CHAPTER II

IRRIGATION DEVELOPMENT IN PUNJAB - A HISTORICAL BACKDROP

2.1 INTRODUCTION

The basic objective of this chapter is to trace the development of irrigation sources in the region within which the present state of Punjab is situated. An attempt is made to identify the set of factors that influenced the timing and distribution of investment in irrigation in the region.

Since most of the significant developments in this field came after the annexation of Punjab by the British in 1849, this chapter is divided into two major periods: the colonial period and post independence period. Based on the review, the comparatively superior endowment of irrigation facilities in Punjab relative to other areas in India has been stressed. We propose to investigate in the subsequent chapters the question whether this productive potential has been fully realised and the reasons for the same.

2.2 IRRIGATION SOURCES IN PUNJAB - PRIOR TO THE BRITISH PERIOD

Although irrigation\(^1\) of crops has been a familiar practice in Punjab since times immemorial, it had remained limited territorially and of poor quality before the advent of the British (see Michael; 1966, pp. 46-47). Dug wells using

\(^{1}\)That is artificial irrigation through man made sources, as opposed to natural irrigation through floods, rains etc.
the Persian wheel for instance, which were one of the major sources in use at the time, were feasible only in areas like central districts of Punjab which had suitable water table conditions with respect to the quality and depth of water. Secondly, the area irrigated by them was severely limited on account of their operational dependence on bullock power.

Inundation canals, the other major source in use, could only irrigate areas contiguous to the river banks, and that too only during the period corresponding to peak flow in the rivers. That is, precisely when the need for irrigation was likely to be the lowest. Besides, there was no system of regulating the water supply through these canals due to the absence of any control mechanism.

2.3 IRRIGATIONAL DEVELOPMENT UNDER THE BRITISH (1849-1947)

The British annexation of Punjab in 1849 provided the political scene favourable for carrying out large scale

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2 Such as the districts of Amritsar, Jullander, Ludhiana etc. Most of the Western and South Western tracts of the State were underlain with saline or brackish water which was unfit for irrigation.

3 That is the depth of water table below the ground level from which it is possible to lift water to the surface with a Persian wheel.

4 For example it takes nearly 10 hours to water one acre of land using a dugwell with bullocks. An electrically operated 5 H.P. tubewell on the other hand, can manage to irrigate double the area in the same time.

5 These comprised of simple excavations of channels along river banks into which the river water would overflow (or inundate) during the monsoons or heavy flow period.
investment by the Imperial State in such fixed and permanent assets as the extensive canal networks. In the present section, we will briefly outline first, the actual development of the major irrigation works in a chronological order and touch upon the 'teething troubles' associated with them. Secondly, we will discuss the probable motivations underlying the irrigation policy of the British which influenced the timing and distribution of this investment.

2.3.1 Irrigation Works - Their Development

The overall growth of major irrigation works in Punjab under the British can be broadly divided into three phases, where each successive phase derived its thrust from the success or failure of the preceding one.

(a) First Phase (1849-1880): This includes two of the earliest projects initiated by the British soon after the annexation of the region i.e. the Upper Bari Doab Canal system (UBDC) and the Sirhind Canal system (SC).

The UBDC system was executed in the Upper Bari Doab (see Map 2.1) taking off from Madhopur on river Ravi. Plans for the construction had been initiated immediately after the signing of the Treaty of Byrowal, the construction of the canal followed soon after. It was opened in 1859, and irrigation commenced in 1861 (see Michael:1964, p. 59). However, given the haste with which the entire project was launched

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6. The treaty by which Punjab was formally incorporated in the British Empire.
MAJOR CANAL NETWORKS IN PUNJAB UNDER THE BRITISH

MAP 2.1
and the fact that the experience of the British engineers in the construction of perennial canals was rather limited, a host of problems emerged soon after its commencement. For example the design containing excessive slope led to its bed erosion; further, the permanent shuttered weir which was constructed across the entire river in 1872 silted up soon after (See Michael: 1966, p. 6). Similar problems were experienced with the SC system which was proposed to take off from river Sutlej at Roper, irrigating the Malwa region. Although the canal was opened in 1882, "in view of the care which the designers and constructors had taken to induce the worst possible silt and all the troubles arising therefrom, were experienced immediately" (Michael: 1966, p. 72). In fact silt continued to accumulate for the next ten years, reducing the capacity of the canal far below the designed one of 1000 cusecs (Michael: 1966, p. 72).

