Chapter - 2

SOURCE AND STATUS OF MINOR IRRIGATION IN THE DISTRICT

2.0 The District

The Panchmahals district is situated in eastern part of Gujarat. This eastern most district has an area of 8866 km^2 which is around 4.53 percentage of the total state's geographical area. The tenth largest district of the State, lies between 22' - 15' and 23' - 30' north latitude and 73' - 15' and 74' - 30' east longitude. In the north it is bounded by Sabarkantha district of Gujarat and Banaswada district of Rajasthan. In South it is bounded by Vadodara district of Gujarat and Jhabua district of Madhya Pradesh. In the east it is bounded by Jhabua district. In west it is bounded by Vadodara and Kheda districts of Gujarat.

The district can be divided into two main physiographical subdivisions. The entire northern and eastern portion, comprising mainly of Jhalod, Dahod, Lunawada, Santrampur, Limkheda, Jambughoda and Devgadh Baria talukas (Administrative units), is covered by hills and forests interspersed by plain cultivable land.The western portion, comprising mainly of the Kalol, Shehera, Godhra, Halol and parts of Lunawada taluka, is plain in aspect and rises gradually to the east, though it is cut by rivers and interspersed by sprinkling of low hills. Nearly two-thirds of the district is covered by small hills.

The district is apparently rich in water resources. There are seven rivers of notable size which flow through the district. The rivers are Mahi, Goma, Kun, Karad, Kali, Panam and Mesri.The biggest river, Mahi rises from the Vindhyachal hill range in Madhya Pradesh and has a course of 576 kms. of which 256 kms flow through Gujarat State. It passes through Panchmahals in a north-west to south-west direction enters Kheda district and finally drains in the gulf of Cambay.

2.01 Climate

The weather conditions faced by the district are extreme. The maximum temperature ranges between 39°C to 45°C during April, May and June and the minimum reaches to 5°C in December and January.The wind velocity (Annual) recorded in 1970 was 16.3 km/hour. In June it was maximum (29.6 km/hour). The district has an average annual rainfall of about 920 mm. The south-west monsoon brings rains. Most of the areas in Gujarat State receive rainfall from the south-west monsoon with different degrees of variations. The coefficient of variation of rainfall is 30 to 40 per cent for the district. This variation is related to the total precipitation. About 95% of the annual rainfall in the district is received during the monsoon months from June to September. July is the rainiest month. On an average, there are 43 rainy days in a year. The statistical probability of insufficient rainfall is nearby 35%. Every third

year in the last three decades has been drought conditions.[1] Good and evenly rains are experienced once in 3 to 4 years.[2]

Apparently, 920 mm of average annual rainfall seems to be sufficient for normal crop plant growth. But it needs a thorough examination whether enough water is available in the root zone of the crops after the losses, run off and deep percolation. One such rough estimate tends to conclude that water available in the root zone of maize crop is not sufficient.[3]

2.02 Soil Status

The textural status of the soil in the district is almost uniform. Barring Santrampur and Halol talukas, more than 40% of soil is of medium texture. Halol has more than 60% of soil which is of medium texture. Santrampur is relatively lowly placed with 60 to 80 % of soil with high or light texture.

The fertility status of the district is not very impressive. In general, the soil possesses high potash content, low nitrogen content and medium phosphorus content in most of the talukas. The fertility status and gradation of other features of the district in detail is given below :

---

1 Panchmahals Gazetteer, 1970. Gujarat Government Publication Department.

2 Drought Prone Areas Programme 1974-75 to 1978-79. Rural Development Agency, Panchmahals, Godhra.

3 op.cit., Dr. Girija Sharan's work.

Table 2.1

Physical Features of Panchmahals

Sr. No.	Name of the taluka	Climate	GRADES Topo-graphy	Tex-ture	Ferti-lity	NPK
1	2	3	4	5	6	7
1.	Lunawada	C	BC	C	D	LMH
2.	Santrampur	C	BC	D	E	LLA
3.	Jhalod	C	CD	C	B	MMH
4.	Dahod	C	DC	C	B	MMH
5.	Limkheda	C	CD	C	D	LMH
6.	Devgadh Baria	C	CD	C	D	LMM
7.	Jambughoda	C	B	C	D	LMH
8.	Shehera	C	AB	C	D	LMM
9.	Godhra	C	BA	C	B	MMH
10.	Kalol	C	B	C	AD	HMH,LMH
11.	Halol	C	B	B	D	LMH

Climate - 'C' grade implies 30 to 40 % variation in rain fall.

Topography : Degree of topographic elevation (Height in Meters).

A = 75 plain area

B = 75

C = 75 to 150

D = 150 to 300

Texture: B = more than 60% soil of medium texture.

C = more than 40% soil of medium texture.

D = more than 60% soil of high or light texture.

Fertility L = low M = Medium H = High

NPK Nitrogen - Phosphorus - Potas.

A = HMH

B = HLH, MHH, MMH

C = MLH, MHM

D = LHH, LMH, LMM

Source: Report of the Gujarat Land Commission, Govt. of Gujarat, 1979, Appendix II.

The above mentioned report which is the source for Table-1 also has worked out the land productivity status for the district. This exercise has been done for all the talukas. The southern part of the district, comprising of Godhra, Halol, Kalol and Jambughoda, has been classified in grade III of productivity classification. The state as a whole does not have a single spatial unit which has Ist grade productivity. The district Panchmahals similarly does not have any area with Ist or IInd grade land productivity. The productivity is worked out by attaching weights to the physical features and soil status. The northern portion, comprising of Lunawada and Santrampur taluka, has a very low productivity profile. It is classified under grade V. The Northeast portion, comprising of rest of the talukas, has a low profile again being classified under grade IV. Thus, the general land productivity profile in the district is on the lower side.

