CHAPTER – VI

THE CATALYSTS OF CHANGE

After all, the change is the law of nature It never occurs without a proper cause, therefore, the nature of change depends on the nature of cause, which plays vital role in shaping the apparent destiny of any place There are certain factors which may have positive role to play in the prosperity of any given area and there are certainly negative factors which have a negative impact

In the course of study on the dynamics of land use of the two taluka viz Padra and Karjan, a host of factors have been found operative. The following factors are to be the most significant

6.1 Physical Factors.
- 6.1 1 Climate
- 6.1.2 Soil

6.2 Socio-Economic Factors
- 6.2.1 Agricultural work force and G C A ?
- 6.2.2 Biotic Factor ?
- 6.2.3 Von Thunen's Model. ?

6 3 Technological Factors
- 6 3 1 Tractors
- 6 3.2 Sources of Irrigation
- 6 3.3 H Y V S.

6 4 Political Factor
- 6.4.1 Government Policies and Programmes.

6 1 PHYSICAL FACTORS

Physical factors have always worked as the determinants of land use The soil, terrain, physiography etc. have directed man to choose the suitable uses of land

Not all the types of land are useful for all the types of human activities This is the reason why the world is full of diversities in respect of the uses of land for agriculture, housing, transport and many others These conditions have therefore produced disuniformity in the type of living and livelihood According to Trewartha, "Physical earth is a stage for man to play his drama"

Physical factors consist of land, terrain and soil, the temperature and rainfall, the humidity, sun shine precipitation etc Each on its part reflect its influences on the socio-economic life, culture, behaviour and nature of man They all together and also individually affect the land use and cropping patterns in their respective zone of influence

Among the various elements of physical factors most important for the present purpose are climate i e temperature and rainfall, soil and terrain These are briefly dealt here to ascertain their role as a catalyst

6.1.1 **Climate**

In crop land use and cropping pattern changes, especially in the Indian conditions, the climate and more particularly its significant component, the rainfall has always played a vital role. Its uncertainities, precariousness and irregularities have decided the fate of the crops grown, as well as the success or failure of the agriculture in totality. But when rain god has been found smiling the Indian agriculture has always been successful in respect of all types of crops grown. However, when the rains have been successively regular and sufficient, the significant changes in cropping pattern and more especially in the selection of crops tells that the rains had no role to play This is what has been the cropping condition in the two talukas under study In both Padra and Karjan the decline of cotton, and ascendence of tuer speaks some thing

different Table No 6 1 shows the G C A rainfall relationship quin-quinially during the entire span of study

Table 6.1

Quinquinial Rainfall and G C.A Relationship – Padra & Karjan.

YEARS	PADRA		KARJAN	
	G.C.A. (in per cent)	Rainfall (in mm)	G.C.A. (in per cent)	Rainfall (in mm)
1960-61	75.72	1039.00	-	-
1965-66	79.42	963.00	-	-
1970-71	79.55	835.50	89.56	931.00
1975-76	78.28	1124.00	90.38	1052.00
1980-81	80.49	1012.00	89.70	791.00
1985-86	80.10	834.00	88.13	1429.50
1990-91	85.85	1397.00	88.78	1022.00

It is seen that as long as the amount of rain received is around 20 inches (500 mm) or more almost equally distributed throughout the rainy months, which is the minimum essential for cultivation in the study area, the G C.A. ranged between 75 per cent to 85 per cent in Padra and 88 per cent to 90 per cent in Karjan, divided among the different crops Thus, it is established that crop land use has not been affected by the rainfall during the entire span of the study However, the cropping pattern has been drastically changed for which rainfall may not be considered responsible.

It may therefore, be stated that in both the talukas – Padra and Karjan, the amount of rainfall has been normal or above normal (Table above) during the period of study. Thus, no change is noted in the crop land use as the entire percentage of G C A was under use (as referred to above) in both the talukas But a very significant change is noted in the cropping pattern that the most desired and most

profitable crop has succumbed to the unavoidable circumstances giving way to the crops that had petty significance at the first point of time

6.1.2 **Soils** .

Soils are the basis for all agriculture. The agricultural regionalization has mostly been done on the types of soils varying from place to place. It is also true that some crops are thriving in certain type of soils and some in others, e.g cotton is the crop of black cotton soil, and wheat etc thrive well in alluvials. But this is not a strict rule, cotton can be sown and harvested under conditions in alluvials and wheat is invariably successfully cultivated in the black cotton soils in the cotton belt of Gujarat Soils can affect land use changes when any physical change take places in them or in their properties such as increasing salinity, sand or silt, or oozing water making a quagmire as has happened near the canals in many parts of Gujarat specially in the influence zone of Mahi canals or sometimes flash floods corrode away the top mantle of the fields But nothing of this sort has ever happened in the study area, thus, the soils may not be taken as a catalyst. In case of the cropping pattern soils have always played their traditional role, but the change in cropping pattern has occurred owing to the external forces, not the innate physical properties of the soils It therefore, establishes that the changes have taken place not in the crop land use but in the cropping pattern.

