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Agriculture and Irrigation Development in Gujarat: Special Reference to North Gujarat

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ABSTRACT

North Gujarat is naturally endowment with one of the richest alluvial aquifer of India, A study carried out four district in North Gujarat, Banaskantha, Sabarkantha, Mehsana, and Patan. In these districts uncontrolled exploitation for irrigation has resulted in many undesirable Consequences, in these areas estimated that 60 percent of the net farm output generated through groundwater use in agriculture .Tubewell irrigation Supports of the farming in Cropping Pattern, But this is despite the fact that tube well irrigation costs have increases rapidly with depleting water tables . Irrigation areas have increased steadily, even more precariously dependent upon sustainable groundwater management.

1. Introduction

The position of agriculture in the economics of the developing countries of the world is very important and strategic. The contribution of agriculture in the total domestic production of the countries is the heighest and majority of the population and engaged in the agricultural sector either as a farmer on agricultural labourers or workers. The agriculture sector also provides food to the entire population. Moreover, development in the agricultural sector is also important for industrial development as crop like Jute, Oilseeds, beet, sugarcane, cotton, etc. are the raw materials for some important industries. Thus development in the agricultural sector is necessary pre condition for industrial development. The contribution of the agricultural sector in the total export of the country is also significant. In any economy, the basis for agricultural development lays in the changes in the cropping pattern, and level of productivity of various crops, in addition .soil and its types also affects crop productivity.

The state economy is dependent upon agriculture and so the agricultural sector should be effective and development .Water is very much essential for irrigation of crops for agricultural development. There are two sources of water – one is rain water which is available in a natural way and second is through irrigation facilities. The first source i.e. getting water for irrigation through rain is irregular and uncertain and there for irrigation becomes an important factor for crop protection and production. Thus, irrigation is an important input in the development of the agricultural sector.

The area of Gujarat can be classified in to four groups- **1**.North Gujarat 2**.** South Gujarat 3. Central Gujarat 4. Saurashtra and Kutchchh. The rain is uncertain in Gujarat. sometimes there is drought in some parts of North Gujarat and Saurashtra.In 1981, 60 out of 184 talukas were declared as drought affected by the irrigation Commissioner .Agricultural development is impossible without irrigation in areas having in sufficient rain and in areas having no rain at all.

2. Contribution of Irrigation

The Contribution of irrigation in development of agriculture is important in many ways. As the volume of land is limited, in areas having shortage of land .it is necessary to take two or more crops by intensive cultivation. At the same time , it is necessary to use chemical, fertilizers, insecticides etc. to achieve higher Productivity. which is impossible without irrigation. Moreover ,irrigation is important in the context of requirement of food grains and other commodities .As the irrigation facilities expand the area under high valued superior cereals and cash crops increases and thus a Proper cropping pattern .In order to increase productivity irrigation is an indispensable input for the use of neatly improved and hybride varieties of seeds. In parts of country where population pressure is high, irrigation becomes important, as it is possible to increase employment in agriculture through irrigation further irrigation may become an important factor directly and indirectly for livestock, development by increasing the production of required food and fooder. In short irrigation is important and indispensible tool for agricultural development. All these things flip interesting this paper study on **"Agriculture and Irrigation development in Gujarat: - Special reference to North Gujarat."**

3. Study Region

The Study area is Bounded North Gujarat and Covered Four Districts, Banaskantha, Sabarkantha, Patan, and Mehsana.

4. Objectives of the Study

The Specific Objectives of the study are:

1. To examine the trends of irrigation development in Gujarat Both at the North Gujarat level as well as District level as a whole.
2. To see the factor that influencing Agriculture and Irrigation Development in Gujarat.

5. Data Sources and Methodology

The study is based on secondary data. Data on Irrigation, Gross Area Irrigated, Net Area Irrigated, Irrigation Potential Utilised, Food grain production and area under irrigated were

compiled from various issues of Economic and Socio of Gujarat, Irrigation Reports. Economic Survey of Gujarat, Literature for exiting studies will be taken from sources .The Study Period is restricted to only last 10 years. Simple statistical tools is examines the trends of irrigation development in Gujarat

6. Organization of the Study

The Study has been divided in to three parts including introduction. The second parts deals with review on the studies on irrigation development. Third parts analysed the growth of irrigation development in North Gujarat and at last part deals with main findings with Summary and Conclusions.