2.03 Demographic Characteristics

The major occupation of workers in the district is agriculture. According to 1971 Census, 86% of the total work force were engaged as cultivators and 8% were engaged as agriculture labourers. Most of the workers who were and are engaged in agriculture have some land holding on their names. The agriculture labourers without any holding are very few though the district is not very prosperous with regard to

agriculture. Sizeable number of inhabitants (38%, 1971 Census) are tribal. Hence, the district is a mix of tribal and non-tribal population. One of the features that did not get reported in the Census was that of seasonal migration of tribals to the neighbouring rural and urban areas of the district as well as other districts. However, there have been separate studies on this aspect carried out from time to time. The demographic characteristics suggest that the district is still predominantly an agrarian district.

In the light of the geo-physical and agro-climatic features and the occupational structure of the population, it will be appropriate to examine the land use, cropping pattern, productivity and other related aspects of agriculture.

2.04 Land Use

Towards the end of 19th century, the district area was covered with thick forests. Reportedly, the area was not utilized intensively for agriculture purposes. The district was rich with forests and was famous for it. In 1980-81, of the total cultivated and uncultivated area, 27% was cropped area, 36% was forest and rest was either fallow or culturable waste. By the beginning of the 20th century, forest area started shrinking. In 1900-1901, area under forests was reduced to 21% and the cropped area also came down to 20% of the total cultivated and uncultivated land. By 1947 trend became clearer and steadier. Crop cultivation picked up and forest started losing

the area steadily. In 1947-48, area under crops amounted to 55% and under forests it amounted to 20% of the total reporting area. Within a decade (1960-61) the total cropped area went up to 62% and forest area was reduced to 12% of the total reporting area. This implies that forests were being wiped out fast and the land was brought under cultivation. This feature was much more prominent in the tribal areas (northeast of the district). The tribal population which was used to 'slash and burn' and 'shifting cultivation' techniques had started settling down at regular places for systematic cultivation.[4]

The current status of land utilization is available only upto year 1974-75. There exists some gap in data collection at district level. In 1967-68, of the total reporting area, forests accounted for 26% and the area under cultivation was 53%. The forest area that is reported is higher than the 1960-61 figures. This must have been so because by then the forest conservation activity had begun with a fresh seriousness. The area were declared as 'Reserve Forest Areas' and were brought under the ownership of the Forest Department. These areas were being brought under fresh plantations year after year. In 1970-71 the area under forests remained the same but area under crops went up slightly by 5 to 6 %. In 1974-75 the area under forest shrinked once again and accounted for 16% of the total reporting area whereas, the area under crops accounted for

---

For detailed discussion refer Panchmahals Gazetteer, 1970.

about 55%.[5] The Land Utilization Pattern in the district is in some sense better than that of the Gujarat State. The state statistics[6] suggest that in 1961-62 net area sown in the state constituted 52% of the total reporting area. The land use for the purpose was same in 1970-71. The other half seems to remain uncultivated in the state too.

There is one distinct feature in this district. The intensive use of land is made more by the tribal cultivators who are rather late starters. The 1970-71 figures show that the area sown more than once for the tribal areas (the taluka area which is an administrative unit in tribal as well as non-tribal zones have been added up) was 20% of the net area sown and for non-tribal talukas the figure was 13%. In 1974-75, there was significant reduction in the area sown more than once. In tribal areas it was 8% and in non-tribal areas it was 2.4% of the net area sown. A plausible explanation is that the tribal farmers grow early maturing variety of maize in Kharif (monsoon) and invariably go in for Rabi crop of Gram and/or wheat. The non-tribal talukas concentrate more on paddy and hybrid maize variety that mature late and hence only farmers with guaranted source of irrigation go in for a Rabi crop.

2.05 Land Holding Pattern

The land holding pattern in the district is somewhat

5. For yearly statistics - Directorate Agriculture's yearly publication, Government of Gujarat.

6. Statistical Abstract of Gujarat 1977. Director, Information, Government of Gujarat.

different from the state. The statistics on this count is not available for recent years. A decade old data (collected by Revenue Branch of District Panchayat) show that of the total holders in the district (1, 97, 521) 73.3% (1, 44, 740) holders' operational holdings ranged between 0 to 4.99 hectares, 19.3% (38148) holders' operational holding ranged between 5 to 10 hectares and 7.4% (14363) holders' operational holdings were 10 hectares and above. The state figures show that in 1970-71 about 20% of the holders' operational holdings were of 10 hectares and bigger sizes. 80% of the holders had the operational holding size between 0 to 10 hectares.

The distribution of cultivated area by size of holding is not available for the size class that has been discussed above. The total cultivated area reported in 1971 was 4, 81, 493 hectares. Of this 3,71,341 hectares were held by farmers who owned in the range of 0 to 4 hectares of land. This means that 77% of the cultivated area was held by 0 to 4 hectares range owner farmers. 20% area was held by 4 to 12 hectares range owner farmers and 3% area was held by farmers owning 12 hectares and more. If we consider a range of 0 to 2 hectares only, then the cultivated area held by this class accounts for 42% of the total cultivated area. The comparable figures for state is not available. One thing can be definitely said that the distribution of land is not skewed in favour of large holder farmers. Few big farmers own relatively lesser area under cultivation. Majority of the farmers were reported to be owner farmers

in 1971. 78% of the total farmers reported (250481) were owner farmers, 12% were protected tenants and 10% were unprotected tenants. Within the district, unprotected tenants were more in tribal parts of the district.[7]

2.06 Production Resources

By and large the land is cultivated with the help of a pair of bullocks. The draught animal is bullock. In tribal areas Malvi variety, which is lean and short is extensively observed. In the non-tribal areas Kankrej variety is observed which is a better variety compared to non-descript local breed. The preference for Malvi in tribal parts, according to experts, is because the animal's heels have a special formation that facilitates traversing the undulating hilly terrain.

The absolute number of draught animals in the district is relatively high. The Livestock Census reports suggest that there has been a steady increase in the number of draught animals over past thirty years or so. Since numbers alone would not help in understanding the position, an estimate of cropped area under each pair of bullock has been attempted. The figures for the district have been compared with the state figures.

---

7 For District data - DPAP 1974-75 to 1978-79 Panchmahals District.
For State figures - Report of the Gujarat Land Commission, Government of Gujarat, May 1979.