6.2 **SOCIO-ECONOMIC FACTORS** :

Land man relationship is the soul of geographic study Any land use without man is non existent Man being the creative genius has devised various ways of using the land for all his social, cultural and economic objectives

6 2.1 **Population and G.C.A.**

Population and G C A , in rural areas are strongly related In 1960-61, population of Padra rural was 1,18,653 and its G C.A was 39,532 77 ha In 1990-91, 66,069 people more were added correspondingly G.C.A. also went to 44,325.66 ha. Thus the ratios of the population and G.C.A were 3·1 and 4.1 respectively. The population and G.C A are therefore correspondent to each other According to Wards' scale, the land man ratios at both the points of time have been poorly correlated as instead of 1:2 i e one man to 2 ha, the ratios here are 3 persons to one hectare and 4 persons to one hectare. The statistical correlation co-efficient according to Pearsonian Product Moment Method also comes to 0 68 and 0 85 respectively of the two points of time, which is a weak positive correlation. Thus, the land in Padra was quite insufficient and heavily loaded at both the points of time.

With the increasing number of population the need of land is also increasing for economic and non economic uses Housing, roads, schools, other cultural centres are increasing even in the rural areas Further the developments of agriculture such as canals, tube-wells and their arteries are also going on taxing upon the limited amount of land Thus, the increase in other uses definitely has the effect of decreasing the agricultural land Since increase in the consuming heads has to be co-ordinated with the increase in the consumable articles. Attempts have been made to up grade the old fashioned uses of land with the increasing innovations in agriculture.

But it has been seen that man has always attempted to gain more out of the given resources The rural people too have the same instinct.

An eye on the cropping pattern of Padra and Karjan reveals that Padra has been in a natural state of cultivating two cash crops-tobacco in its northern segment and cotton in the Southern segment A quinquinial survey of these two crops show that tobacco at 1960-61 occupied 2,436 43 Ha.(5.93%). A successive increasing trend is observed from the base year till 1990-91, when it grabbed 5,884 01 Ha(13.13%) In contrast to it the cotton has 17,910 58 Ha (45.30%) under its sway, increased by 259.80 Ha in 1965-66 Thereafter, a successive decline is observed till 1990-91, when its occupied area remained only 6,780.74 Ha (15.13%) The table 6.2 gives the selected crops and the rain of Padra at an interval of five years

P.T.O.

Table · 6 2

Quiquinial statement of selected crops and the rainfall of Padra

Year \ Crops	1960-61	1965-66	1970-71	1975-76	1980-81	1985-86	1990-91
Jowar	i471.85	1507.71	1483.57	1579.43	1615.29	1651.15	1686.98
	3.72	3.64	3.57	3.86	3.84	3.81	3.76
Bajra	2471.28	2696.38	2821.48	3446.58	3571.68	3596.78	3821.86
	6.25	6.26	6.79	8 43	8 50	8.30	8 52
Rice	3121.67	3067.91	3014.15	2960 39	2906 63	2852 87	2799 12
	7.90	7.40	7.26	7 24	6 92	6 58	6.24
Wheat	441 50	691.70	941 90	1392 10	1982.30	1692 50	1942 70
	1.12	1.67	2 27	3 41	40.72	3 90	4.33
Kodra	2656.59	1983.61	994.83	-	-	-	-
	6 72	4.78	2 40	-	-	-	-
Tuer	2737.59	2794 33	3451.07	6907 81	7964 55	8921 29	9078 04
	6 92	6 74	8.31	16 90	18.95	20 56	20 25
Other Pulses	1005 65	979 82	953.99	928 16	902 33	876 50	850 70
	2 54	2 36	2.30	2.27	2 15	2 02	1.90
Vegetables	1218 54	1701.17	2183.80	2666 43	3149.06	3631.69	4114 29
	3.08	4.12	5.26	6.52	7.49	8 37	9 18
Tobacco	2436.43	2869.03	3285 63	4460 23	4934 83	5609.43	5884.01
	6.16	6.92	7.91	10.91	11.74	12.93	13 13
Oilseeds	1306.48	1512.03	1917.58	2323.13	2528.68	2834.23	3139 80
	3.30	3.65	4.62	5.68	6.02	6 53	7.00
Cotton	17910.58	18170.38	17391.64	10445.67	8550.70	7435.73	6780.74
	45 31	43.81	43.17	25.55	20.35	17.14	15.13
Fodder	2394.21	2651.37	2908.53	3465 69	3822.85	4180 01	4537 17
	6 06	6.39	7.00	8 48	9.10	9 63	10.12
N.S.A.	39172.16	41168 44	41348.17	40575 62	41928 90	43282 18	44635 41
	75 02	78.85	79 19	77.71	80.30	82 90	85 49
G.C.A.	39532.77	41472.42	41536.82	40875 88	42028 17	43388 51	44825 66
	75.72	79.42	79.55	78.28	80.49	83.10	8585.13
Rainfall (in mm)	1039.0	963.0	835.5	1124.0	1012.0	834 0	1397.0

It is observed that rainfall has been invariably above normal and thus this factor may not be taken responsible for the decline of cotton as other crops in the same period have increased and also the G C A has substantially increased from 39,532.77 Ha. in 1960-61 to 44,825 66 Ha in 1990-91

giving a net increase of 5,292 89 Ha Thus cotton the most profitable crop and widely grown in the entire southern segment and partly in the northern segment (Fig 4 17) has been slashed by 30 17 per cent shows that margin of loss in cotton has gone so high owing to the biotic menace that it drastically became uneconomic for the farmers to retain it in its full significance Cereals are characterised by both up and down swing Kodra attained its peak only in 1960-61 There after it declined and disappeared after 1970-71 Tuer was the most destined crop among the pulses that marked the up swing from 1965-66 and continued to rise so much so that it became the number one crop by 1990-91 Thus, the greatest comparative advantage has always remained the a priori motive of the decision making of the farmers

KARJAN :

Population and G.C.A.