The financial losses incurred as a consequence of the problems encountered with these earliest canal projects stalled their further progress, leading to a temporary halt in the development of canal works in the Punjab. In fact all the subsequent canal works in Punjab were constructed in the formerly virgin areas (i.e. the dry waste-lands of west and south west) which offered higher probable returns on account of

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7 The entire region south of Sutlej in Punjab is known as Malwa area (see Map 2.1).
enhanced irrigation revenue and production as well as sale of land thus colonised.

(b) Second Phase (1880-1900): Two of the earliest projects of this phase were the Lower Sutlej and Para Canals and Sidhanai Canal Project, both of which were quite small schemes. The importance of these two projects derives mainly from their association with incipient colonization schemes.

Probably the most significant scheme during this period was that of Lower Chenab Canal (L.C.C.). It was taken up in 1891 and, "called for irrigating the huge area of 1,100,000 acres by means of the largest canal - 8,000 cusecs - yet constructed in India. In actuality, thanks to the Triple Canal Project of 1905-45, the L.C.C. has come to irrigate 2.9 million acres and carry up to 11,500 cusecs. Its financial success was far in excess of the most optimistic expectations (Michael; 1966, p. 77). The L.C.C. was opened in 1892.

Thus by the turn of the century Punjab had tapped most of its rivers and most of the engineering problems had been overcome. Irrigational investment in Punjab was proportionately far above that in the other regions and increased

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The former canals, drawn from Sutlej below Ferozpur, remained inundation canals and watered only about 100,000 acres. The latter too was a small scheme, taking off from Ravi at Sidhanai and irrigating a total of 351,000 acres of which 206,000 acres comprised the wastelands belonging to the Crown. The work was initiated in December 1883 and the main canal was opened in 1886, to which three short canals were added in 1891.

An idea of the relative pre-eminence of irrigation in Punjab at that time can be had from the following indices.
further in the following years. As Michael puts it, "colonization and settlement work was well in hand and revenues from the newer systems were more than making good any deficits on the old. Everything called for extending the systems and reaping larger returns" (Michael:1966, p. 80).

(c) Third Phase (1900-1947): Following from the optimism generated by the success of the foregoing schemes, the exploitation of the rivers received a further impetus. Although most of the available supplies of Punjab rivers had been used up, surplus water was available in the eastern rivers of Indus and Jhelum, which could be used if transported to Punjab. This transportation was realised via the Triple Canal Project (TCP)\(^{10}\) which was sanctioned in 1905. It brought irrigation to large chunks of Bari, Rechna and Upper Chaj Doabs (see Map 2.1), i.e. areas which were formerly dry and sparsely populated by Jungli tribesmen. These tracts were then

Out of 11.2 million acres irrigated by major canals in the Indian Empire in 1900-01, 4.6 million were in Punjab, while Madras ranked second with 2.9 million acres and United Provinces third with 1.9 million acres. Further, of the total capital outlay on irrigation works upto 1900-01, 3.66 million rupees, nearly 30% was spent in Punjab (Irrigation Commission Report: 1901-03, Vol. I, p. 21).

\(^{10}\) It involved the construction of Upper Jhelum Canal (UJC) which would irrigate 345,000 new acres in Upper Chaj Doab on its way to pour water in Chenab at Khanki. Water was then drawn from Chenab at Narala to the South through the Upper Chenab Canal (UCC), which irrigated another 650,000 acres in Rechna Doab, on its way to join Ravi at Ballowki. From a little south of Ballowki, on the other side of Ravi, took off the Lower Bari Doab Canal (LBDC) to irrigate 1,494,000 acres in the lower Ravi Doab, that is the areas which had to be left dry due to the water shortage in UBDC (see Map 2.1).
colonised by importing cultivators from the settled districts of Punjab, a step which involved a flow of huge sums to the government treasury from the sale of this land.

The next major project sanctioned (in 1921) after the completion of TCP, was the Sutlej Valley Project (SVP). The entire project was completed by 1933 and irrigated areas mainly on the left bank of Sutlej.