Table - 2.2

Average Area to be covered by a Pair of Bullock

(Area in Hectares)

Year	District	States
1951	2.64	N.A.
1956	2.40	N.A.
1961	2.40	6.30
1966	2.20	6.33
1972	2.20	6.30
1977	2.20	N.A.

N.A. = Not Available.

$$\text{Average area} = \frac{\text{Total gross cropped area}}{\text{Total pairs of draught animals}}$$

With the help of Table-2.2 the only observation that can bemade is that the Panchmahals district's bullock pair has to cover lesser area compared to a bullock pair of the state. Whether this size is optimum in relation to draught capacities or not is not known.

2.07 The implements in use are generally traditional.

They are light, portable, locally manufactured and repaired and relatively inexpensive. Mechanized farms are not yet very often seen on the district canvas. Once again, the absolute number of implements will not be able to suggest much and hence average area under each implement has been worked out for the district as well as the state.

Table - 2.3

Average area (hectares) under Implements

Implement – Code		1951	1961	1972	1977
1	D	2.64	2.30	2.21	2.19
	S	NA	6.10	6.64	NA
2	D	15.00	16.00	15.50	16.00
	S	NA	13.50	11.70	NA
3	D	NA	466	273	383
	S	NA	NA	NA	NA
4	D	NA	NA	6.53	6.33
	S	NA	NA	NA	NA
5	D	NA	NA	45	46
	S	NA	NA	NA	NA
6	D	NA	NA	20	18
	S	NA	NA	NA	NA
7	D	NA	NA	50	12
	S	NA	NA	NA	NA
8	D	NA	654	280	101
	S	NA	213	26	NA
9	D	7446	2794	1700	1116
	S	NA	1535	198	NA
10	D	NA	NA	615	326
	S	NA	NA	NA	NA
11	D	NA	NA	1386	1225
	S	NA	NA	NA	NA
12	D	27577	26555	20039	9596
	S	NA	4770	1007	NA
13	D	NA	NA	NA	3485
	S	NA	NA	NA	NA

NA = Not Available; D = District; S = State.

Sources: 1. Gazetteer Panchmahals.
2. District Statistics Abstract (Available years)
3. Report of Gujarat Land Commission.

Implements Code :

1 Plough (Iron & Wooden)
2 Carts
3 Rahats or Persian Wheels
4 Improved Harrow
5 Improves seed drill
6 Wet land Puddlers
7 Earth Levellers
8 Oil engines
9 Electrict pump-sets.
10 Maize shellers
11 Sprayer's and Dusters
12 Tractors
13 Other modern implement such as Disc Harrows, Cultivators, Scrappers, Trailers, Threshers etc. etc.

The district has more of traditional implements. It is rich in ploughs (specially wooden) and earth levellers. The oil engines and electric pumps have been steadily replacing the persian wheels. In case of rest of the implements, the tribal area has registered relatively slower improvement than the non-tribal area. The State of course, is showing trends of modernization with increased use of tractors. This also implies that the other related implements must also be growing in the state.

2.08 Credit System

The old Gazetteer of Kaira and Panchmahals prepared in 1879 and 1880 narrates the institutional structure for credit. The local money lenders were Vanias, Brahamans and Bohras. Rich Kanbis (Patels) also advanced cash loans and grains. Kanbis were considered to be liberal lender's than Vanias. Of the total local money lenders, ten percent dealt with towns-

people. Only, sixty percent dealt with Kolis, Bhils and other poorer classes and thirty percent dealt with both. The repayment of loans by tribals and poorer communities was by crops. The cooperative movement started in 1920s. In 1921, there were 33 agricultural credit societies. The number increased to 52 in 1922. In 1947, there were 221 agricultural societies in the district. In 1960-61 there were 800 societies with paid-up capital of Rs.16.99 lakhs and working capital of Rs.58.87 lakhs. These societies had advanced loans worth Rs.40.68 lakhs. In the early seventies the cooperative bank and its branches and the Commercial Bank branches had entered the scene. The Cooperative Bank's total lending reached Rs.11740 lakhs by 1972. The Commercial Bank expansion picked up in sixties. Initially, there were 3 to 4 branches of State Bank (the then Imperial Bank) and Dena Bank in the earlier decades. The advances in agriculture started only in 1968-69. Presently as on 1st September, 1981 there are 74 commercial Bank branches in the district with atleast half of them being totally rural branches. The coordination efforts of the Reserve Bank of India has seen light of the day and the Lead Bank Scheme is in operation. The District Credit Plan is prepared after assessing the credit requirements of the district with specific attention towards agriculture and rural credit.

The primary Agriculture Societies also deal to some extent in handing the supply of fertilizers, pesticides and other necessary inputs.

2.09 Cropping Pattern and Productivity

In the context of land utilization pattern, land holding and operation, the draught animal capacity and availability, implements and agriculture credit and other inputs availability, let us turn attention, towards the cropping pattern and productivity.

Maize is the staple food in the district. It is still favourite of tribals. The cereal crops grown are: Paddy, Jowar, Bajri (millet), Kodra (Hill millet), and wheat, Tor . and Gram are main pulse crops, Groundnut and Seasum are oilseed crops and cotton and tobaco are main cash crops.

The cropping pattern differs not only from the state but it also differs in different parts of the district. The pattern, therefore is reviewed for tribal, non-tribal parts of the district and the state.

Compared with the state, the district is still mainly grain producing area. 80 to 90 % of the total cropped area has been under food grains. It is important to note that area under cereals seems to have been the same (70%) at two points of time in last 100 years. The change in cropping pattern has takenplace in pulses, oilseeds and other cash crops. The distinguishing feature of the district in general and tribal area in particular is the growing of pulses. The area under pulses has been in the range of 12 to 15% in the district.