In rural areas the sustenance of the larger sectionof humanity directly depends on land. It is therefore the quality of the sustainability of land that attracts thin or thick density of population.

As already discussed about Padra, Karjan in its close vicinity, had many physiographical condition in common and differences too Where Padra has two major chunks of two different soils alluvial and black cotton. Karjan is characterised by a big chunk of black cotton soil and smaller ones have alluvials and other mixed ones. Thus, both talukas have different patterns of crops essentially in cases of the most significant ones.

Inspite of the fact that Karjan exceeds Padra in its total areal extent, in G C A , in number of villages, it is seen that Padra far exceeds Karjan in number and growth rate of population (Table 6.3).

The table shows that in 1960-61, Padra had 1,18,653 and Karjan in 1970-71 had only 1,03,049 population While in 1990-91 Padra had 1,84,722 and Karjan had 1,23,033 population and their growth rates were 557‰ and 194‰ respectively. This great difference in population number and growth rate explains the impact of the neighbourhood of sprawling city of Baroda on Padra and that of its remoteness on Karjan Table 6 3.

Table 6 3

Showing Impact of Urban Neighbourhood on the Development of Padra & Karjan.

	PADRA		KARJAN	
	1960-61	**1990-91**	**1970-71**	**1990-91**
T.G.A.	52212.57	52212.57	58566.30	58566.30
No. of villages	82	82	93	93
Total Population	118653	184722	103049	123033
Growth rate	557‰		194‰	
G.C.A.	39532.77	44825.66	52453.99	51997.15
Distance from Baroda city (in Km.	16		40	

The table therefore reflects that the size of any area is not significant for its different attributes such as population and its growth rates etc, but the neighbourhood of any fast developing city plays a vital role in their different components making them large or small irrespective of their differential areal extent For example in the study area Padra is physically smaller than Karjan but demographically it is bigger than it

When the relation between the population and G C.A. is worked out the result is disappointing as the ratio of population to G C A. in Karjan at the first point of time was 2 1, and at the second point of time was 2 36.1 or the other way land man ratio was 0.50:1 and 0 42 1 respectively. This is too small area much below the wards' standard of 1·2 i.e one person to 2 ha. of land to give sustenance to the people.

However, the sustainability and the productivity of the land, assuring successful growth of sustainable crops particularly high price fetching cotton, tobacco, oilseeds, vegetables and even fodder These crops have assured desired output and net profit in comparison to the other marketable crops. The irony of the fate, however, has to be reckoned with, as the highly desired crops are equally desired by friends and foes i e man and the crop destroying pests and insects.

When the crop position is seen in the quinquinial order as given in table 6.4 below, both Padra and Karjan are found in similar state of affairs.

P.T.O

Table · 6 4

Quiquinial order of crops and rainfall of Karjan

Year \ Crops	1970-71	1975-76	1980-81	1985-86	1990-91
Jowar	6182 78	6911.26	6839 74	5998.22	5896.71
	11 79	13 06	13.02	11.62	11 34
Bajra	227.59	484.93	422.27	596.61	616.93
	0.43	0.92	0 18	1.10	1 19
Rice	2021.00	1726.79	1362.42	1138.13	843 84
	3.85	3 26	2.59	2.20	1 62
Wheat	1544 31	1845 53	1976.75	1847.97	1949 19
	2.94	3.47	3.76	3.58	3 75
Tuer	791 14	17994.31	21867 48	23987 65	25603.80
	1 57	33.99	41 63	46 47	49 24
Other Pulses	636.98	541 39	445.80	350 21	254 64
	1 21	1 02	0.85	0 68	0 49
Vegetables	1369 63	1809.32	2549 01	3988.70	3128 40
	2 61	3.42	4 85	7 72	6 02
Sugarcane	2.78	416 73	1286 68	1544.63	1658 58
	0 01	0.79	2 45	2 99	3 19
Oilseeds	63.64	975.55	2087 46	2017.37	2511.29
	0.12	1.84	3 97	4.30	4.85
Cotton	37100.84	16787 15	9937 46	6954 77	5686 08
	70.75	31.71	18.92	13.47	10.94
Fodder	3220.23	3334.43	3448.63	3562.83	3677.02
	6.14	6 30	6.56	6.90	7 07
N.S.A.	52160.92	52827.39	52493.70	51160.09	51826.48
	89.06	90.20	89.63	87.35	88.49
G.C.A.	52453 99	52935.46	52531 74	51616 10	51997 15
	89 56	90.38	89 70	88 13	88.78
Rainfall (in mm)	931.0	1052 0	791 0	1429 5	1022 0