Thus we find that although the construction of irrigation works was taken up soon after the annexation of Punjab, the actual development proceeded at an uneven pace. The following points regarding the pattern of this irrigational investment may be noted: first, except for the first two canal systems constructed in the settled districts of Central Punjab, the entire bulk of investment was done in the Western and South Western 'Crown Waste Lands'. Large tracts of Southern Punjab comprising the dry districts of Rohtak, Hisar etc. did not invite any investment inspite of the relative difficulty there of provisioning well irrigation and low rain fall. Secondly, almost the entire investment took the form of constructing major canal networks to the utter neglect of minor irrigation and protective works, such as those of flood control (see, Irrigation Commission Report: 1972, Vol. I, pp. 65-66). Nor were adequate drainage facilities provided.

11 It involved the construction of four new barrages on Sutlej at Ferozpur, Sulimank, Islam and Panjnad, together bringing a gross total of 3,400,000 acres under perennial irrigation and 5,747,547 acres under non-perennial irrigation. The entire project was completed by 1933 and irrigated the area mainly along left bank of Sutlej (see Map 2.1).
which led to the emergence of serious waterlogging conditions (see, Michael:1966, p. 455).

2.3.2 Irrigation Policy - The Underlying Rationale

Speculations regarding the motivations underlying such large scale investment in public irrigation have often been voiced. That is, whether this investment was induced by a concern for social welfare or otherwise. The British government for instance, often justified it on humanitarian grounds, i.e. as a famine relief measure, specially in so far as it involved the colonisation of virgin lands. This relief was sought to be realised by an increased food production as well as a reduction of population pressure in the inhabited districts\textsuperscript{12} - consequences expected to follow upon the said irrigational investment. However the existing evidence regarding the ultimate outcome tends to belie the professed statements. For example, the amount spent on famine relief and preventive measures in other states was far below the investment in the colonisation projects of Punjab, even though Punjab ranked sixth in the frequency or severity of famines, coming after Bengal, Orissa, Bombay and Central Provinces (Bhatia:1963, p. 81). Secondly, it has been noted that, "The results of assured water supply, was a considerably greater increase in the cultivation of cash crops", compared to food grains" (see Agnihotri:1977, p. 24).

\textsuperscript{12}In so far as an increasing population pressure and reduced production of food grains were perceived as the major causes of the recurrent famines (see Bhatia:1963).
Thirdly, on the whole the colonisation schemes failed to contain the increase in population in the Central districts, from where most of the migration to the colonies took place (see Paustian:1930, p. 53). The relative bias of the public investment policy in favour of railways (compared to irrigation), despite the emphatic declaration of the Famine Commission to the contrary, tends to belie benevolence as the primary motive for irrigational development. Finally, the relative neglect of minor works and the greater official emphasis on 'productiveness' rather than on protective for the selection of irrigation projects, clearly pointed to the prevalence of considerations which were more commercial than humanitarian (Report of Irrigation Commission:1972, Vol. 1, p. 43).

In fact quite contrary to the professed motives it has been argued that the particular attraction for investing in Punjab derived, to begin with, from the political economy of the times. Soon after the annexation of Punjab, the disbanded Sikh army, appeared as a potential source of political trouble. Irrigational development was therefore, initiated as an employment measure to absorb and placate the

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13 For example the government guaranteed a rate of interest on private investment in railways, while irrigation projects had to depend on the state resources and could be sanctioned only if they gave a minimum rate of return of the capital investment (see Bhatia:1963, p. 126).

14 This is important to note, considering the critical importance of irrigation for ensuring food production to counter famines, and the fact that railways were more suited to serve the commercial interests of the Imperial State.
now idle, but sturdy soldier of the former Sikh Army. Work on UBDC was therefore begun in 1850 itself, and that too in a region which formed the seat of political power of the former Sikh Empire, and later, the major origin of the army recruits for the British Army (see Agnihotri: 1977, p. 35). Later, the colonies served yet another purpose for the army, in so far as they were used as breeding ground for horses, since the colonists were often granted land on the stipulation of breeding a specified number of horses.

However, probably the most powerful motivation for this irrigational development was the realisation by the British Government, of the tremendous financial potential of these schemes. By 1903 most of the initial problems faced

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15 As Paustian points out, "There was the poignant need of finding some kind of work for the disbanded Sikh soldier" (Paustian:1930, p. 27). Similarly, the Punjab Administration Report of 1921-22 notes that, "the UBDC project was one of the first measures which engaged the attention of the British Government after annexation in 1849, its construction being regarded almost as a matter of political necessity. It was important to provide employment and an early supply of water for irrigation for large bodies of disbaned Sikh soldiery, whose homes were in the watershed between Ravi and Bias. Thrown out of their accustomed means of livelihood, they would otherwise have had little encouragement to turn to agriculture." (Report, Punjab Administration: 1921-22, Vol. I, p. 16).