Table - 2.4

Cropping Pattern in the District and State Percentage to Total Gross Cropped Area

Year		Total cereals	Total pulses	Total oilseeds	Total cash cropps
1880-81	D	70	20	8	2
1900-01	D	77	14	7	2
1930-31	D	72	12	13	3
1950-51	D	69	14	14	3
1962-63	T	64	18	13	5
	NT	62	7	20	11
	S	48	6	23	23
1971-72	T	70	15	8	7
	NT	65	5	12	18
	S	50	5	22	23
1974-75	T	73	13	5	9
	NT	65	4	10	21
	S	48	4	23	25
1979-80	D	70	13	8	9
	S	45	6	26	23

D = District; T = Tribal; NT = Non-Tribal; S = State.

Source: 1. District Gazetteer, 1970.

2. Directorate Agriculture, Gujarat State.

The state figures show that area under pulses in entire state has never been more than 6%. Within the district, the tribal parts grow pulses in relatively larger areas. The non-tribal parts seem to be following the state pattern by growing more of oilseeds and other cash crops. In case of oilseeds, the area was significant in early years and has come down in

recent years. This may be because, castor, which must have been growing in thick forest areas, has lost the area in tribal parts since the forests are depleting fast. The cotton, tobacco and other cash crops are more popular in the non-tribal parts of the district.

Table - 2.5

Yields of Major Crop Groups

Yield/Hectares in Kgs.

Year		Total cereals	Total pulses	Total oilseeds	Cotton*	Tobacco
1950-51	D	430	386	560	124	769
	S	NA	NA	NA	NA	NA
1960-61	D	742	425	599	121	917
	S	417	331	613	139	700
1971-72	D	1216	584	723	329	990
	S	901	375	828	222	1359
1972-73	D	693	600	365	233	685
	S	532	295	218	139	1262
1973-74	D	857	743	914	156	649
	S	816	393	757	156	1446
1974-75	D	442	365	544	117	1560
	S	583	327	324	155	1440
1975-76	D	1293	657	914	137	996
	S	999	401	1153	160	1483
1976-77	D	941	633	687	161	1196
	S	902	417	953	161	1659
1977-78	D	723	577	655	148	1127
	S	925	330	846	180	1538
1978-79	D	852	771	546	213	2021
	S	1055	923	860	203	2060

NA=Not Available; D=District; S = State

* Cotton Bales have been converted into Kgs.

Source: 1. Panchmahals Gazetteer 1970.

2. Directorate Agriculture, Gujarat State.

The characteristic feature of yields of major crop groups both in the district as well as state is the variation. Almost each year the yield figure changes significantly. In case of cereals, the state average shows improvement in seventies. The district averages are better than the state averages in 60s and early seventies. The superiority of district averages can be seen for most of the years for cereals, pulses and cotton. During 70s, the state yield averages have bettered over district yield averages in case of oil seeds and cash crops. The yield of pulses has been high in district since 1951 without exception. Nothing can be commented definitely on yield pattern since the difference between highest and lowest figures is highly significant in case of each crop group.

The unstable productivity levels may be attributed mainly to lack of irrigation facility in the state in general and in the district in particular. The majority of the cultivated area is under rain-fed crops. Most parts of the state including the district are prone to drought. This was recognized and accepted since the beginning of Five Year Plans. It was thought that best way of fighting drought was to create irrigation facilities in all the possible ways. This marked the beginning of an eraa of public investment in irrigation all over the state.

2.1 Sources of Minor Irrigation in District

According to Gazetteer of India, Panchmahals district, the methods of irrigation in former times were simple and easy. Fields were watered directly from the sources like rivers, ponds and wells. J. Campbell in 1879 Gazetteer of Bombay Presidency, Kaira and Panchmahals states, "Fields are watered from rivers, ponds and wells. From rivers the water is drawn by means of rough wooden lever lifts, dhekudis, costing only Rs.3-4 to set up. Except at Malav reservoir where are gravitational gates, the system of watering is the same as from rivers. As springs are found close to the surface, wells have not to be sunk more than from fifteen to thirty feet."

The 1970 Gazetteer states, "the first irrigation work in Panchmahals was constructed near Dahod to provide relief work to the affected people in famine of 1899-1900. Situated within limits of Muvalia village, amd so named after the village the tank was started in 1900 and completed in 1906-07. The tank occupies a picturesque basis surrounded by hills. The catchment area is 30 square miles consisting of hilly country. The dam is constructed in two parts at right angles to one another. The length of main dam is 1780 feet and maximum height 64 feet above ground. The tank has two channals one on the right and the other on the left bank."

The statistical Atlas of Bombay Presidency (1925) describes the situation till 1925. It states that there were

about 3500 wells which were used for irrigation purposes in the district. Over and above Muvalia Tank one more tank namely Futelao in same Dahod taluka was operating since 1916-17. Interestingly enough, the Atlas notes that the Futelao tank did not however, prove, "either remunerative or protective."*

Public Investment in Minor Irrigation

The old observations and statistics go on to suggest that the development of tank irrigation in the district started not with an idea to build up the irrigation facility but may be to provide relief employment to the famine or scarcity hit population. The irrigation facility to protect as well as augment better cropping was accepted as an essential purpose in building minor irrigation structures but the decisions mainly seem to have been based on some other pressing considerations. The systematic tapping of surface water for irrigation purpose alone started with planning and implementing of major and medium projects during the Plan period. It is in this backdrop that we shall be viewing the public investment in minor irrigation in the district.

From the tables 2.6, 2.7 and 2.8 it can be observed that there are three sources for information. The Gazetteer has obtained information from the Executive Engineer's Office and so also the information in Table 2.8. The district-wise information has its base in the state government's P.W.D. All these

* Statistical Atlas of Bombay Presidency, Director of Agriculture, Bombay, 1925, p.55.

Table - 2.6

Minor Irrigation Facilities 1951-1969 in Panchmahals with Public Investment

Period	Catchment area in Sq.Kms.	Cost in Rs. (lakhs)	Gross capacity (in M.Cm.)	Irrigation potential (in Hectares)
1	2	3	4	5
1. Before 1951	182.00	20.91	15.87	2725
2. During First Five Year Plan:1951-1956	87.04	18.62	13.22	1740
3. During Second Five Year Plan:1956-1961	22.65	1.60	4.89	746
4. During Third Five Year Plan:1961-1966	46.31	21.18	6.62	666
5. 1966-67	9.19	7.53	1.88	303
6. 1967-68	87.68	16.81	3.09	1007
7. 1969-70	89.33	7.79	2.42	312

Source: Gazetteer of India, Gujarat State, Panchmahals Dist.

