



Structural Changes In Agricultural Economy of Gujarat, India: Irrigation and Cropping Pattern Aspects

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ABSTRACT

This paper assesses the structural changes in economy of state of Gujarat, India and precisely focusing on the aspects of irrigation and cropping pattern. The study covered the post green revolution period from 1950-51 to 2013-14. The structural changes at the major sectoral level are examined in terms of the variation in the shares of sectoral output in the total output of the state. In this paper, the analysis is carried out terms of the changes in total gross cropped area and the trend in different sources of irrigation in Gujarat are analyzed of using compound growth rates. I find that the agriculture is the major sub-sector in the primary sector and the structural changes that have been taking place in the state economy in may have an impact on this sub-sector and on the livelihoods of the rural masses. However, the research results exhibits that the increasing ground water irrigation leads to declining ground water table and environmental degradation to the state. In addition, the cropping patterns shifts have been taking place in the state is favorable to the small and marginal farmers because the capacity of invest and risk bearing of the farmers are low.

Keywords: - Agricultural economy
- Irrigation
- Cropping pattern
- Gujarat

Historically, the growth of the economics has been associated with the structural changes. The most common structural changes followed a sequence of shift from agriculture to industry and then to services. This pattern has also been observed across the countries with different levels of development. Today's developed countries follow the common pattern of steadily declining share of agriculture in the total output, increasing share of industry for a considerable long period and a steadily increasing share of

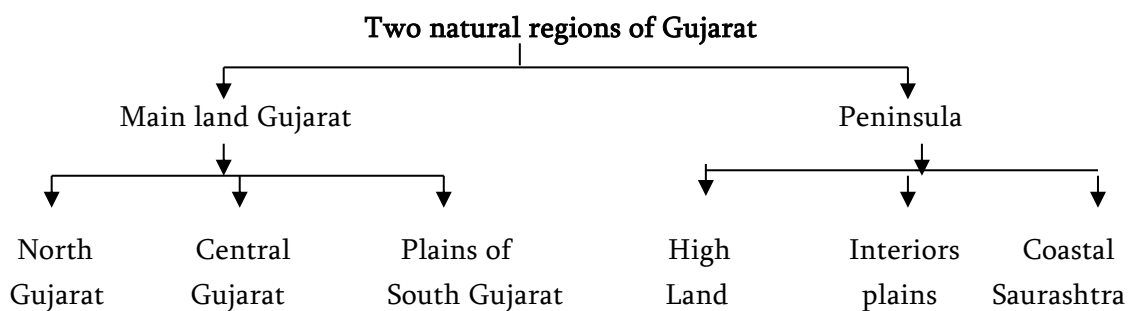
services although. The economic development in India during the last 50 years seems to have followed more of less the same structural changes. However, the most striking feature of the structural changes of the Indian Economy in recent decades has been the preeminence of services sector as the major contributor to growth. Industry particularly manufacturing which has been observed historically as the main contributor of economic growth at least, in the initial period of economic growth has played only a minor role in India's economic growth in recent years. Observing this phenomenon, the question has been raised whether India is on the way to become a post-industrial service economy without industrialization? whether such a pattern of growth and development in the Indian economy sustainable? what are its implications on the distribution of income and poverty? Many studies examined these aspects at the all India level, as India is a country with large variations in climatic condition, resource base and social and cultural atmosphere, Observations at the all India level may be different from those at the state level, hence the state level studies assume importance.

Gujarat is predominantly a resource poor small farm agricultural economy. The pattern of structural changes observed at the all India level may also be followed in the state economy. It May have implications for the living conditions of rural masses and rural poverty.

In this paper an attempt has been made to examine the structural changes in the economy of Gujarat. In general and the structural changes in agricultural economy particular focusing in aspects irrigation and cropping pattern.

Regional Geography of Gujarat

Gujarat is one of the western states of India. It is located in the western part of India, between 20°-1 and 24°-7 North longitudes and between 68°-4 and 74°-4 east longitudes. Gujarat has the Arabian Sea on west and south Pakistan in the North west, while Madya Pradesh is in the east, Rajasthan in the North and South east and Maharashtra in the south and south west.