16 This was often done in the face of explicit resistance by the grantees, on grounds of poor economic returns from horse-breeding (see Agnihotri:1977, p. 39).

17 By 1926-27 Paustian notes a return of 14.38% on the total capital invested in irrigation. The rates of return on some individual projects were as high as 57 per cent (for L.C.C.) and 70 per cent for Sidhni Canal (Paustian:1930, p. 173). Further, the Punjab Administration Report for the year 1926 shows that between the years 1914-1923, the new profit of the Irrigation Department of Punjab recorded a
with colonisation and technical ones faced earlier, had been overcome and the revenues from the newer systems were more than making good any deficits on the old.

Finally, it may be noted that the irrigation policy has to be viewed in the light of the government's desire to stimulate capitalist development in agriculture. In so far as initiative for such large scale investment could not be expected from private individuals and constraint of water supply was considered a bottleneck to productive investment in agriculture, the government sought to provide this critical prerequisite. It was then expected that the peasantry, or at least some sections of it, would exploit the potential, eventually generating a development along capitalist lines.

2.3.3 Concluding Remarks

Thus by the end of the British period the districts comprising the present state of Punjab were well endowed with irrigation facilities, particularly compared to the other

rise from Rs.193 lakhs in 1914-15 to Rs.296 lakhs in 1922-23...between the years 1921-22 to 1935-36, i.e. including the depression years, the net receipts from the Irrigation Department contributed as much as 35-43 per cent of the total revenue receipts of the Punjab Government (Agnihotri:1979, p. 39).

18The grants of land in the colonies were made in three categories - the peasantry, the yeoman and the capitalist - with the larger grants reserved for the latter two categories who, it was hoped, "being drawn from a superior class would naturally fall into the position of local pioneers and leaders of the people and possibly emerge as the capitalist class" (Agnihotri:1977, p. 28).

19The districts of Bari doab (i.e. Amritsar and Gurdaspur) and Malwa region (i.e. the cis-Sutlej districts
regions under the Empire. However, within the State there remained distinct differences in the level of irrigation, mode of irrigation and the consequent differences in the irrigational practices. Added to these were the differences in property formation resulting from the mode of colonising the virgin lands in the West, which created a pattern of land ownership different from the one in the settled districts. These irrigation-related differences were bound to have implications for differences in production patterns within the State during the colonial period, as also later. In the present thesis we have focussed our attention on the nature of this irrigational development - the foundations of which were laid during the colonial period - and its impact on agricultural development, particularly for the post Green-Revolution period in Punjab.

2.4 IRRIGATION DEVELOPMENT AFTER INDEPENDENCE - AN ALL INDIA BACKGROUND

The partition of the country in 1947 following independence implied a division of the irrigation sources as well, between India and Pakistan, which turned out to be more favourable to the latter. It was imperative therefore for

of Patiala, Sangrur, Bhatinda, Faridkot and Ferozpur) were irrigated by public canal networks and the central districts of Jullunder, Kapurthala and Ludhiana which were richly endowed with ground water, were dependent on well irrigation.

20 For example the problem of fragmentation of holdings was totally absent in the colonies, atleast to begin with.

21 For example, although Pakistan with 18% of the population and 23% of the geographical area of undivided
India, got about 16% of its cultivated area, most of this enjoyed irrigation facilities or assured rainfall. It got about 31% of the irrigated area of undivided India, and 80% of this was irrigated by Canals (see: Report, Irrigation Commission:1972, Vol. I, p. 60). Therefore, it got a larger share of the existing public investment, which anyway accounted for a larger proportion of the total irrigation of undivided India. Prior to partition, the net irrigated area in the Indian subcontinent was about 28.2 million hectares, representing nearly one fourth of India's cultivated area, out of which 94% was irrigated by canals, mostly public, and 23% by wells, predominantly under private ownership (Report, of Irrigation Commission:1972, p. 67).