7. Irrigation Profile of Gujarat

Irrigation is a precondition to the adoption of the so called green revolution technology of high yielding seeds, fertilizers and irrigated area typically has more active and year round labour markets, offering more employment, Opportunities at a higher wage rate compared to dry farming areas (Shah and Singh, 2004 PP-167-68)

Table: 1
Source wise Irrigation Potential and Its Use (in Lakh Hectares)

Sr.No.	Item	Ultimate irrigation Potential	Irrigation Potential Created Up to June: 2017	Maximum Utilization up to June: 2017
1	2	3	4	5
1.	**Surface water**	**48.11**	**43.60**	**29.76**
1.2	Major & Medium Irrigation Schemes including direct benefits of Sujlam Suflam spreading Canal , Bandharas of Kutchchh district and Big Check Dam Of Surendranagar Dist.	18.06	17.35	13.37
1.2	Sardar Sarovar Project	17.92	14.18	6.28
1.3	Minor Irrigation Scheme	2.57	2.57	1.65
1.4	Indirect Benefits through Minor irrigation works Such as percolation Tanks, safe stage etc.	2.66	2.61	1.64
1.5	Indirect Benefits through Check Dams	6.9	6.9	6.9
2.	**Ground water** (Ground water Tube wells & Others)	**20.04**	**20.04**	**19.93**
	Grand Total (1 and 2)	**68.15**	**63.64**	**49.69**

Source: Socio-Economic Review, Gujarat State, Gandhinagar, 2017-18.

Irrigation facility is an important factor for increasing agricultural production. The Surface water irrigation potential has been estimated to be 48.11 Lakh hectares, which includes 17.92 Lakh hectares of irrigation potential of the Sardar Sarovar (Narmada) Project. Ground water is not available in sufficient quantity in the State. Not only this but it has been totally absorbed in some parts of the State, an environmental imbalance has been created. In this context prevention of absorption of ground water should be considered as an important requirement and steps should be taken in this direction, and this will be possible only when Surface water Sources are developed rapidly. How far the State has been able to utilize the potential of surface water and Ground water sources in indicated in Table :1.This table shows that by June :2017,including17.92 Lakh hectares of land to be irrigated by Narmada Project. The total Potential of the Surface water is estimated 48.11 Lakh hectares .we are aware of the fact irrigation is important for increase agriculture production However, the quantum Of ground water sources is limited in the State and as it has been used haphazardly in some parts of the State, there have been serious environmental Problems. Under these circumstances. It is Necessary to stop use only alternative surface water efficiently and increase its availability in Table: 1

8. Growth of Irrigation in Gujarat

The growth of study period of Net Sown Area Net Irrigated Area and Gross irrigated Area, since 2001 -02 to 2014-15 is shown below.

Table: 2 Trends of Net sown area, Net irrigated area and gross irrigated area During Period
(Area in '00 hectares)

Year	Net Sown Area	Net Irrigated Area	Gross Irrigated Area
2001-01	96779	29944	35728
2002-03	94814	36362	36370
2003-04	98515	33875	41112
2004-05	97469	35276	42698
2005-06	97222	39074	47642
2006-07	98009	42376	52787

2007-08	99658	42333	56141
2008-09	95891	33779	55905
2009-10	99192	43342	59598
2014-15	96184	44326	71054

Source: Directorate of Economics and Statistics, Government of Gujarat.
Irrigation in Gujarat: 2017-18

From the Table: 2 the above facts are evident, during the period the decrease in production was mainly due to decrease in Net Sown Area. But increase in Net Irrigated Areas and Gross Irrigated Areas also increased production.

Table: 3
Percentage distribution of GIA by District (Study Areas) And District wise GIA of percentage of GCA (2009-10 to 2014-15)

Sr.No.	District	G.I.A. in % of G.I.A. in the State		G.I.A.as % of G.C.A.	
1	2	3	4	5	6
		2009-10	2014-15	2009-10	2014-15
1.	Banaskantha	10.25	12.24	59.37	71.70
2.	Mehsana	5.19	5.65	62.89	76.46
3.	Patan	2.68	2.99	32.34	47.49
4.	Sabarkantha	6.32	3.95	58.75	73.42

Source: Directorate of Economic & Statistics, Government of Gujarat.
Irrigation in Gujarat: 2017-18