There are three types of mainland Gujarat: North Gujarat, Central Gujarat and Plains of South Gujarat which are spread in the Valley regions of Mahi, Narmada and Tapi rivers. These rivers flow from east to west and meet the Gulf of Khambhat, in the North, eastern direction of the mainland Gujarat. There are Arvalli mountain ranges with heights of about 150 to 319 mts. These ranges are spread up to the right of Narmada River in the south

In the eastern side of the mainland Gujarat, there are Satpura mountain ranges. Which have Heights between 150 and 243 mts. These mountain ranges separate Gujarat from the western Khandesh of Maharashtra and divides water of Tapi and Narmada in two parts. Tapi, Narmada, Mahi and Sabarmati rivers flow through the alluvial plains of these mountain ranges. Pavagadh is situated in the Panchmahal district in the alluvial Plains of Gujarat with a height of about 329 mts. Moreover, there are small hills in the plains of Rajpipla (Narmada) district.

The Perminsula Gujarat can be divided into three parts, (1) High land (2) Interior plains and (3) Coastal Saurashtra regions. In the central high land rivers like Machchhu, Shetrunji, Bhadur, Demi, Bambhan, Ojat, Kalubhar, Ghelo and Bhogavo flows through various parts of Central Gujarat or towards the Arabian Sea or the moreover in some areas of Saurashtra which are known as coastal region are various types of hills that are different from each other. The northern part of Saurashtra is attached to Kachh region where there are muddy plains that have come into existence due to tides in the sea and also large area of saline land.

The Method and Source of Data:

This study is mainly based on the secondary sources of information obtained from the various issues of statistical Abstract of Gujarat, published by Bureau of Economic and Statistical Govt. of Gujarat. The study covers the post green revolution period from 1950-51 to 2013-14 the area under crop and irrigation. There had been shifts in the various crops grown in the state. The structural changes at the major sectoral level are examined in terms of variations in the shares of sectoral output of the state. In this study trends in growth of area under irrigation by types of sources and Gujarat are analyzed of compound cropping pattern.

In this paper is organized as follows, the section 2 outlines the regional geography of Gujarat, Sector 3 describe the structural changes in economy of Gujarat, Section 4 describe the structural changes in agricultural sector irrigation on and shift in the cropping pattern, followed by section last conclude the major finding of the study.

Structural changes in Economy of Gujarat

As per the CSO methodology estimating the state income, the economy consists of three major sectors viz.. Primary sector, Secondary sector and tertiary sector. The Primary sector consists of sub-sectors, agriculture and livestock, forestry and logging, fishing. Secondary sector consists of the sub-sectors, mining and quarrying, registered and unregistered manufacturing, electricity gas, and water supply, and constructions. The tertiary sector consists of the sub-sectors, trade, hotels and restaurants, railways transport, other means of communication, banking and Insurance, real estate, ownership of dwelling, public administration and other services. The estimates of the shares of these major sectors and sub-sector in the output are presented in Table 1.

Table- 1
Sectoral Shares of Net State Domestic Product at Constant (2004-05) Prices
(Percentage Distribution)

Sr. No.	Industry Group	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
1	Agriculture, Forestry & Fishing	17.7	19.2	17.5	17.0	14.7	12.5	13.9	14.2	12.1	13.3
1.1	Agriculture	14.4	16.2	14.7	14.5	12.3	10.3	12.0	12.4	10.3	11.5
1.2	Forestry & Logging	2.6	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.4	1.3
1.3	Fishing	0.7	0.8	0.7	0.6	0.6	0.6	0.5	0.4	0.4	0.4
2	Mining & Quarrying	3.4	3.0	2.7	2.5	2.1	1.9	1.8	1.7	1.5	1.4
	Sub-total: Primary	21.1	22.2	20.02	19.5	16.9	14.4	15.7	15.9	13.6	14.7
3	Manufacturing	23.4	23.7	24.5	23.8	23.4	27.3	24.8	23.6	23.4	21.8
3.1	Registered	17.1	17.7	18.3	17.5	17.4	21.4	19.1	18.3	18.4	17.4
3.2	Un-registered	6.2	6.0	6.2	6.3	6.0	5.9	5.7	5.3	5.9	4.4
4	Electricity, Gas & Water Supply	1.5	1.4	1.4	1.2	1.4	2.5	2.7	2.5	2.6	2.5
5	Construction	7.4	6.8	6.8	8.3	9.3	8.2	7.8	8.5	8.8	9.1
	Sub-total: Secondary	32.2	31.9	32.7	33.2	34.1	38.1	35.3	34.6	34.8	33.4
6	Trade, Hotels & Restaurants	18.6	18.7	19.5	19.9	19.9	20.2	21.4	21.3	22.3	22.3
7	Transport Storage & Communica.	6.9	6.7	7.0	7.2	8.1	8.1	8.5	9.1	9.6	10.1
7.1	Railways	0.7	0.6	0.6	0.5	0.7	0.6	0.6	0.7	0.7	0.8
7.2	Transport by other means	4.6	4.4	4.5	4.3	4.7	4.3	4.2	4.3	4.4	4.3
7.3	Storage	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04
7.4	Communica.	1.6	1.7	1.9	2.3	2.7	3.1	3.6	4.0	4.4	5.0
8	Financing Insurance, Real estate and Business services	12.8	12.6	12.9	12.8	13.3	11.9	12.1	12.3	12.9	12.7
8.1	Banking & Insurance	6.5	6.7	7.1	7.4	7.8	6.9	7.4	7.8	8.3	8.2
8.2	Real estate, Ownership of Dwellings Business Services	6.4	5.9	5.8	5.5	5.6	5.0	4.7	4.5	4.7	4.5
9	Community, Social & Personnel Services	8.4	7.9	7.7	7.4	7.7	7.3	7.0	6.9	6.9	6.8
9.1	Public Admn.	3.0	2.8	2.9	2.7	2.9	2.9	2.6	2.5	2.5	2.3