22 That is the headworks and the upper reaches especially of the Easter rivers.
recommended as the Benefit Cost ratio\textsuperscript{23} based on the economic and technical evaluation of the project proposals. However, it has been observed that the decision making process is far more amenable to political pulls and pressures, often in spite of technical opinion to the contrary.\textsuperscript{24} Whatever the underlying motivations influencing the timing and regional distribution of this investment, independent India began with a very ambitious programme of public irrigation under the plans, particularly under the first two plans. Subsequently the further development of any new major irrigation schemes slowed down, partly due to poor realisation of targets and partly due to poor realisation of the potential that was created. The emphasis therefore shifted to the completion of the earlier schemes. After the mid-60s there was a greater concentration towards developing private sources of irrigation. This was largely supported by providing institutional finance for the same, through organisations like the Agricultural Refinance and Development Corporation.\textsuperscript{25}

\textsuperscript{23}That is, a simple comparison of net costs and benefits of an irrigation project, before and after the introduction of irrigation. This criteria has been in use since 1964, prior to which it was the criteria of financial productivity, which was used as inherited from the British (Report, Irrigation Commission:1972, Vol. I, p. 25).

\textsuperscript{24}As for instance in the case of Rajasthan Canal Project (see Michael, 1966) for a detailed discussion of the technical problems associated with the project in spite of which it was taken up.

\textsuperscript{25}For further details see Report of Irrigation Commission:1972, Vol. I.
It may be pointed out that while comparing the relative investment in some of the major public irrigation projects as among different States of India (for instance, in terms of their respective costs of construction), those located in Punjab account for the highest proportion (See Table 2.1). Therefore it seems, that the pre-eminence that Punjab enjoyed in terms of attracting irrigational investment before independence continued thereafter.

2.5 IRRIGATION DEVELOPMENT IN PUNJAB AFTER INDEPENDENCE

The irrigational development of the present State of Punjab after independence can broadly be classified under the following categories:

(a) Public Works: Which include (i) Surface Water development, comprising largely of canal networks which are a part and parcel of multipurpose hydroelectric projects, and (ii) Ground Water development of the deeper aquifers by deep tubewells.

(b) Private Works: The predominant source of irrigation that is privately owned is the shallow tubewells - both diesel and electric ones.

2.5.1. (a) Public Works (Surface Water Development): The immediate programmes taken up after independence in Punjab were those that were dictated by the altered political situation. Their goal was the diversion of waters flowing to Pakistan towards the Indian side. Work was therefore begun immediately on the
Haripura Barrage (see Map 2.1) towards the end of 1948. The more positive motivation for it came from the fact that Haripura had to be built as part of the larger Bhakhra-Beas-Rajasthan Project in which Sutlej waters, stored at Bhakhra, would be diverted from Sutlej at Haripura and sent on their 400 mile long journey into the Thar Desert via the Rajasthan Canal taking off at the barrage. Two other canals were also built from the barrage which was completed in 1952.

The next major work taken up was the Bhakhra Project, some work on which had already been done in 1946. For further details see Michael (1966, p. 316). As a result of this development, it is expected that a total of 15 million acres will be irrigated by the canals in the Indian portion. The only major component of this left to be completed is the Thein dam on river Ravi which has been delayed due to inter-State problems related to sharing of costs and benefits of the project.

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26 This was partly necessitated to ward off any danger of Pakistan short circuiting Ferozpur, by building a barrage five miles upstream, where the Radcliff Award, by specifying the Lahore district boundary rather than the course of Sutlej as the partition line, had given Pakistan both sides of the river.

27 Added are the later increments from Beas at Pong and Ravi at Thein.

28 Ferozpur Feeder, which took over the supply of Bikaner canal from Ferozpur head works and the Sirhind Feeder, which increased supplies to the lower end of Sirhind (Roper Head Works) distribution system, making possible intensities on the upper reaches of that system.

29 Under the British, this area used to be 9 m.a.f. of water while now it would be 32.5 m.a.f.
The annual increase in canal irrigated area as a result of these schemes of Punjab is shown in Table 2.2. It may be noted that most of this increase took place mainly in districts (i.e. Bhatinda, Ferozpur, Paridkt, Sangrur, Patiala and Amritsar) which had a relatively poor feasibility for shallow tubewell installation due to the prevalence of ground water salinity and low water table. This investment thereby tended to balance the distribution of public and private investment in irrigation.