Note

pieces of informations are not strictly comparable. The state Government figures show the plan-wise expenditure in districts which have been finalized by the irrigation department at state level. Whereas, the Gazetteer table and the table culled out from Master Plan give information about the works which have been completed till the date of reference. The Master Plan thus gives information about the total investment in different categories of works till 1979. A total of Rs.500 lakhs have been spent to build class I and II MI tanks, check-dams and percolation tanks. Of these, Check-dams and percolation tanks augment

irrigation in an indirect way. These structures help increase the water table in the nearby command and thus improve the yields from wells.

Table - 2.7

District-wise Expenditure on Minor Irrigation During Plan Periods

(Third Five Year Plan and Onwards) (Rs. in lakhs)

Name of Districts	Third Five Year Plan	Three Annual plans	Fourth Five Year Plan	Fifth Five Year Plan	Total
1	2	3	4	5	6
1. Ahmedabad	33.21	32.75	27.36	112.03	205.35
2. Kaira	17.85	30.44	96.08	44.45	188.82
3. Mehasana	15.71	11.96	22.41	62.77	112.85
4. Banaskantha	17.45	20.87	67.49	85.89	191.69
5. Sabarkantha	17.03	33.94	51.97	213.14	316.48
6. Vadodara	27.48	26.93	79.79	148.96	283.18
7. Bharuch	33.90	29.40	55.66	107.51	226.47
8. Surat	11.07	15.59	74.92	42.77	144.35
9. Valsad	-	00.82	51.26	50.42	102.50
10. Panchmahals	18.12	107.95	255.29	221.35	602.71
11. Dangs	-	-	4.42	13.56	17.98
12. Gandhinagar	-	-	-	-	-
13. Rajkot	13.27	64.05	148.36	221.77	447.39
14. Jamnagar	20.39	12.02	122.92	118.56	273.89
15. Junagadh	37.96	9.91	67.07	90.14	205.08
16. Bhavnagar	29.12	32.12	111.24	159.03	331.51
17. Amreli	21.79	11.69	71.42	128.01	232.91
18. Surendranagar	6.56	4.57	81.33	175.14	267.60
19. Kutchh	89.73	27.87	139.97	186.13	444.30
20. Survey expenditure					141.32
21. Miscellaneous					88.86
Total	410.64	567.07	1585.03	2321.57	4824.84

Source: Tribal Research and Training Institute Publication No.70, Gujarat Vidyapith, Ahmedabad, Table 1.2.

Table - 2.8

Work-wise Public Investment in Minor Irrigation in Panchmahals As in 1979 in Completed Works

Work Category	Storage capacity (in MCft)	Catchment Area (sq.miles)	Estimated Cost (Rs.in lakhs)	Irrigation Potential in Hectares
1	2	3	4	5
1. Class I MI tanks (100 hectares and above)	2752.00	207.39	248.70 (49.64)	13567
2. Class-II MI tanks (100 hectares or less)	1234.30	92.76	112.27 (22.32)	4438
3. Bandharas	96.00	28.5	1.51 (00.30)	330
4. Lift Irrigation	-	-	13.48 (02.69)	1170
5. Check dams	-	-	38.14 (07.16)	790
6. Percolation tanks	570.15	58.81	86.88 (17.34)	-
Total			500.98 (100.0)	20395

Note: Figures in brackets indicate percentages.
Source: Master Plan, Executive Engineer,MI Division,Godhra.

The investment process for these works still is continuing. To have a comprehensive view let us also look into the investment in on-going schemes and proposed schemes.

For the analysis of the problem, the study intends to adhere to the statistics supplied by the Master Plan. The basic reason for this is that, the projects will be taken up in future from among the ones which have been included in the

Table- 2.9

Investment in On-going MI Works in Panchmahals

Work Category	Storage capacity in Mcft.	Catchment area Sq.miles	Estimated cost Rs.in lakhs	Irrigation potential in hectares
1	2	3	4	5
1. Class I tanks	1586.01	117.96	538.63 (84.59)	12947
2. Class II tanks	79.43	11.52	14.63 (2.29)	307
3. Bhandharas	-	-		-
4. L.I.Schemes	-	-	52.81 (8.29)	2753
5. Check-dams	-	484.01	22.43 (3.52)	370
6. Percolation tanks	37.30	2.87	8.22 (1.29)	-
Total			636.72	16377

Note: Figures in Bracket indicate percentages.

Source: Master Plan 1979, M.I. Division, Godhra.

Table - 2.10

Investment in Proposed M.I. Works in Panchmahals

Work Category	Storage capacity in Mcft.	Catchment area Sq.miles	Estimated cost (Rs.in lakhs)	Irrigation potential (in hectares)
1	2	3	4	5
1. Class I tanks	YE	YE	860.45 (62.42)	7572
2. Class II tanks	"	"	46.79 (3.31)	255
3. Bandharas	"	"	- ~~(10.42)~~	-
4. L.I.Schemes	"	"	143.70 (10.42)	5548
5. Check dams	"	"	153.87 (11.16)	1510
6. Percolation tanks	"	"	88.00 (6.38)	-
7. Deep Tube wells	"	"	85.50 (6.2)	1425
Total			1378.31	16310

Note: YE = Yet to be estimated.
Figures in brackets are percentages

Source: Master Plan 1979, MI Division, Godhra.

Master Plan. The Master Plan spells out category-wise minor works which have already been completed, which are on going and which are feasible (tentatively) to be taken up in future. The rest of the sources may be dropped since the computation of statistics do not reveal any uniform basis. The reference to them has been made here just to highlight some relevant points.