The above Table: 3 show the gross Irrigated area in Banaskantha district in 2009-10, 10.25 percentages and increase 12.24 percentages in 2014-15. The Gross crop area increase From 59.37 Percentage to 71.70 Percentage, In Mehsana District Gross Crop Area is 62.89 percentage to 76.46 percentage, Patan District has 32.34 Percentage to 47.49 percentage in 2014-15.We can see the G.I.A. Increased in North Gujarat's Districts. Its reason that there are a large number of reservoirs constructed in North Gujarat. Mainly in the basins of Sabarmati, Banas and Saraswati. Recorded for three reservoirs in North Gujarat, namely Hathmati, Meswo and Dantiwada (G.O.G.1989).

Table: 4
District wise Source of Irrigation (in %)

Sr. No.	District	Canal	Tank	Well including tube well	Other Sources	NIA '00 hectares
1.	Banaskantha	4.30	0.63	16.45	1.65	3143
2.	Mehsana	4.14	3.48	6.35	4.32	2686
3.	Patan	2.16	0.54	3.16	4.30	1264
4.	Sabarkantha	1.70	0.18	4.39	6.54	1586

Source: Directorate of Economics & Statistics .GOG.
Irrigation in Gujarat 2017-18.

In the State the total No. Of 4488 and 4488 tube wells have been completed during the year 2012-13 and 2013-14 respectively. Whereas the total of. 58365.24 hectares and 84122 hectares have been irrigated for the same period (Irrigation in Gujarat 2017-18, PP-40).

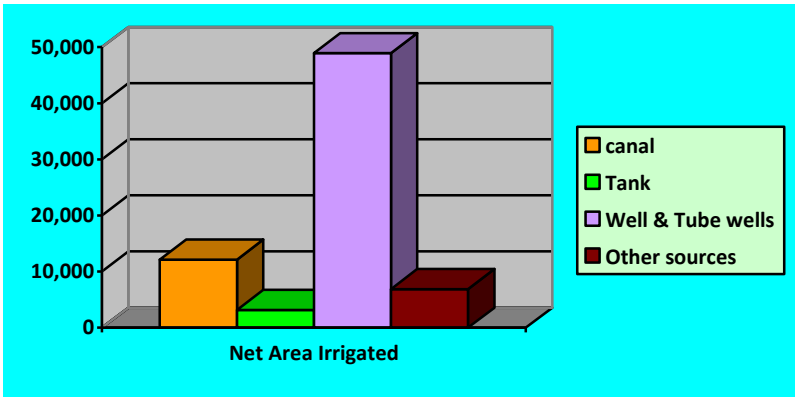
During the year 2012-13 and 2013-14 the Maximum tube wells 1025 have been completed for the both years in Banaskantha in this period well including tube wells were 16.45 percentage in this district and In patan district has using 3.16 Percentage of Tube wells and Sabarkantha district 4.39 Percentage source of irrigated area by Tube wells but canal and tank using very less in these North Gujarat's Districts.

The above Table: 4 shows the NIA in North Gujarat by sources through the government facilities and private Tube well. very different system of irrigation water distribution. It can be noted that the NIA by source in Banaskantha is increased by well and including Tube wells. Source of canal has 4.30 percentage in hundred hectares in 2017-18. The Geo hydrological conductive to artificial recharge of ground water. Total NIA in Banaskantha is very highest among the other district of North Gujarat. Mehsana, Patan and Sabarkantha there are no sufficient irrigated Source.

Table : 5 Total Net Area Irrigated By Sources 2014-15 (Area in '00 Hectares)

No.	Source	Net Area Irrigated
1.	canal	12,113
2.	Tank	3,160
3.	Well & Tube wells	48,916

4.	Other sources	6865



Source: Directorate of Economic & Statistics, Government of Gujarat.
Irrigation in Gujarat: 2017-18

Above the Table: 5 and chart, we see the Tube wells are main Source of irrigation for the State. The district wise and Source wise Information about from which irrigation water supply , Area of Irrigated, Net Area Irrigated through sources are provide in Table :4. For the Year 2017-18.It is interesting to Note that the Banaskantha district has highest Tube well in the state. The crop wise, season wise are irrigated by tube well is also Collected by the Gujarat State Water Resources Development (GSWRDS) in the state of information is provide for the Year 2015-16- irrigation in Gujarat.