(b) Public Works (Ground Water Development): The government took up the programme of the installation of deep tubewells, the major form of ground water development under public ownership under the Grow-More-Food-Programme, during the early 50s. Most of these, in Punjab, were located in districts of Kapurthala, Hoshiarpur, Roper and Sangrur. However, they accounted for a very small proportion of the total irrigated acreage and as we shall latter see later, had very poor utilisation levels. In 1970 the government set up the Punjab State Tubewell Corporation (PSTC), a separate organisation designed specially for handling the installation, operation and maintenance of deep tubewell in the State. However, as in the case of tubewells installed earlier, their performance did not meet with much success (see Appendix A.3.5). From the point of view of overall irrigation development in Punjab it has made a marginal contribution.

Mainly through shallow tubewells which increased after the mid-sixties.
2.5.2 Private Works

(a) Their Development: At present, the major privately owned source of irrigation in Punjab are shallow tubewells - operated either by electricity or diesel. Most of their development has taken place in the recent past i.e. mainly after the mid-sixties, concomitant with the spread of the Green Revolution technology. From Table 2.2 which shows the total growth of tubewell (and wells)\(^{31}\) irrigated area in the districts comprising the present State of Punjab from 1950 to 1980. We notice that the increase from 1950 to 1966 is only 13.8%, while that from 1966 to 1980 is 123%. The districtwise distribution of this development has been discussed in Chapter VII. However, it may be noted that the growth took place throughout the state except in areas constrained for technical reasons. In the following section we will discuss the influence of mode of financing on the distribution and growth of shallow tubewells in the state, finance being one of the major influences.

(b) Source of Finance: No comprehensive statistics regarding the source of finance are available which throw light on the role of private and institutional finance in the growth of

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\(^{31}\) Separate statistics for well and tubewell irrigation are not available. However, since most of the tubewells were installed after mid-sixties and, by now, have almost entirely replaced the ordinary dug well irrigation by Persian wheel, it will not be illegitimate to assume that the relative stagnation in well plus tubewell irrigated area prior to mid-sixties reflects the near absence of tubewell development;
tubewells. In the present section we will briefly discuss the development of the major avenues of institutional finance for tubewell installation available to the farmers, and the actual financing of tubewells that they effected—both over time and in terms of the amount.

The major sources of institutional finance for tubewell installation at present are the following: Small Farmer Development Agency (SFDA), Marginal Farmer Development Agency (MFDA), Primary Land Mortgage Banks (LMB), and Agricultural Refinance and Development Corporation (ARDC) and funds routed predominantly through the LMBs. Following the recommendations of the All India Rural Credit Review Committee (1969), the SFDA and MFDA were instituted during the Fourth and Fifth Five Year Plan periods. Although they are not financing institutions, they are expected to help the small and marginal farmers to get their supplies of agricultural inputs, including credit from Co-operative Banks as well as other credit institutions32 (see RBI:1978, p. 73). Probably the most important source of institutional finance for tubewells in Punjab is the

while the sudden upsurge in the same acreage, in the subsequent period can almost entirely be accounted for by the sharp increase in the number of tubewells.

32The small/marginal farmers are being provided with a subsidy, ranging from 25 to 50% on their investment, for example, in minor irrigation. Till 1975, the number of tubewells financed under these schemes in Punjab was 17,682 and 3,099 pumpsets (RBI:1978, p. 74).
Punjab State Co-operative Land Mortgage Bank (SLMB) registered as a co-operative society on 26th February, 1958. At present, it disburse long and medium term loans through 42 primary Land Mortgage Banks (PLMB). Although set up in 1958, its role in financing tubewell installation assumes significance mainly from 1967 onwards. Finally, the Agricultural Refinance Corporation\(^{33}\) (ARC), which began functioning on July 1, 1963, effectively began supporting the tubewell installation in Punjab from 1967-68 onwards. In fact till July 1973 the bulk of corporations refinance assistance has been for minor irrigation schemes, accounting for 77% of its total disbursement of Rs. 219 crores till then and 89% of this has been routed through the various state LMBs (see RBI:1974, p. 18).

Effectively therefore, the LMBs are the major source of institutional finance for tubewells - both under its normal schemes as well as ARC financed schemes. However it is only towards the latter part of '60s that first, the total amount of loans disbursed increased suddenly. Secondly, the major emphasis of this disbursement turned sharply in favour of tubewells and tractors, particularly the former as opposed to the earlier emphasis on objectives like debt redemption, land purchase etc. (see Report, PLMB:1971-72, p. 6).\(^{34}\)

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\(^{33}\) This was essentially a national level organisation, set up, to refinance development projects which cannot be financed by LMBs, state cooperative banks, and scheduled commercial banks.

