sub-section, if any,
are indicated by alphabetical letters. Footnotes are numbered
sequentially for every chapter. Details of the references
cited are found in the bibliography at the end of the thesis. The tables and appendices are attached at the end of each chapter.
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