9.2	Other Services	5.3	5.1	4.8	4.7	4.8	4.5	4.4	4.3	4.4	4.5
	Sub-total: Tertiary	46.7	45.9	47.1	47.3	49.0	47.6	48.9	49.5	51.7	51.9
10	Total NSDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Directorate of Economic and Statistics, Govt. of Gujarat, Gandhinagar - 2013-14.

During the study of 2004-05 to 2013-14 periods has been a continuous decline in the share of primary sector and continuous increase in the share of tertiary sector in the total output. But in the case of secondary sector, the contribution is subjected to neither an upward nor a downward movement.

Within the secondary sector the major contributions are construction followed by the registered manufacturing, mining and quarrying the unregistered manufacturing. The contribution of electricity, gas and water supply to the secondary sector income is very less. Unlike the pattern of contribution of registered and unregistered manufacturing and electricity gas and water supply, the contribution of construction to the secondary sector income has been on an increasing trend during the period.

To the tertiary sector income the major contributor is the service followed by real estate ownership of dwelling and banking and insurance. Among these the fastest growing one is a banking and insurance. In current year, real estate and ownership of dwelling is observed to be growing at a faster rate than the other sub-sectors of tertiary sector.

Sectoral Contribution (GSDP)

Since the inception of the State, i.e. year 1960-61, there has been a significant structural shift in the State economy. Like other developing economies, there is a gradual increase in share of Industry and Services sectors and there by decline in share of primary sectors.

At current prices, in 1960-61, the share of primary sector was 41.8 per cent which went down to 38.7 per cent in 1980-81 and further declined to 22.1 per cent in 2013-14.

In 1960-61, the share of secondary sector in economy was 25.7 per cent which increased to 29.0 per cent in 1980-81 and further grew up to 34.1 per cent in 2013-14 indicating that the secondary sector has gained continuous momentum since year 1960-61. Whereas, the share of tertiary sector in economy was 32.5 percent in 1960-61 which remained stable in 1980-81 at 32.3 per cent and thereafter gained steep rise and registered a share of 43.8 per cent in 2013-14 which also directs simultaneous, possible divisions of economic activities and the emergence of market, ultimately leads to better employment scenario.

At constant price (2004-05) the share of primary, secondary and tertiary sectors has been reported to be as 14.9 per cent, 36.6 per cent and 48.6 per cent in 2013- cent 14. The share of these sectors in the base year 2004-05 was reported to be as 19.5 per cent, 36.5 per cent and 43.9 per cent respectively.

At current price the share of primary, secondary and tertiary sectors has been reported to be 22.1 per cent, 34.1 per cent and 43.8 per cent.

