

Strategies for Doubling Farmers' Income in Gujarat by 2022



**Report of the State Level Co-ordination
Committee to develop strategies and road map
to double the farmers' income by 2022**

December 2017

Preface

Akin to the Green Revolution of the late 1960's, Doubling Farmers' Income by 2022-23 has become the watchword of the current agricultural policy scenario in India. The Hon'ble Prime Minister of India, Shri. Narendrabhai Modi, envisioned this target on February 28, 2016 while addressing farmers in Bareilly district of Uttar Pradesh. The target year (i.e. 2022) has more special connotations since that happens to be the 75th year of the country's Independence. As the policy level deliberations of various stakeholders toward identifying farm income issues and affixing strategies have gathered steam all over the country, it is beyond doubt that the Hon'ble Prime Minister's vision has certainly made a paradigm shift in our thinking process from ensuring food security to addressing income security.

There cannot be anyone questioning the need for doubling farmers' income. But how far it is possible to be achieved within the targeted five years remains the moot question. For the goal to be realized, it is estimated that an agricultural growth rate of 10.46 per cent is required, the rate which has never been achieved pan-India, barring a few states, since Independence. But twice over the last 30 years, farmers' income have almost doubled in six years only in nominal terms (i.e. without adjusting for inflation) - once between 1987-88 and 1992-93 and then between 2004-05 and 2009-10. Realizing this feat for the third time will itself be an achievement and doubling farmers' income in real terms, by removing the inflation factor from income levels, will be nothing short of a scientific miracle like Green Revolution.

Turning the pages of history would reveal that just a couple of years before the heydays of Green Revolution, many international experts predicted that India cannot be saved from famine and its food aids to India need to be diverted to other countries which can be saved. The country's scientific fraternity proved them wrong in a matter of a few years. When given with the task of doubling farm output and move the country toward self-sufficiency, the determined stakeholders (policy makers, scientific community and farmers alike) worked with positivity and made sure that the vision got delivered. In the current context, if all the stakeholders work with the same level of positivity and determination, the Hon'ble Prime Minister's vision of doubling farmers' income is certainly deliverable. But there is one contrasting fact that separates the Green Revolution era from that of this Doubling Income era. In the former, the stakeholders focused on lab-to-land strategies alone in which they were able to exercise complete control. But in the latter, for doubling farmers' income, now they have to bring the third element: market, which not only happens to be the most complex but also happens to be devoid of any institutional control. Now, the strategies need to shift from the two-dimensional lab-to-land approach toward the three dimensional lab-to-land-to-market. Thereby, either the farm production need to be market-led or the markets need to be tapped or created or facilitated to absorb farm output.

Despite its disadvantage of being a water-deficit state and prevailing arid and semi-arid conditions, the performance of Gujarat in terms of State GDP, agricultural GDP, per capita income and rural development measures is consistently among the top few states in India. The State's agricultural growth rate has never been short of seven per cent throughout the last decade. The farm income sources are also well diversified as farmers derive sizeable incomes from both crop and animal sector. With 53 per cent of its work-force dependent on non-farm operations, small-scale industries and enterprises are also flourishing in the rural areas. The state tops the charts in milk production as well. Fisheries sector has been identified as the sunrise sector and it is expected to contribute more to the farm income basket. Micro-Irrigation and Soil Health Card schemes are being well implemented in the State and the water conservation efforts through construction of over 1.25 lakh check dams and water distribution efforts through intra-state river linking have started paying dividends. In addition, Gujarat is both pioneer and leader in harnessing solar energy for irrigation purpose. Going by all this track record, it is no coincidence that the State proves to have high potential for doubling farmers' income. Accordingly, the present report has included a host of specific strategies that are expected to exploit the natural advantage of Gujarat and to tap the entrepreneurial spirit of the farmers along with making better use of farm sector and business friendly initiatives of both the State and Central Governments alike.

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1. Introduction

“If farmers give up farming, even the Rishis (Sages) cannot afford to survive.”- Thirukkural (300 BCE)

The above sacred verse from an ancient Indian literary text opines that no living person, however minimal his worldly needs be, could think of leading their lives without farming. The same condition continues to be applicable to the present days as well and whatever may be the per capita income levels, the food cannot be simply downloaded from the internet. Though farming is the backbone of Indian economy, it is still intractably dependent on the vagaries of monsoons and dotted with small and fragmented holdings which in turn are run by resource poor farmers. Agriculture in India is still dependent on the vagaries of monsoons and it is inextricably supported by small and fragmented holdings which in turn are run by resource poor farmers. Thereby, farming turns out to be a non-viable proposition and often not profitable. On the other hand, agricultural development in any region can occur only by: 1] growth in crop output; 2] increase in value of the given output; 3] diversification of agriculture towards high valued crops and livestock products (Bhalla and Singh, 2009). Here, the growth in output can result from two major phenomena: First, the output of a crop can increase due to a variety of reasons, including crop technology adoption, irrigation supplement to rain-fed crop, precision irrigation, and availability of adequate soil moisture and better soil nutrient management; or increase in area under the given crop. Second, the value of the given output in the market can increase due to changes in demand-supply situation, which is particularly important in the case of non-cereal crops and perishable products such as fruits and vegetables, and where the sufficient infrastructure for storage is either absent or economically unviable. Third, the farmers can shift to high valued crops or livestock, which give higher returns from unit of land and unit of livestock, respectively. Such a shift can be often subject to high crop risk or market risk (Kumar *et al.*, 2009). But the availability of good credit facilities, marketing infrastructure, research and extension services and technical inputs can faster this process.