The important crops as given in the table at the first point of time were jowar, rice, wheat among the cereals, vegetables and fodder among the green crops and cotton among the fibres. Out of these the jowar increased to an all time high in the year 1975-76, there after it successively decreased giving way to bajra Rice steadily decreased in all stages from 1970-71 to 1990-91, but wheat

showed an increase. Vegetables got spurt from the low start of 1369 63 ha under their sway in 1970-71 to an all time high i e. 3988.70 ha in 1985 86, but decreased by a substantial hecterage of 860 30 by the last point of time Sugarcane entered the arena in 1970-71 with a most insignificant area of 2 78ha but favouring conditions enabled it to grab 1658.78 ha by 1990-91. It made an steady increase from the very low start to very high within a period of two decades. Oilseeds also made substantial increase from 63.64 ha. during 1970-71 to 2511 29 in 1990-91 showing a steady pace of increase. Cotton-the traditional crop most favourite and profitable being widely grown over around more than 70 per cent of the total cropped area in 1970-71 met a most disappointing conditions after its suzerainty at the first point of time to a successive downfall by more than seven times In the actual hecterage it occupied 37,100.34 hectres in 1970-71 which shrunk to an all time low i e. 5,660.08. Thus, this drastic decline of once the majestic crop gave a face lift to the very down trodden crop tuer, which had only 791.14 hectares (1 51%) in 1970-71 and steadily marched ahead at all the stages so much so that it acquired the position of the foremost crop, grabbing 25,603 80 ha. (49.24%) under its sway at the second point of time

However, in cases of other crops there are routine changes The cereals never attained any high position in both Padra and Karjan. These up and down swing can clearly be seen in the given table. Their area of occupancy always depended on the will of the cultivators as their consumption was more for domestic needs and if at all, a small surplus was released for the markets Cotton was beyond any doubt, the only supreme commercial crop of entire Karjan and near entire Padra. After 1970-71 the hybrid varities of cotton viz. Hybrid-4, Hybrid-6 and

varalaxmi strains were widely propagated and grown. Along with their better qualities of strains, fine fibers and desireably higher yield They had the greatest draw back of being infested by intensive biotic menace so much so that by the passage of time the pests and insects resisted all types of insecticides and pesticides. This made the cultivators unable to wrest with them. Thus, a successive loss decreased the significance of once the sovereign crop and so it lost its domain

6 2 2 **Biotic Factor**

An eye on the physical factors reveals that the soil was intact in its quality, rainfall had been normal and above normal over the entire study period, decision making of the farmers had also been in the favour of cotton, it changed only when they started meeting successive losses. In this case when all the physical and human factors are favourable, it is only the intruders i.e. the crop damaging insects and pests which led to the doom of cotton. The most dangerous among them is called "Lashkari Ead" (Prodenia) which is hard to kill even by the very strong pesticides and also it has a tendency of very high rate of multiplication. Thus, the biotic elements turned the most famous crop region (cotton belt) into a common crop region. Inspite of intensive biotic menace cotton did not totally disappear from the agricultural milieu of both Padra and Karjan. It could retain atleast a small percentage of the total cropped area of both the talukas (i.e. 15.13 per cent in Padra and 10.94 per cent in Karjan). This reflects the deep love of the farmers for this crop.

Thus, the eventual decrease of the most important crop of both the talukas and the partial increase in several other crops is not owing to the physical or human factor but absolutely because of the biotic factors. It, therefore, compelled the farmers to make decisions against their wishes

to opt for other crops particularly tuer in place of cotton This is in view of the intention of atleast making a gain out of the investment of their labour and capital On the other hand the change in the economic and commercial environment of the markets leading to the increasing demand and alluring prices of vegetables, pulses, oilseeds etc. An increasing population attracted to them to increase the hectrage under these crops as well as cereals Thus, the catalyst factor in this radical change may be taken as the loss factor in the fall of cotton and gain factor in the rise of other marketable crops.

6.2 3 VON THUNEN'S MODIFIED MODEL

An attempt is made to apply von thunen's model to the agricultural conditions of the two talukas under study It became a vain effort to apply this model in its totality Thus a modification became necessary All his constants are no more effective as the climate, terrain, labour, cost of imputs, and the amount of outputs are variable and they cannot be concieved constant at least under the present conditions of the areas. The problem of goods carriers from the producing areas to the market, which is emphasized by him has also become ineffective, as the horse or bullock carts are totally off the roads Rural roads are improved, and have become all season roads. The road pliars are mechanised and their carrying capacities have far greatly increased. But to popularise their uses among the rural folk slab rates are charged for the given stages. Thus, only the effect of distance is practically effective on the agricultural products Moreover, several cultivators together hire trucks or mini goods carriers and pay their cost as agreed upon between them and the owners of the vehicles, according to the size of their packages.

The transportation of the agricultural products are made by either tractors or mini trucks, in rare cases, specially when the goods are in tons, trucks are also used Their cost is charged on set stages of 3 kms Each starting with Rs. 100.00 for the first stage or a part there-of and increasing by Rs. 50 00 for all other subsequent ones. Thus, tapering rates are charged so that the cost may remain with in reasonable limits. This pattern of cost charged has its effects on economic gains for the farmers of the villages nearer the markets or away from it Those nearer pay less cost of transport and gain relatively more than those placed away from the markets. Now there is a better facility provided by the agricultural co-operative societies, that the societies take all the marketable products from the farmers, and manage to supply it to the respective markets, and deducting the prices of several requisits of agriculture, as seeds, fettilizers, the cost of tilling the fields by their tractors and even the minimum charges of transporting the products by their own vehicles, pay the farmers their due This facility has saved the farmers from the post harvest troubles. Even in this case also the effect of distance cannot be ruled out, in both the talukas, as the co-operatives also charge the cost of transportation according to distance. This is the reason why, the pattern of crops nearer the Padra town were more diversified, while in Karjan was less, the cotton and tobacco in Padra, and cotton in Karjan were the principal crops at the first point of time. While in 1990-91 greater degrees of diversification are seen in both Padra and Karjan, but tuer dominaed the combination. Descending down south in both talukas crops more tolerant of increasing cost of transport are found cultivated