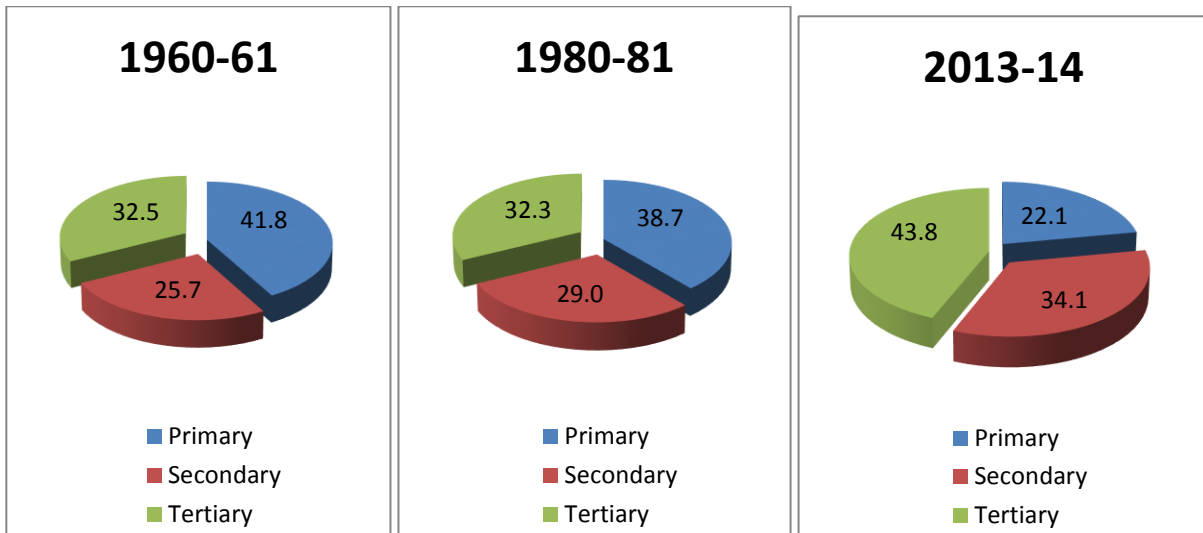
The sectoral contribution by broad sectors i.e. primary, secondary and tertiary sectors at current and at constant (2004-05) prices is given in Table-2

Table- 2
GSDP Sectoral Contribution: by broad Sectors (In %)

Sr. No	Industry	At Current Prices			At 2004-05 Prices	
		2004-05	2012-13	2013-14	2012-13	2013-14
1	Primary	19.5	19.2	22.1	12.9	14.9
1.1	Agriculture	13.2	22.1	18.6	9.6	11.7
2	Secondary	36.5	36.3	34.1	38.4	36.6
2.1	Manufacturing	27.3	25.8	26.5	26.5	24.6
3	Tertiary	44.0	44.4	43.8	48.7	48.6

Source: Directorate of Economic and Statistics, Govt. of Gujarat- 2013-14.

Sectoral shift in the state Economy : By Broad Sectors (In %)



Structural Changes in Agricultural Sector- Irrigation

As already pointed out the major sub-sector in the primary sector is agriculture and livestock and its share in SDP declined from 41.8 percent in 1960-61 to 22.1 percent in 2013-14. This decline trend in the shares of agricultural sector might be the outcome of the changes that have been taking place within the agriculture sector itself. Since irrigation is a critical factor influencing the agriculture production the study of the irrigation aspect assume importance. The net irrigated area as a percentage of net sown area, which was, 25.86 percent in 1989-90 gradually increased on 42.48 percent in 2007-08. Similarly the percent of gross irrigated area in gross cropped area increased from 27.07 percent in 1989-90 to 45.97 percent in 2007-08. Consequently the irrigation intensity increases from 117.98 in 1989-90 to 132.62 in 2007-08. (Table-3)

Table- 3

Trends in irrigation and irrigation intensity

Year	Percentage of Net Irrigated Area to Net Area sown	Percentage of gross Irrigation Area to Gross Area sown	Intensity of irrigated cropping (% GIA/NIA)
1989-90	25.86	27.07	117.98
2000-01	29.57	31.84	119.11
2001-02	30.94	33.11	119.32
2002-03	32.13	43.21	100.02
2003-04	34.39	36.00	121.36
2004-05	36.19	37.97	121.04
2005-06	40.19	41.45	121.93
2006-07	43.24	44.71	124.57
2007-08	42.48	45.97	132.62

Source: Season and Crop report- 1989-90, 2000 to 2007-08,
Directorate of Agriculture, Gujarat State, Gujarat.