Table: 6 Crop wise and Area Irrigated by Tube Wells

No.	Crop	Years (Unit Hectares)				
		2012-13	2013-14	2014-15	2015-16	2017-18
1.	Cotton	7722.05	7806.90	6339.9	5879.7	5562
2.	Tobacco	4952.00	4163.00	6707.85	4967.2	4881
3.	Wheat	5955.59	6478.95	5248.45	5209.15	5140
4.	Paddy	2376.47	2191.30	2652.00	2417.9	2104
5.	Vegetable&Pluses	4296.29	4338.90	3574.68	4275.9	4094
6.	Jowar/Bajri/Maize	10461.87	11301.25	10685.58	11046.04	9539
7.	Oil seeds/Ground Nuts	10528.72	7568.29	7679.83	8742.9	6698
8.	Ground Nuts	252.85	355.35	123.00	208.00	501
9.	Other Crops	5742.40	4500.50	4703.6	5417.85	5108
10.	Total perennials Crops	6077.00	5031.90	4220.96	4454.46	3540
11	Total All Crops	58,365.24	53,736.34	52,435.95	52619.3	47167

Source: Gujarat Water Resource Development Corporation Ltd. Gandhinagar.

Examining figures on crop wise irrigated area by Tube wells, one find that except Ground nut, the irrigated areas by tube wells under all the crops have decreased in 2017-18 as compared to 2012-13. During this periods, the irrigated areas by tube wells under total all crops has decreased from 58,365.24 to 47,167 hectares in 2012-13 to 2017-18 respectively.

9. Agricultural System of Study Area

The problems of saline land in Gujarat are found not only in Central Gujarat and the Coastal areas of kuchchh but also in the other areas. The main reason for spread of salts in the land is that as the most of the rivers of Saurashtra and North Gujarat areas are not perennial rivers, water is not recharged moreover, as more quantity of underground salt is absorbed, according to one estimate salty water of sea has spread to about 1,65,000 hectares of land, about 13Lakh farmers are adversely affected, due to spread of salt in the land. More than 800 villages of the state are affected; the farmers of Gujarat are incurring a huge financial loss due to damage to crop. Same way, in the North Gujarat Simi –Arid and in the absence of major surface irrigation schemes, cropping is mainly governed by access to Ground water supplies. Tube wells Operated By submersible Pumps are the most common sources of irrigation broadly, The area has three cropping season, Winter (November to February).Summer(March to June) and Kharif (July to October) .

Table: 7
Crop wise, District wise which account for large proportion of irrigated Area under Main Crop 2014-15
('00 Hectares)

No	District	Banaskantha		Mehsana		Patan		Sabatkantha	
	Crops	Irrigated area	**%**	Irrigated area	%	Irrigated area	%	Irrigated area	%
1	Oil seeds	3150	36.21	1083	26.97	703	33.14	439	15.65
2	Rapes & Mustard	1390	15.98	198	4.93	663	12.45	-	-
3	Bajri	1359	15.62	-	-	-	-	-	-
4	Fooder crops	1097	12.61	815	20.30	-	-	107	3.81
5	Wheat	886	10.18	630	15.69	370	17.44	918	32.72
6	Cotton	-	-	551	13.72	285	13.44	861	30.68
7	Condiment Spices	-	-	-	-	416	19.61		
8	Groundnut	-	-	-	-	-	-	93	3.31
9	Other Crops	818	9.40	738	18.38	83	3.91	388	13.83
10.	Total all crops	8700	100	4015	100	2121	100	2806	100

Source: Irrigation in Gujarat (2017-18)

The above Table: 7 indicate the crop wise and district wise irrigated area and its percentage during the 2014-15; the area under oilseeds in the North Gujarat, In Banaskantha district has 36.21 percentages of total irrigated area and very less in other Crops. In the Mehsana district has also under irrigated area in Oilseeds, In Sabarkantha district the main crops is Wheat which is 32.72 percentage and cotton in 30.68 percentage of total irrigated area. There are various Cropping pattern in North Gujarat's districts .The farmers grow Oilseeds, wheat, cotton. groundnuts grows only Sabarkantha district and Condiments spice grows only Patan district .Bajri grows only Banaskantha district which is 15.62 Percentage of irrigated area. Cropping system of the districts comprises food crops, cash crops, and fooder crops. Cropping pattern differs across the all seasons. It also various across the region, the most important deciding factor being availability of ground water. Some parts of the districts have experienced major shifts in cropping pattern over time. The shift is from water intensive crop to less water intensive varieties area under food crops has remained more or less the same over the period in all districts. The cropping pattern shift has been characterised by a expansion in area under cash crops.