In short, all of the conditions except one concieved by Thunen do not exist in their form and spirit in the study area. Inspite of the radically changed situations, as they are today. Thunen's model may not be rejected in to to

The present researcher has devised a modified economic rent model of thunen and attempted to apply it to study areas What ever be the situation, this concept of Thunen, according to present researcher, has to live long as human decisions for better comparative advantages out of labour and capital invested are not going to cease as long as the man land interaction would be existing, be they in any changed form or altered spirits.

The model based on Thunen's economic rent irrespective of his other considerations is devised as follows

$$r = (xYP) - (xd) - (LC_i)$$

Where,

r is the economic rent per unit area.

x is the unit area of production of a commodity.

Y is the total yield per unit area.

d is the investment of labour and capital per unit area

P is the market price per unit weight of the commodity

L is the local market

C is the cost of transportation

i is the stage of distance.

The formulae is tested on the procured data of the values of inputs outputs in rupees and the current rates in markets and found giving positive results e g. two major crops of Padra and Karjan were tobacco and cotton respectively Their per unit area yields and average values are procured from the two talukas and the following result is obtained by computing them with the help of the formulae.

Tobacco of Padra :

r = (xYP) – (xd) – (LC_1)	xYP=1x12x12500		1,50,000=00
x = 1 ha	xd = 1 x 60,000	-	60,000=00
Y = 12 Q	-		90,000=00
P = 12500 per Q	C_1 = 1 x 100	-	100=00
d = Rs. 60,000 per ha.	r		89,900=00

C_1 = (0 – 3 kms.) Rs. 100 per truck load.

r = (xYP) – (xd) – (LC_1)	xYP=1x12x12500		1,50,000=00
x = 1 ha	xd = 1 x 60,000	-	60,000=00
Y = 12 Q	-		90,000=00
P = 12500 per Q	Ci = 10 x 50	-	500=00
d = Rs 60,000 per ha.	r		89,500=00

Ci = (0 – 28 kms.) Rs. 500 per truck load.

Cotton in Karjan :

r = (xYP) – (xd) – (LC_1)	xYP=1x24x2200		52,000=00
x = 1 ha	xd = 1 x 22,000	-	22,000=00
Y = 24 Q	-		30,000=00
P = 2200 per Q	Ci = 1 x 100	-	100=00
d = Rs. 22,000 per ha	r		29,900=00

C_i = (0 – 3 kms.) Rs. 100 per truck load.

r = (xYP) – (xd) – (LC_1)	xYP=1x24x2200		52,000=00
x = 1 ha.	xd = 1 x 22,000	-	22,000=00
Y = 24 Q	-		30,000=00
P = 2200 per Q	C_1 = 12 x 50	-	600=00
d = Rs 22,000 per ha	r		29,400=00

C_i = (0 – 35 kms.) Rs. 600 per truck load.

Tuer in Padra :

r = (xYP) – (xd) – (LC_1)	xYP=1x8x1700		13,600=00
x = 1 ha	xd = 1 x 2200	-	2,200=00
Y = 8 Q	-		11,400=00
P = 1700 per Q	C_1 = 1 x 100	-	100=00
x = Rs 2200 per ha	r		11,300=00

C_1 = (0 – 3 kms.) Rs. 100 per truck load.

$r = (xYP) - (xd) - (LC_{1,})$	xYP=1x8x1700		13,600=00
x = 1 ha	xd = 1 x 2200	-	2,200=00
Y = 8 Q	-		11,400=00
P = 1700 per Q	C_1 = 1 x 50	-	500=00
d = Rs. 2200 per ha	r		11,900=00

C_i = (0 – 28 kms.) Rs. 500 per truck load.

Tuer in Karjan :

$r = (xYP) - (xd) - (LC_{1,})$	xYP=1x11x1700		18,700=00
x = 1 ha	xd = 1 x 2000	-	2,000=00
Y = 11 Q	-		16,700=00
P = 1700 per Q	Ci = 1 x 100	-	100=00
d = Rs. 2000 per ha.	r		16,600=00

C_1 = (0 – 3 kms.) Rs. 100 per truck load.

$r = (xYP) - (xd) - (LC_{1,})$	xYP=1x11x1700		18,700=00
= 1 ha.	xd = 1 x 2000	-	2,000=00
Y = 11 Q	-		16,700=00
P = 1700 per Q	Ci = 12 x 50	-	600=00
d = Rs. 2000 per ha.	r		16,100=00

C_i = (0 – 35 kms.) Rs. 600 per truck load.