Table- 4

Trends in source-wise Net irrigated Area in Guj.('000ha) : 1960-61 to 2007-08

Source	Year							
	1960-61	1970-71	1980-81	1990-91	2000-01	2005-06	2006-07	2007-08
Canals	625 (9.15)	2364 (17.25)	3668 (18.32)	4694 (19.26)	3942 (14.05)	7782 (19.92)	7892 (18.62)	7710 (18.21)
Tanks	128 (1.87)	327 (2.39)	409 (2.04)	314 (1.29)	182 (0.65)	422 (1.08)	398 (0.94)	454 (1.07)
Tube wells	0 (0)	948 (6.92)	2517 (12.57)	4934 (20.24)	N.A.	10,779 (27.59)	11,333 (26.77)	11,222 (26.51)
Other Sources	366 (5.35)	141 (1.03)	65 (0.33)	67 (0.27)	95 (0.34)	628 (1.61)	1016 (2.40)	1142 (2.70)
Other well	5677 (83.13)	9883 (73.00)	13,367 (66.75)	14367 (58.93)	N.A.	19,463 (49.81)	21,737 51.30	21,805 51.51
NIA	6829 (100.00)	13708 (100.00)	20,026 (100.00)	24,376 (100)	28,060 -	39074 (100.00)	42,376 (100.00)	42,333 (100)

Source: Viswanathan and Pathak (2014)

The most striking feature of agriculture in Gujarat is increasing the net irrigated area is during the 1960-61 to 2007-08. The structure of irrigation in the state is such that, irrigation water are provided through Canals, tank, wells including tube wells and others sources. In 1960-61 the major source of irrigation was

other wells, which is 83.13 % of irrigation area followed by 9.15 percent canal and tank 1.87 percent and other sources of 5.35 percent but on that time tube well was 0 percent. Over the last 50 years period structural changes took place in the system of irrigation- canal and the tube well gained importance and other sources of other well lost the prominence. Canal irrigated increase to 9.15 percent to 18.21 percent and tube well increase 0 percent to 26. 51 percent and other well declined 83.13 to 51.51 in 2007-08.

The structural changes in irrigation in the state are outcome of the positive changes.

Structural changes in shift in cropping pattern:-

The level of diversification of crop sector reflects the extent of economic development in the rural sector. In the early stages of development, the farmers generally grow subsistence crops, with increase in population, the total farm output is sought to be maximized. In the third state the agriculture is diversified to strengthen the existing level of development. Introduction of HYVS and new technology not only lead to intensification of farming but also causes diversified farming with spillover benefits. The agriculture in Gujarat is highly diversified, because of its varied agro-climatic conditions, ranging from dry sub humid to acid. The state districts considerable heterogeneity in terms of agro metrological and climate conditions, soil and moisture region is conditioned by water availability and other natural phenomenon.

The cropping pattern in Gujarat in the early fifties, as usual, was dominated by food grains, which occupied over 62 percent of gross cropped area (GCA) Table-5, Among food grains, cereals as a group were most prominent as large as 57 percent. Non food grain crops occupied only about 38 percent of the cropped area of which cotton with 13. 75 percent area was most important followed by oilseeds crops with 12. 43 percent G.C.A.

Table- 5
Cropping Patterns in Gujarat

Crops Period	1950-1953	1960-1963	1970-1973	1980-1983	1990-1993	1998-2001	2010-2011
Rice	5.51	5.49	4.83	5.31	6.15	5.81	6.1
Wheat	3.78	3.82	4.93	5.92	5.45	4.42	11.9
Bajra	23.01	14.28	18.59	13.06	13.39	8.86	6.6
Jowar	18.46	1.317	11.19	10.08	5.90	1.86	-
Maize	2.14	2.25	2.56	2.94	3.53	3.60	4.3
Cereals	57.04	41.69	44.31	40.21	35.71	24.90	30.2
Tur	3.49	0.90	0.89	2.85	2.99	3.13	2.1
All Pulses	5.25	5.30	4.46	7.86	8.71	6.59	6.7
All Foodgrains	62.29	46.99	48.77	48.07	44.42	31.49	36.9
Groundnut	8.74	22.07	18.22	19.76	17.71	16.57	14.4

Castor seeds	0.73	0.67	0.60	1.78	3.31	3.13	3.7
Rape and Mustard	0.34	0.36	0.54	1.77	3.24	2.55	1.7
Sesamum	2.62	1.04	1.14	1.22	2.34	2.71	1.9
All Oilseeds	12.43	24.14	20.65	24.62	26.81	25.33	23.4
Cotton	13.75	17.56	19.43	14.04	10.70	14.49	19.7
Sugarcane	-	-	0.40	1.02	1.62	1.73	9.5
Other Non-foodgrain Crops	11.53	11.31	11.15	13.23	18.07	2.696	10.6
All Non-foodgrain Crops	37.71	53.01	51.23	51.93	55.58	68.51	63.2
All Crops	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Bureau of Economics and Statistics, Gujarat. various years.