10. Main Problems of Irrigation Development in Gijarat and Factor Responsible for these Problems

1) Climate and Rain Fall:

In Gujarat, during most of the year the climate is found to be hot. Of course due to the Arabian sea and the bay of Khambhat in the west. The climate in those regions is less hot. That is to say, normally the climate in the western coastal of the state is quite pleasant and healthy. The climate and rainfall in the various areas of the state may be describes as follows;

(A) In Jamnagar, Rajkot, Kuchchh and Surendranagar district ,the climate is very dry, average the average temperature in a year in these areas is above18°C.while the average rainfall is less than 50 C.ms.

(B) In Vadodra, Bharuch, Surat, Valsad and Dang districts in the South eastern parts of the State, The average temperature in the 10 Months except December and January is more than 20° C. in these area the average rainfall is above 100 C.ms. rain fall has been recorded in these areas.

(C) In the remaining districts Junagadh, Bhavnagar, Panchmahal, Banaskantha, Mehsana, Patan, Sabarkantha, Amreli, Gandhinagar, Kheda and Ahmedabad the average temperature in the 10 months is found to be more than 20°C. and the average rainfall is between 50 to 60 Cms.

2) Problem of saline Land :

The problem of saline land in Gujarat is found not only in central Gujarat and the Coastal areas of Kuchchh but also in the other areas. The main reason for spread of salts in land is that as the most of the rivers of Saurashtra and North Gujarat's areas are not perennial rivers, water is not recharged, moreover quantity of underground salt is absorbed, according to one estimate salty water of sea has spread to about 1,65,000 hectares of land, as a result about 13 Lakh farmers are adversely affected. Due to spread of salts in the land more than 800 villages of the State are affected. The farmers of Gujarat are incurring a huge financial loss due to damage crops, in these circumstances.

3) Institutional factor :

Irrigation facilities in Gujarat are very Poor assured and controlled water supply for agricultural land is particularly important in the Gujarat where rain fall distribution is not even and crops transpiration rates is very high in winter, but adoptions of modern inputs such as irrigation utilisation among the development .Thus the volume of agricultural finance for farmer is adequate and in the absence of large scale credit facilities. adoption of modern technology cannot grow satisfactorily.

11. Finding from the study

From the point of view of irrigation and agriculture in North Gujarat.

1. The North Gujarat alluvial area has low rainfall. but has good topography condition of recharge and ideal condition of aquifers, with rich groundwater reservoir. In fact, this storage has supported thousands of tube wells and wells for more then 5 decades in this region.
2. But the rapid loss of groundwater resources in the region for salinity in water. The most quality problems are pertaining to excessive salinity and excessive fluoride in water. Mehasana has the highest proportion of such villages (28.78) Percentage, followed by Banaskantha (24.8) Percentage salinity and fluoride is Observed in almost all districts of State. (Indira hirway)
3. Over exploitation and consequent deplation of Tubewell and well has led to sharp rise in the cost of well irrigation, but the farmers are able to off set the income losses through expansion in area under irrigation, which is enable by a technology shift from dug-well irrigation to Tube well irrigation.

12. Conclusion

To conclude, in the area under investigation, agriculture and irrigation are highly dependent on availability of the access to groundwater. The private returns from well and Tube well irrigation are sufficient in the study areas of North Gujarat's Districts of Banaskatha, Mehsana, Patan and Sabarkantha. The economic value of Ground water use in agriculture, expressed as the size of ground water economy of the areas. The Lion's share of the Net area irrigated and output generated through groundwater-tube well use in agriculture, not a surface irrigation by Canal, tank and other sources. The ground water irrigation also contribution in agricultural cropping pattern. However development of Ground water and changes in water table condition has led to a sharp increase in the cost of irrigation, resulting in reduced economic returns from farming. A farmer of North Gujarat's able to sustain irrigated production because subsidised electricity availability in the farm sector.

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