The computation of economic rent on the given formula proves that tobacco is the utmost profitable crop giving a net profit of rupees 89,900 per hectare. The effect of distance is visible when it is carried for more than one stage i.e for ten stages as computed, the net gain decreased i e. it became rupees 89,500. This is applicable to all other marketable crops Cotton is the common crop of southern segment of Padra, and entire Karjan. With the loss of cotton owing to pest infestations in both the talukas, tuer was given the status of its substitute in both of them However, the present calculation has proved that Karjan has much better favourabele conditions for tuer than Padra as a result it

devoted 25,603.83 ha. in comparison to Padra where 9078.04 hectares were under this crop in 1990-91 Where as Padra increased the hectareage under tobacco from 2436 43 ha. of 1960-61 to 5,884 01 ha in 1990-91, as tobacco is highly profitable in the northern part of taluka Tuer has, however, gained favour by its low inputs and relatively greater output.

A table of some other crops is given here under to understand the economic rent of them, and the accruing gains to the farmers.

Table · 6 5

Statement of per unit area yield, input and market prices of the cultivated crops.

Padra

Kind of Crops	Average Yield per hectare (in quintals)	Input per unit area (in Rs.)	Rate of sale per quintal (in Rs.)
Jowar	5	1200	600
Bajra	6	1480	700
Wheat	20	7000	800
Rice	10	8000	1500
Tuer	8	2200	1700
Oilseeds	12	3500	1000
Cotton	22	19000	2000
Tobacco	12	60000	12500
Fodder	11	2800	750

Table . 6.6

Statement of per unit area yield, input and market prices of the cultivated crops.

Karjan

Kind of Crops	Average Yield per hectare (in quintals)	Input per unit area (in Rs.)	Rate of sale per quintal (in Rs.)
Jowar	8	1680	700
Bajra	5	1080	600
Wheat	18	8000	800
Rice	9	9000	1600
Tuer	11	2000	1700
Oilseeds	13	4000	1000
Cotton	24	22800	2200
Fodder	10	2600	700

Tables 6.5 & 6.6 give the yield, market prices, inputs and investments of each crop. This is more or less uniform for the entire taluka of Padra and Karjan barring a few crops in which the variabilities have existed and that is natural.

In Padra and Karjan there are a few similar crops and a few dissimilar Accordingly the rates, the yields and the economic rents are, to a great extent, responsible for organizing the cropping patterns of the two talukas The economic rent, may also, therefore, be included among the significant factors of crop land dynamics of Padra and Karjan.

6 3 TECHNICAL INNOVATIONS

Like other economic activities, agriculture is also being shifted from manual to mechanical devices. The plough pulling animates are disappearing giving way to gaint tractors Almost all innovative measures have been brought in vogue. Hybrid seeds have replaced the desi seeds, fertilizers came in place of manures, at places green manures have also been observed. Irrigation, which was almost a rare phenomenon were used under the conditions of scarce rain from the tanks, ponds and wells. Tube wells were unseen in both the talukas under study. Now the innovations have over taken so much that the old devices are out of sight Mechanical devices and innovations have increased the productivity of human labour and have decreased the hours of work.

6.3 1 Tractors :

Padra : Tilling of land is gradually switched over to mechanical means using inanimate energy from those using animate. The work efficiency has tremendously increased so much so that the agricultural scenario dominated by bullock driven ploughs has almost vanished giving place to tractors. Where in 1960-61 the former was the only source of ploughing, in 1990-91 the latter has become the sole source. By and by the bullocks have gone out of sight, as their up keep was labourious and uneconomic The number of tractors increased from nil to 38 by 1990-91. Some of them belong to capicitated farmers and others to agricultural co-operative societies. They are invariably used by all cultivators, as they give much greater efficiency in tilling than the former. Those who possess them use it for their purpose and those who do not possess, take it on hire Apart from tractors other improved agricultural machinaries as thrashers and winnowers, harvestors etc. are also being used.

Thus, the agricultural activity is gradually getting well mechanised, as a result the old practices hardly come to sight.

Karjan . The mechanization of agriculture is the order of the day. It has reached to even the far removed parts of the land Karjan has also been found using various types of scientific agricultural implements like Padra and others. Where in 1970-71, there was no record of any such mechanized means, not even the tractors were seen The agricultural work was done with the help of bullocks and he-buffalows By 1990-91, the tractors have replaced them all over the taluka As many as 46 tractors are plying and ploughing the agricultural fields and also used as means of transportation of agricultural produce Apart from tractors, the other machinaries like harvestors, winnower, thrashers etc are widely used.

These machinaries have enabled the cultivators to save their time and money on one hand and increase the productivity of their land on the other In Padra a big chunk of area (i.e. 5292.89 ha.) is found included in the G.C.A of 1990-91 making total G.C.A. to the size of 44,825.66 as against 39,532 77 ha. of 1960-61. Land reclaimation and development, in view of the increasing population may be taken as the main cause for it however the innovations in this regard may not be ignored

In Karjan the position is seen the other way that it decreased from 52,453.99 of 1970-71 to 51,997.15 ha. in 1990-91. Even though, the physical and economic factors were not adverse, the present system of cultivation is also profitable, the decrease, therefore, is because of the fact, that some of the cultivators have migrated abroad handing over their land to their relatives The relatives often keep such lands uncultivated owing to the pressure of work on

their own lands Secondly, the speed of reclamation of unculturable land in Karjan is not satisfactory So, the increase in N S.A or G C A is found almost abscent