Table 2.6 for example shows that before 1951 there were few works which exploited water from minor sources. It has to be added that the district had no major works. A reference to this has already been made in the earlier part of this section. The table further shows that the Second Five Year Plan was slack in investment. It seems that no new work was taken up during this Plan period. The committed and on-going works must have been provided with funds to enable completion. Third Five Year Plan onwards there has been a steady investment in minor irrigation in the district. By 1951 the investment in minor irrigation had created a potential command of 2725 hectares. By 1970 further investments through Plans had added another 4774 hectares of potential command.

Table 2.7 has been presented to show the share of the district in the total investment made in all the districts in minor irrigation. The district-wise figures for First and Second Five Year Plan have not been given but in the later periods it can be observed that of the total investment of the state in MI from 1961 to 1979 Panchmahals district shows

expenditure of Rs.6 crores which is top ranking among the 19 districts of the State.This amount works out to be 13% of the total investment in all the districts.

Tables 2.8, 2.9 and 2.10 which have been compiled from the Master Plan show systematically the investment figures. The figures may be considered as most reliable. Since, the category-wise investment figures have been obtained by adding the estimated costs of each and every, completed, on-going and proposed project. The actual expenditure incurred and what will be required for on-going and proposed project will definitely undergo a change but they suggest a trend which is relevant here. From Tables 2.8, 2.9 and 2.10 it can be observed that the district by 1979 had already spent Rs.5 crores in minor irrigation projects. Out of these Rs.5 crores, 50% was spent on building Class I MI tanks each of which is designed to irrigate 100 or more hectares of land in the command area. The Class II tanks and percolation tanks follow the Class I tanks with 16 and 17% of total expenditure. Bandharas are more or less like Class I tanks. It is a structure with a weir. Head works are not required for this. It is a natural set up available warranting only a marginal structure building to create storage of water. The expenditure on check-dams was about 7% and a few lift irrigation schemes built amounted to 2% of the total expenditure.

In case of on-going schemes, with an estimated cost of about Rs.6 crores, the Class I tanks assume a paramount importance. 84% of the estimated expenditure for ongoing schemes will be required to be spent on Class I tanks. The percentage to be spent on Lift Irrigation Schemes will be high relatively to the Class II tanks and other structures.

Under the category of proposed works again, the share of Class I tanks will be as high as 64%. The future Plan introduces one more scheme of Deep tube wells for which about 6% of total estimated cost of all MI works is intended to be spent. The proposed projects are in any case not final projects. The projects in this section have only been identified by the department, where preliminary feasibility stuay has been done. The Master Plan thus exhausts almost all the sites for most of the works which may be deemed technically feasible.

Increasing Costs

As per the 1979 estimates (calculated on the basis of actuals for completed works and relevant Schedule of Rates, (SOR) a total of Rs.25 crores is required for creating all the types of minor irrigation structures in the district. The costs will be obviously high in money terms by the time of completion since inflation will add to the costs; With the estimated costs as given, it is implied that, 20395 hectares of irrigation potential has already been created at the cost of Rs.3837 and 16310 hectares potential is proposed to be

created at the cost of Rs.7911 per hectare. This may means that easily accessible and feasible sites have been taken up in the earlier stages and the difficult sites have been left to be taken up as the need arises. Whether the increasing costs are comparable with the benefits that would accrue to the society is a relevant query, the answer to which is attempted in the following chapters.

2.2 Status of Minor Irrigation

It will add to our understanding if we further look into the present status of minor irrigation in the district. The Post Independence era has witnessed development of irrigation facilities in the district with possible tapping of every available source. The statistics pertaining to minor sources alone is not available at the desired level of disaggregation, hence, we shall be viewing the status of irrigation in toto from the time when data has been made available.

Table - 2.11

Area Irrigated by Sources Before Independence in Panchmahals

(Area in Acres)

Source	1918-19	1930-31	1945-46
1	2	3	4
Government Canals	960	1171	2697
Tanks	10	24	431
Wells	5379	3304	4947
Other sources	266	706	212
Total	6615	5205	8287

Source: Gazetteer of India, Panchmahals District, 1970.

The Gross cropped Area for these years were 400,120, 675,646 and 676,751 acres respectively. The area under irrigation was extremely low prior to independence. Of the total Gross Cropped Area im 1918-19 only 1.65% was irrigated. This figure slumped to a mere 0.77% in 1930-31. It improved to 1.22 in 1945-46 but did not reach the 1918-19 level.A possible explanation to this is that it was only after 1918-19, the area under crops increased substantially.This is reflected in the total gross cropped area figures.

Before independence there was no major or medium surface water source which was tapped. The Government Canals in the Table 2.11 indicate to the big tank works which were taken up in Dohad taluka (Muvalia and Futelao tanks). Whatever irrigation was being done was mainly from the minor sources. Of them wells clearly dominated. In 1918-19, well irrigation was 81%, in 1930-31, it was 63% and in 1945-46 it was 60%.The share of tanks and canals started increasing after 1918-19.

Table 2.12

Area Irrigated by Source in Panchmahals

(Area in'00 hectares)

Source	1950-51	1956-57	1960-61	1967-68
Government Canals	4	16	16	41
Private canals	5	-	-	-
Tanks	7	12	1	29
Wells	38	55	76	76
Total	54	83	113	166

Source:Gazetteer of India, Panchmahals district.

Table 2.13

Area under Principal Crops and Total Area Irrigated

1950-51 to 1967-68

(Area in 00 hectares)

Years	Total cropped area	Area irrigated	Percent area irrigated
1950-51	5504	54	0.98
1955-56	-	-	-
1956-57	6096	83	1.36
1960-61	5232	113	2.16
1967-68	5446	166	3.04

Source: Compiled from Gazetteer of India, Panchmahals District, 1970.

In the post independence era the wells continued to dominate. Of the total area irrigated in 1950-51, 1956-57, 1960-61 and 1967-68, the share of wells was 70, 66, 88 and 58 percentage respectively. The share has declined except for 1960-61 year when the tank irrigation seems to have shrinked almost to rock bottom. By 1956-57, one of the two medium irrigation project commissioned. The Patadungari Medium irrigation project commissioned by the end of First Plan with a Command of about 3000 hectares. By 1962-63 the other medium project namely Karad project also commissioned with a command of about 6000 hectares. In the initial years, the actual irrigation from these two sources was not likely to be high. The minor sources continued to dominate the total irrigation scene. The area under irrigation increased impressively by

more than 100% in 16 to 18 years (between 1950-51 to 1967-68). The development of tank irrigation was also highly significant. The area under tank irrigation wentup more than 4 times by 1967-68.