\(^{34}\) For instance, while the total loans disbursed for the undivided state during 1964-65 and 1965-66 were Rs. 102
Table 2.3 below, which gives the yearwise disbursement of loans according to different purposes after 1967-68, shows the continuous dominance of tubewells in the total loan disbursement of the PLMB, as well as increasing total amount thus loaned. Since the data used for the table includes the loans advanced by ARDC also - it gives an indication of the growth of the entire institutional finance for tubewells in Punjab.

It follows therefore, that most of the institutional financing for private irrigation sources was made available after the late 60s. However, its role as compared to that of private financing of the same can only be inferred indirectly, in the absence of suitable data. For example the total number of tubewells financed by the SLMB since its inception in the early 50s till June 1972 was 75,800 (see: Report, PLMB, 1971-72, p. 6). This however accounts for only 37% of the total

and 164 lakhs respectively. The corresponding figures for the reorganised state of Punjab for the years 1967-68 and 1968-69, were Rs. 430 and Rs. 1174 lakhs respectively. In fact the progress recorded during 1968-69 was 267% of the progress attained in 1967-68 (PLMB Annual Reports: 1966, p. 6 and 1969, p. 3). Secondly, out of the total loans disbursed before 1966, nearly 42% had been for purposes like redemption of mortgaged land, liquidation of prior debts etc. and only about 11% for installation of tubewells; during 1967-68 and 1968-69 the proportion of loans disbursed for debt redemption and land purchase had come down to 4.5 and 1.5% while that for tubewells installation had gone up to 50% and 70%, respectively. In fact loans for tubewells and tractors together accounted for 97.25% of the total disbursement during 1968-69 (Report, PLMB: 1968 and 1969).
number of tubewells installed in the state till 1972 i.e. 203297 (see Statistical Abstract of Punjab:1974).\textsuperscript{35} Other evidence based on field work data and certain sample surveys discussed in the later chapters, also points to the marginal role played by institutional financing in developing the tubewell irrigation in Punjab. At best it supported the development but did not initiate or sustain it which was largely done by the farmers' private financial resources.

2.6 CONCLUDING REMARKS

From the foregoing discussion regarding the irrigational development in Punjab after independence we can infer the following: first, most of the public investment in irrigation in the form of canal networks took place before the mid-sixties. Secondly, most of the private investment in the form of shallow tubewells took place after the mid-sixties, largely financed by private sources. Thirdly, in terms of the regional distribution of public and private sources - it has been, by and large balanced, i.e. it is areas with poor feasibility of tubewell installation that are well supplied with irrigation through the public canals.\textsuperscript{36} Fourthly, Punjab

\textsuperscript{35} Further, as of 1978, a total of Rs. 72.88 crores had been loaned out for tubewells by LMB in Punjab. Assuming an average loan of Rs. 5000/- per tubewell, this gives a figure for the total number of tubewells financed as nearly 1.6 lakhs which is only 39\% of the total tubewell growth in Punjab after reorganisation in 1966.

\textsuperscript{36}Even in a district like Amritsar, which has a concentration of both public and private sources of irrigation the
continued to be favourably placed compared to other regions, with regard to public investment in irrigation, even after independence.

This impressive development of irrigation works in Punjab in the post independence period, has no doubt made its contribution towards making possible the Green Revolution in the region. However, the questions that remain to be answered are: whether the full potential thus created, has been realised or not; what have been the problems encountered in full utilisation; their nature, extent and underlying reasons; what are their consequences for production patterns and distribution of gains from the new agricultural technology which requires assured irrigation as a necessary prerequisite; whether public and private sources have been competitive or complementary when both coexists. It is questions such as these that we turn to in the following pages.