Though, tractorization with all its benefits is quite attractive the earnings from the countries abroad is much more alluring than what is obtained from the home activities The tractors and their benefits are, however enjoyed by those who cultivate their lands e g. some of the pieces of the cultivable lands near the rivers were having uneven levels. Formerly these pieces were used for small grains, now with the help of tractors these can be levelled, ploughed and are used for marketable grains. Tractors are not only used for tilling but a host of other activities are done by them

6.3 2 **Sources of Irrigation**

It had been an age old practice in all agricultural areas receiving seasonal rainfall. Usually the kharif crops needed it in the events of scarcity of rains, but rabi crops invariably wanted it for their successful completion. Owing to widely diffused innovations, irrigation has become an integral part of successful cultivation of the H Y.Vs the facilities of irrigation has also developed in agricultural regions

Padra

In Padra, the irrigation facilities were availed even during 1960-61, but the sources were tanks, ponds and wells. Canals were an ever desired facility which could not be fulfilled. Now the time is ripe for the materialization of that desire with the commissioning (whenever takes place) of the long awaited Narmada Project

There have been 82 tanks, 86 wells and 34 ponds Their stagnated water was manually lifted and supplied to the fields. The persian wheel was the means to lift well

water. It was definitely a tedious and very loaburious work with much less efficiency Its result is obvious from the amount of area added to the N.S.A. But the mechanized means of lifting water have gradually replaced the former ones. By 1990-91, as many as 36 tube wells have been installed. The tanks decreased from 82 to 76, the number of wells remained the same, but electric and diesel pumpsets are installed on most of them Since electricity is undependable particularly in rural areas, the peasants have preferred diesel sets Most of them are only pumpsets run by the tractors. However, the mechanised means have given far better efficiency that the area irrigated in 1960-61 was 6,431 ha. but in 1990-91, it went up to 13,624 ha It included the areas, irrigated for cultivation before the advent of monsoon, and also those which are irrigated during the long dry spell between the rainy months.

However, it is a methodological change brought by the mechanised means that the double cropping has increased by more than five times over a period of three decades and the calamity of crop failures are curbed to the extent of negation.

Karjan :

Karjan has the advantage of being drained off by three rivers flowing at almost equi distant from each other Dhadhar in the north, Bhukhi in the middle and Narmada at the southern most end of the taluka have been supplying irrigation water whenever desired. Besides there were as many as 98 tanks, 164 ponds and 398 wells. These are the sources of irrigation used whenever there was the need of irrigation. During and before the first point of time usually manual means were used to lift water from these sources. The persian wheel was used on the wells But the mechanised means getting popular in due course of time replaced the older ones by electric or diesel pumpsets on

wells, diesel pumps are used at tanks and ponds also The peasants prefer to use diesel pumps in place of electric pumps. Even though the latter are more efficient than the former, their attributes are marred by the deficient and unreliable supply of electricity Tractors, too help in lifting the water either from wells or from tanks and ponds

Karjan, in 1970-71, having reliable sources of irrigation had a big irrigated area to the tune of 4902 30 ha (9.35%) By 1990-91, it increased more than 2 9 times to the size of 14,282,70 ha (27 47%). Besides the traditional sources of irrigation the period between 1970-71 and 1990-91 has seen the installation of tube well both in public and private sectors By the second point of time there came as many as 44 tube wells increasing the levels of reliability and dependability especially in the events of scarcity of rains or long dry spells during the rainy months The plan of Narmada canal is on the anvil. The better prospects are foreseen, the future may have higher levels of dependability, and still more dynamicity of land use may be seen

Since the land of Karjan is largely composed of black cotton soil which does not need much of irrigation but since the late arrival of monsoon or scanty showers, long dry spells etc make irrigation compulsory and over and above the wide spread use of hybrid seeds have made irrigation essential for the present system of cultivation It is, therefore, obvious that the increasing dependability on sources of irrigation and decreasing scare of crop failures have the effect of augmenting the areas under those crops which were quite nominal during the first point of time in both the talukas Ready cash earning crops have also been found occupying sizeable areas of the G C A during the ending period of study It has, therefore, brought about a discernible change in the land use systems of both the

talukas. These factors may, therefore, be reckoned as a positive catalysts of change in both the talukas

6 3 3 **H.Y.V.S.**

Since the dawn of the human kind, man developed a instinct to acquire more and more out of the given resources This is the fact that inspite of desi strains, hybrids and H.Y.Vs have been developed to achieve desired and attractive quantity and quality of yield However, these hybrids need comparatively more amounts of fertilizers and water for a better yield, than the desi strains

A change from the traditional varieties of seeds to H.Y Vs is found almost in all the villages of both the talukas under study. The hybrid seeds of cotton were widely used even before 1965-66. From Vijay strain to Digvijay, from Digvijay to various hybrid strains viz Desi hybrid 7, Shankar-4, Gujarat hybrid-13, Gujarat hybrid-4 and 6 and varalaxmi are the strains adopted from time to time. They give an output of 600-700 kg or more per hectare

The hybrid tuer (pigeon pea – cajanus Indicus) are T 15-15, B.D.2, and Pusa Ageti. The first two are the late maturing and the last one is early maturing variety Their estimated yield is 1700-2000kg per ha. if not infested by the pests

The hybrid seeds of jowar are C S H 5 and C S H 6 Both the strains give an yield of 1800-2400kg. per hectare if the required amount of manures and chemical fettilizers are supplied. But in the study areas its average yield varied from 750 to 900 Kg. per hectare.