The overall irrigation picture also shows a steadily rising trend after 1950-51. For comparison purposes we have taken percentage area irrigated vis-a-vis the total cropped area for the relevant years. In 1950-51 the irrigated area to total cropped was only 0.98% which was less than the 1945-46 figure. The situation seems to have improved after 1950-51. By 1967-68 the area irrigated to total cropped area was more than 3%. The irrigation facilities were slowly extending. The tanks and other canals were gaining relative importance.

From Table 2.14 it can be observed that Wheat was irrigated more than any other crop.This being a Rabi crop, one can say that Kharif irrigation was not much upto 1967-68. For Kharif crops farmers mostly relied on rains. It is also likely that Wheat was irrigated mostly by those farmers who owned wells.This is so because the source-wise irrigation data reveals that well was the major source of irrigation.

Why not Sd. L Report

Table - 2.14

Area under Irrigated Crops : 1951 to 1968

(Area in 00 hectares)

Crops	1950-51	1955-56	1960-61	1967-68
I. Total food crops	54	86	105	154
1. Rice	4	9	7	12
2. Wheat	30	45	63	77
3. Bajri (Millet)	1	1	3	7
4. Barley	-	5	3	7
5. Maize	1	2	15	9
6. Gram	-	5	6	14
7. Sugar cane	1	1	2	1
8. Chillies	-	5	9	12
9. Ginger	-	-	-	1
10. Miscellaneous food crops	17	13	8	14
II. Total Non-food crops	-	5	7	12
11. Cotton	-	-	-	8
12. Tobacco	-	2	4	4
13. Miscellaneous non-food crops	-	3	3	-
Total	54	91	113	166

Source: Gazetteer of India, Panchmahals district, 1970.

Taluka-wise Status

It will now be desirable to have segregated picture of irrigation in general and Minor Irrigation in Particular. The district comprises of 11 talukas (administrative unit, same as Tehsil in other parts of India). The taluka-wise picture will help building an idea about the locational spread of the farmers and sources that dominate in different areas of the district.

Table 2.15

Consolidated Status of Minor Sources of Irrigation in the District

Name of the talukas	Cl.I tanks*		Cl.II tanks*		LI Schemes*		Check dams		Wells**		Energised wells	
	1967-68	1978-79	1967-68	1978-79	1967-68	1978-79	1967-68	1978-79	1967-68	1978-79	1967-68	1978-79
1. Godhra	6	7	N	14	N	-	N	4	4063	4250	350	1113
2. D'Baria	1	5	0	7	0	1	0	10	2402	6000	58	586
3. Dohad	8	10	T	19	T	2	T	9	1864	2212	41	212
4. Halol	1	1	K	12	K	-	K	6	824	1360	262	874
5. Jhalod	4	9	N	17	N	1	N	8	4154	3430	101	1126
6. Jambughoda	-	2	0	3	0	-	0	2	690	900	38	213
7. Kalol	-	-	W	15	W	1	W	3	1130	1450	287	1167
8. Lunawada	7	10	N	11	N	-	N	14	3103	5910	94	2884
9. Limkheda	-	2	N	3	N	-	N	13	3120	4350	50	461
10. Shehera	2	4	0	9	0	-	0	8	3458	4934	123	647
11. Santrampur	1	5	T	7	T	-	T	2	4273	7354	95	894
Total	30	55	NK	117	NK	5	NK	79	29081	42150	1499	10177

Source: 1. Panchmahals Gazetteer. 2. Master Plan, M.I. Division.
3. DSO's Publication: District Statistical Abstract, 1976-77-78-79.

* Definition of these works are given in glossary in Appendix VII, Chapter III.

** Wells include Masonary and non-masonary both.

Table 2.15 reveals that by 1978-79 there were 55 class I irrigation tanks, 117 Class II tanks, 5. L.I. Schemes, 79 check-dams, 42150 wells with 10177 of them energised. The tribal talukas- Godhra, Kalol, Halol, and Lunawada top the list in wells and energization. These areas are predominantly non-tribal. With plain area and little undulation, better texture and fertility status. Lunawada and Godhra also have good number of tanks with bigger size that are used for irrigation purposes. By source these four talukas are relatively well placed. With regard to Class II tanks and checkdams, the talukas - Dohad, Limkheda and Jhalod are better placed in relative terms. The district as a whole also has a large fleet of Class II irrigation tanks. These tanks, which have a maximum command of 40 hectares each, are almost non-functioning. Majority of them were built at the time of scarcity when the technical feasibility and economic viability are not carefully apparaised. The management, too, is a factor in the gross non-utilization. The taluka Panchayats are supposed to maintain and operate these tanks. The Panchayats do not have enough funds for the purpose.

With regard to minor irrigation sources therefore, the position is that Class I tanks are used for irrigation wherever they have been located and secondly, the wells energised or otherwise masonary or non-masonary are tapped for watering the fields.

The latest data available on area irrigated by source and area under irrigation are for the year 1974-75.

Table - 2.16

Area Irrigated by Source and Area under Irrigation in District: 1974-75

(Area in Hectares)

Name of the talukas	Sources					Area Irrigated				Total Gross cropped area
	Canal	Tank	Wells	Others	Total	Total area irriga-ted	Total cereals	Other edibles	Total non-edible	
1	2	3	4	5	6	7	8	9	10	11
1. Godhra	-	412	2990	110	3512	3512	2067	340	1105	63191
2. D'Barida	370	25	431	-	826	826	398	67	361	63232
3. Dohad	1650	70	722	25	467	2517	2195	275	47	62594
4. Halol	-	184	873	-	1057	1057	602	219	236	32876
5. Jhalod	-	1915	2305	147	4367	4417	4133	239	45	53825
6. Jambughoda	-	10	264	-	274	274	217	7	50	6319
7. Kalol	1340	20	2233	20	3613	4939	3736	178	1025	30836
8. Lunawada	170	395	5675	80	6320	6320	4541	299	1480	57211
9. Limkheda	-	-	421	-	421	421	303	85	33	45737
10. Shehera	-	105	1230	-	1335	1375	1047	95	233	28713
11. Santrampur	559	97	1043	107	1806	1806	1274	400	132	77579
Total	4089	3233	18187	489	25998	27464	20513	2204	4747	522131

Source: Compiled from District Statistical Abstract: 1977-78-79.