During the next decade, however the non food grains substituted the food grains in a big way and increased their share to 53.71 percent pushing the latter to 43 percent of GCA. In the next two decades, the food grains crops improved their position by gaining some area but their share remained under 50 percent. During the early nineties, there was further declination and the proportionate area under food grains was 44 percent. The process has continued and during the 2010-11 phase the food grain crops occupied only about 36.5 percent of GCA with the share of commercial and non food grain crops being as large as 68.51 percent.

Thus, the pattern of Crop cultivation in the state has shown a big transformation compound to the all India situation. The analysis further reveals that the share of bajara and jowar. Two important coarse food grains consumed mainly by poor and rural consumers has come down from 23 percent and 18.46 percent respectively during 1950-53 to a low of 6.6 percent in 2010-11 and jowar 1.86 percent in 1998-01. The proportionate area under paddy has remained sticky and around 5 to 6 percent during different periods. Maize, Staple, food and of tribal in the state, has shown some improvement over the years. Area under pulses, the main sources of protein to a large population of Gujarat, has fluctuated and was around 6.5 percent during 1998-01

Interestingly, oil seeds crops are the big beneficiary and their share in GCA has more than doubled from 25.33 percent during 1998-01 and 23.4 percent in 2010-11. The importance of groundnut has increased since 1950s but its share has fluctuated between a high of 22 percent in the early '60s and 16.57 percent in the late '90s. castor, rapeseed and mustard are also the big gainers showing a continuous rise and mustard are also the big gainers showing a continuous rise in their share in the cropped area. Cotton is an important crop of the state, which has shown fluctuation in the area and occupied over 14 percent of GCA and 19.7 percent in 2010-11. Interestingly, other non food grain crops as a group, which includes different fruits, vegetables, spices, tobacco and forage crops have shown a rapid acceleration in their share since the early 80's and now occupy about 27 percent of GCA.

The above analysis suggests that in Gujarat the process of continuous transformation of cropping patterns has been taking place for a long time. Presently, it is more diversified and commercialized compared to earlier periods as well as the all India level.

The cropping pattern change in favour of commercial crops at the cost of coarse cereals crops have serious implication in small farm agriculture with in adequate irrigation facilities. The coarse cereal crops are drought resistant and less capital intensive. Therefore in the resource poor small farm agriculture, which is subjected to frequent occurrence of drought coarse cereal crops are relatively more suitable, although they are low value crops, on the other hand commercial crops are more capital intensive and More risky, although they are high value crops in the event of low risk bearing capacity of farmers, which is generally the case with the small and marginal farmers in the resources poor economics. Cultivation of commercial crops may pose problems. It also increases the market dependence for food and poses the problem of nutritional security especially to the small and marginal farmers and agricultural labourers. This situation calls for Strengthening of Public Distribution System.

Conclusion:

Structural changes have been taking place in the economy of Gujarat from primary sector to tertiary sector with no significant change in the secondary sector. However, the pattern of change is slightly different from the one observed in the national economy. The decline in the share of primary sector and increase in the share of tertiary sector are much faster in the state economy relative to the national economy. Agriculture is the Major Sub-sector in the primary sector and the structural changes that have been taking places in the state economy may have an impact on this sub-sector and on the livelihoods of the rural masses. The two aspects that need to be examined in this connection are changes in the structure of irrigation and cropping pattern shifts. The structure of irrigation in the state is such that irrigation is provided through canals, tanks and wells. Canals and tanks are sustainable sources of irrigation and well irrigation is an unsustainable source. While there is no significant increase in Canal irrigation over the last decades.

There has been a drastic deterioration in the tank irrigation in the state. On the other hand, the ground water irrigation has been increasing at a faster rate. It is not desirable trend. The increase in ground water irrigation leads to decline in the ground water table and causes environmental degradation and poses a threat to the sustainability of water resources for irrigation and other purposes.

The cropping pattern shifts in favourable commercial crops at the cost of coarse cereals have been taking place in the state. In the resources poor and small farm agricultural economies where the capacity to invest and risk bearing capacity of the farmers are low, this trend may cause the distress especially to the small and marginal farmers. Therefore for the protecting the farmers from the adverse consequences of the changes in the agricultural economy resulting from the structural changes, efforts are to be made on the lines of expanding the surface sources of irrigation and regulating the ground water irrigation. Efforts should also be made to regulate the cropping pattern according to the resource availability and risk bearing capacity of the farmers.

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