The bajra also gained favour due to its hybrid strain. It gives 800 – 1000 kg Per hectare if prescribed amount of water, manures and fertilizers are applied but the average yield remains around 600kg. per hectare or so.

The hybrid seeds of wheat are Gujarat wheat – 120, Gujarat wheat –89, Gujarat wheat -48, Gujarat wheat – 1 and Arnej Their expected yields under favourable conditions are 2500-2800 kg per hectare but in the study areas the average yield usually remains within 2000-2500 kg. per hectare Inspite of their meagre out turn necessities have favoured augmentation of cultivable land under these crops in both the talukas.

These grains, however, are not as popular as the cotton or its replacement tuer, as the cultivation in these talukas is found more inclined towards commercially viable crops. Thus, all the cereals in general and wheat and rice in particular are sown merely for domestic, and less for market purposes.

6 4.1 Government Programmes and Policies

The national Government right from the days of independence devised policies and programmes for the development in all fields of socio-economic activities The planning commission was instituted in those early days only with the objective of devising plans of development The key purpose of these policies was to make India a 'welfare state'.

Per chance, after independence, along with the growth in different fields, population also got an spurt, so much so that the country started facing population problem, as the growth in other fields did not pace with its growth. Thus, there was a dire necessity of improving the old and ancestral profession of Indian population, so as to meet the growing needs of the increasing eating heads. The agriculture therefore, was given the first priority in the plans of development The first plan from 1952-57 took agricultural developments as its primary motive. It was also decided at the same point of time that agriculture alone cannot meet the

needs and desires of the increasing population Thus, an all round development being complimentary to each other was envisaged, their programmes were taken up one after the other.

The rural population constitutes around 70 per cent of the country's total population. Their main occupation is agriculture and its allied activities. With the increasing population the per capita ratio of land started fast decreasing which invited the use of scientific measures to increase not only the production but also the productvity of land so that increased production may be obtained from the decreasing per capita amount of land. So the measures of agriculture adopted in the economically advanced countries were introduced in our country and the tradition minded farmers were, however, trained to apply them to their fields Those measures have already been discussed in this chapter under the head 'Technological Innovations', they need not be repeated here

The Government of Gujarat since the formation of this state in May 1960, has started the developmental programmes on war footing. Like the rest of the country agriculture in this state was given priority in the developmental plan. The following strategies were designed to make the objectives successful

1 To evolve public and private institution such as agricultural marketing co-operative societies for the sake of developing agriculture.
2. To arrange necessary inputs and make it easily available to cultivators.
3. To ensure remunerative prices for the crops grown, to give incentive to farmers so that they work dévotedly and attempt to grow more. The grow more food campaign is a part of this plan

4. To provide protection against risk of crop failures owing to the vagaries and uncertainities of the climate So more efficient irrigation facilities have been envisaged
5. To give more incentives for the cultivation of commercial crops.
6. To arrange timely credit facilities through the agricultural marketing societies and societies for small and marginal farmers for agricultural requirements.
7 To increase the cultivable land and optimise the use of soil nutrients-chemical and bio-fertilizers
8 To propogate- 'Integrated Pest Management Programme' (IPM) for the protection of each crop especially the commercial crops (mainly cotton) and to reduce the wrong effects of unnecesary pesticides and inscecticides on the plants, and their products.
9. To replace the traditional seeds by hybrid and H Y Vs to ensure greater out-turn.

The government, thus, devised a host of other useful plan strategies for the development of agriculture in each and every rural entity of the state. More stress have been laid on H.Y.V. seeds and irrigation facilities. The seeds are supplied free or on minimal cost and installation of tube wells are financed by the agricultural co-operative banks Government also allocates some funds Specially for small, marginal and poor farmers. Such farmers repay it on easy instalments from the output of the grown crops.

Protection against risk of biotic menace is made by training and visit schemes and also by integrated pest management programmes. However, pest control seems to be a failure, as the highly pest prone crop is cotton and it is reduced to the level of a minor crop, which once dominated the agricultural milieu of both Padra and Karjan

The agricultural marketing societies have, by and large, relieved the producers from the distress of selling their produce, and their benefits are, however, ensured through the remunerative prices yearly declared by the department of agriculture, Government of Gujarat

Land reclaimation and management has also been taken up briskly. Soil nutrients are applied to save soil exhaustion However, in the study areas, Padra is benefited by the programme of reclaimation and management but Karjan yet awaits any step in this direction

Similarly, other programmes enlisted in the previous page have been wholly or partially implemented, which have brought about visible beneficial changes in the agricultural economy of both the talukas Agriculture, to some extent, has become less reliant on nature, but more have to be done in this direction

An, over all, study of the government policies and plans shows that a great deal of efforts have been put in to uplift the fate and status of the farming society in the state in general, and the two talukas under study in particular, these plans and policies may be reckoned as a catalysts of change over time But, however, their achievements have yet to be made satisfactory, as many problems like scanty rains, excessive rains and floods, biotic menace effectively damaging the most precious crop of the area – cotton But great deal of methodological changes brought in the agricultural practices of the two talukas under study are undoubtedly owing to these plans and policies of state and the nation as a whole.