Table 2.17

Area Irrigated by Source and Crop Area under Irrigation: 1974-75 in the District

(% to total area)

Name of the taluka	Canal	Tank	Wells	Others	Total	Total area irrigated	Total cereals	Other edible crops	Non-edible crops	% area irrigated source wise data to total GCA	% area irrigated by crops to GCA
1	2	3	4	5	6	7	8	9	10	11	12
1. Godhra	-	11.73	85.13	3.14	100	100	58.86	9.68	31.46	5.56	5.56
2. D'Baria	44.79	3.02	52.19	-	100	100	48.18	8.11	43.71	1.31	1.31
3. Dohad	66.88	2.84	29.27	1.01	100	100	87.21	10.93	1.86	3.94	4.02
4. Halol	-	17.40	82.60	-	100	100	56.95	20.71	22.34	3.22	3.22
5. Jhalod	-	43.85	52.78	3.37	100	100	93.57	5.41	1.02	8.11	8.21
6. Jambughoda	-	3.65	96.35	-	100	100	79.19	2.60	18.21	4.34	4.34
7. Kalol	37.08	0.55	61.82	0.55	100	100	75.64	3.60	20.76	11.72	16.02
8. Lunawada	2.69	6.25	89.79	1.27	100	100	71.85	4.73	23.42	11.05	11.05
9. Limkheda	-	-	100.00	-	100	100	71.97	20.19	7.84	0.92	0.92
10. Shehera	-	7.87	92.13	-	100	100	76.15	6.91	16.94	4.65	4.79
11. Santrampur	30.95	5.37	57.75	5.93	100	100	70.54	22.15	7.31	2.33	2.33
Total	15.73	12.43	70.00	1.84	100	100	74.69	8.02	17.29	4.97	5.26

A comprehensive view is obtained by displaying the figures for this year.

Tables 2.16 and 2.17 reveal the following things :

1. Area under irrigation in the district has increased very slowly. We have seen that in 1950-51 area irrigated was 0.98% of the total cropped area. This went upto 5.26% in 1974-75. Assuming unchanged cropped area this overall increase would imply an annual increase of 0.21 per cent.

2. Between 1950-51 and 1974-75 the dominance of wells did not decrease. It was 70 per cent of the total area irrigated in both the years.

3. Next to wells, Canals have been irrigating more area than the tanks. In 1950-51, area under canal irrigation was about 16% of the total area irrigated and area under tank irrigation was about 12%. In 1974-75, the position is almost the same. It appears from the above statistics that the increase in potential area brought under irrigation via different sources has been proportionate.

4. Cropping pattern seems to have registered significant change between 1967-68 to 1974-75. Between 1950-51 and 1967-68 the change was small but important. In 1950-51 entire irrigated area was under food crops (table 2.14). By 1967-68 about 8 percent of the irrigated area was under non-food crops. By 1974-75 this figure went upto 17 per cent.

5. The shift in cropping pattern cannot be attributed to any particular source. Area under non-edible crops is lower in Dahod, Jhalod, Limkheda and Santrampur talukas. Each of these talukas have different major sources of irrigation. Dahod taluka has dominating Canal irrigation, Jhalod has more of tank irrigation, Santrampur again has substantial irrigation though wells and Limkheda has only well irrigation. On the other hand Devgadh Barida taluka which records highest proportionate area under non-food crops is irrigated mainly be Canals and wells. Similarly Kalol with 20.76 per cent of area under non-food crops is irrigated mainly by wells and canals.Godhra, Halol and Lunawada where area under non-food crops is above 20 per cent, wells contribute more than 80 per cent to the total irrigated area.

However, a point of distinction is that the first four talukas mentioned above namely Dahod, Jhalod, Limkheda and Santrampur are tribal talukas. It is likely that it is population specific response to irrigation that tribals have continued to grow food crops with irrigation. If this be true then Devgadh Baria again a tribal taluka stands as an exception with highest percentage of area under non-food crops.

No single factor, therefore, can be held responsible for bringing a change in cropping pattern. In semi-arid regions crop choices are typical for each year depending upon the start of the monsoon and total rainfall received. The crop choices in

Rabi season largely depend on how kharif season comes through. Percentage of total area irrigated to the total gross cropped area is also a relevant variable that may explain changes in cropping pattern. Further, each source of irrigation responds differently to variations in rainfall.

For instance, the share of tank irrigated area seems to be relatively lower in spite of the fact that potential created by them is higher than the actual area irrigated. The district at the time of study had 30 class 1 MI tanks that were completely operational. Of these 21 tanks were functioning in 1974-75. The potential created in these 21 tanks was 11,508 hectares. If we assume that no other class I and Class II tank provided irrigation in 1974-75 except these 21, the utilization works out be roughly 30 per cent (Tanks irrigated 3233 hectares table 2.16). If the tanks irrigated at full potential level, the share of tank irrigation would have definitely gone upto higher level.

The inference that one can draw from the above situation is that importance of tank is reduced due to its non and underutilization. Further as it is evident from earlier discussion, the district is poised for a substantial investment in minor irrigation sources - especially the tanks (refer tables 2.9 and 2.10). Is it that non- and underutilization of tank facility surfaces because variations in rainfall? Is it that command farmers of tanks do not respond to the water supply and change their cropping pattern? These are some of the questions which warrant detailed examination. In the subsequent chapters we concentrate our discussion on these issues.