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growth of private tubewells has acted as an effective anti-waterlogging measure and irrigation through public canals in this region after independence, was largely due to inheriting the UBDC system from The British which was only developed further.
<table>
<thead>
<tr>
<th>Project</th>
<th>Commencement</th>
<th>Completion</th>
<th>Period of construction (years)</th>
<th>Cost (Rs. crores)</th>
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<tbody>
<tr>
<td>2. Sone Barrage Remodelling &amp; Link Canals, Bihar</td>
<td>1958</td>
<td>1973</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>3. Banas (Dantiwada), Gujarat</td>
<td>1959</td>
<td>1969</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>5. Girna, Maharashtra</td>
<td>1956</td>
<td>1970</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>6. Tungabhadra, Mysore</td>
<td>1945</td>
<td>1972</td>
<td>27</td>
<td>51</td>
</tr>
<tr>
<td>7. Hirakund Stage-I &amp; II, Orissa</td>
<td>1948</td>
<td>1960</td>
<td>12</td>
<td>83</td>
</tr>
<tr>
<td>8. Bhakra-Nangal, Punjab</td>
<td>1948</td>
<td>1964</td>
<td>16</td>
<td>175</td>
</tr>
<tr>
<td>10. Jayaksadi</td>
<td>1965</td>
<td>1979</td>
<td>14</td>
<td>74</td>
</tr>
<tr>
<td>13. Ramganga</td>
<td>1958</td>
<td>1974</td>
<td>16</td>
<td>131</td>
</tr>
<tr>
<td>(Civil Works)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 2.2

Net Irrigated Area by Source (Punjab)

<table>
<thead>
<tr>
<th>Year</th>
<th>Government canals</th>
<th>Tubewells/wells*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>1257</td>
<td>809</td>
<td>2066</td>
</tr>
<tr>
<td>1960-61</td>
<td>1173</td>
<td>829</td>
<td>2002</td>
</tr>
<tr>
<td>1965-66</td>
<td>1288</td>
<td>921</td>
<td>2209</td>
</tr>
<tr>
<td>1972-73</td>
<td>1275</td>
<td>1652</td>
<td>2927</td>
</tr>
<tr>
<td>1972-73</td>
<td>1284</td>
<td>1680</td>
<td>2964</td>
</tr>
<tr>
<td>1974-75</td>
<td>1406</td>
<td>1766</td>
<td>3172</td>
</tr>
<tr>
<td>1975-76</td>
<td>1366</td>
<td>1742</td>
<td>3108</td>
</tr>
<tr>
<td>1976-77</td>
<td>1382</td>
<td>1802</td>
<td>3184</td>
</tr>
<tr>
<td>1977-78</td>
<td>1390</td>
<td>1859</td>
<td>3249</td>
</tr>
<tr>
<td>1978-79</td>
<td>1429</td>
<td>1929</td>
<td>3358</td>
</tr>
<tr>
<td>1979-80</td>
<td>1491</td>
<td>2051</td>
<td>3542</td>
</tr>
</tbody>
</table>


*Prior to 1966, the area under this category indicates the area irrigated mainly by dug wells. After 1966 it reflects mainly tubewell irrigated area.
TABLE 2.3

Yearly Disbursement of Loans of Punjab Land Mortgage Bank (PLMB) (Purposewise)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>A</td>
<td>P</td>
<td>A</td>
<td>P</td>
<td>A</td>
<td>P</td>
<td>A</td>
<td>P</td>
<td>A</td>
<td>P</td>
<td>A</td>
</tr>
<tr>
<td>1. Tubewell Installation</td>
<td>220</td>
<td>49</td>
<td>866</td>
<td>72</td>
<td>-</td>
<td>-</td>
<td>952</td>
<td>53</td>
<td>731</td>
<td>62</td>
<td>-</td>
</tr>
<tr>
<td>2. Purchase of tractors</td>
<td>200</td>
<td>45</td>
<td>306</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>714</td>
<td>40</td>
<td>281</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td>3. Purchase of land and redemption of mortgaged land</td>
<td>20</td>
<td>4</td>
<td>16</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>70</td>
<td>4</td>
<td>77</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>4. Others</td>
<td>8</td>
<td>2</td>
<td>21</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>64</td>
<td>3</td>
<td>91</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>5. Total</td>
<td>448</td>
<td>100</td>
<td>1209</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>1800</td>
<td>100</td>
<td>1180</td>
<td>100</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: A = Amount in lakh Rupees; P = Percentage of total.

* This includes the loans disbursed under the ARDC schemes.

Source: Compiled from Annual Reports of the Punjab State Co-operative Land Mortgage Bank Ltd., Chandigarh for the years 1969 to 1978.