Over the years, agriculture has become an occupation marked by large-scale disguised unemployment and unending uncertainties at each and every stage of farm operations. Topping that, recent NSSO survey reveals that 40 per cent of the Indian farmers wish to leave farming if given with some other option. Coming to Gujarat, agriculture is not only a prominent feature of the state but also inextricably linked to its economy (Patel, 1977). It engages nearly half of the rural workforce (52%) despite a decline in its share in the state net domestic product (SNDP) to less than one-fifth, besides severe resource degradation. This is why despite the overall growth of 9.7 per cent per annum recorded since 2000s, the sectoral patterns of agricultural growth have been far from uniform in Gujarat. Given this background, our Hon'ble Prime Minister Shri. Narendra Modi has envisioned of doubling farmers' income by 2022-23 – the 75th year of our Independence. To fuel his vision, he also unveiled a seven-point strategy for doubling farmers' income *viz.* focused measures to scale up irrigation; providing quality seeds and assuring nutrients based on soil health; large investments in post-harvest technologies; prioritizing value addition, creating National Farm Market; leveraging PMFBY; and promoting on-farm ancillary activities. Subsequently, it has become a common understanding that in order to double the farmers' income, there is a need to increase farm productivity, improve market access and also to develop the industrial and service sectors in rural areas, where the surplus farmers can find work.

In this context, it is pertinent to note that the latest Situational Assessment Survey of NSSO (2014) revealing nominal rise in farmers' income pan-India between 2002-03 and 2013-14 has been an impressive 11.4 per cent but the real income has only grown by 3.5 per cent. Besides, it is also necessary to ensure that the rise in income is of inclusive nature. In other words, if large farmers alone are the focus then doubling real-time farmers' income would be easily achievable. But that won't be inclusive growth as the nation's 80 per cent small and marginal farmers would be totally left out. Henceforth, more than average income of farmers, the median income (i.e. the middle-most income) is the one that

needs to be doubled. NSSO (2014) findings further substantiate this claim as they show mean farmers' income in India to be around Rs. 6,250 per month but the median farmers' income was found to be only around Rs. 1800 per month. Similarly, in Gujarat though the average farmers' income was found to be Rs. 7900 per month, the median farmers' income turned out to be Rs. 2500 per month alone. To workout feasible strategies relevant and to develop a road map to achieve this goal, the ICAR has constituted state level coordination committees (SCC) for all the Indian states *vide* reference F.No.5-4/2017-Cdn (Tech) Dated: 6th March, 2017. The composition of the Gujarat state Coordination Committees constituted by ICAR for doubling Farmer's income by March, 2022 is as follows:

- | | |
|---|----------|
| i) Vice Chancellor, Junagarh Agrl. University, Near Motibaugh Vansthali Road, Junagarh-362 001, Gujarat | Chair |
| ii) Director, Directorate of Groundnut Research, Junagarh-362 001 | Convener |
| iii) Vice Chancellor, AAU, Anand-388 110, Gujarat | Member |
| iv) Vice Chancellor, Kamdhenu University, Karmayogi Bhavan, Sector-10-A, Gandhinagar-382 010, Gujarat | Member |
| v) Vice Chancellor, Navsari Agricultural University, Navsari. | Member |
| vi) Vice Chancellor, SKDAU, Sardarkrushinagar, Dantiwada. | Member |
| vii) Director, Directorate of Medicinal and Aromatic Plants Research | Member |
| viii) Director, ATARI Zone VIII Pune | Member |
| ix) Director, Agriculture, Govt. of Gujarat | Member |
| x) Director, Horticulture Govt. of Gujarat | Member |
| xi) Director, Animal Husbandry, Govt. of Gujarat | Member |
| xii) Director, Fisheries, Govt. of Gujarat | Member |
| xiii) Nominee of Secretary DAC&FW | Member |
| xiv) Nominee of Secretary, DAHDF | Member |
| xv) Nominee of Secretary, Ministry of Food Processing Industries | Member |

The details of the meetings conducted by the Co-ordination Committee for Doubling Farmers' Income in Gujarat State are as follows:

Table 1 Details of the meetings conducted by the Gujarat SCC

S. No.	Date	Venue	Remarks
1	14 Mar., 2017	NAU, Navsari	Zone: I & II
2	15 Mar., 2017	JAU, Junagadh	Zone: VI & VII
3	21 Mar., 2017	AAU, Anand	Zone: III & VIII
4	21 Mar., 2017	JAU, Junagadh	Zone: VI & VII
5	22 Mar., 2017	AAU, Anand	Zone: III & VIII
6	23 Mar., 2017	AAU, Anand	All zone SLCC meeting
7	10 Apr., 2017	SDAU, Dantiwada	Zone: IV & V
8	14 Apr., 2017	SDAU, Dantiwada	Zone: IV & V
9	25 Apr., 2017	NAU, Navsari	Zone: I & II
10	08 May, 2017	NAU, Navsari	Zone: I & II
11	29 May, 2017	IIR, Hyderabad	Oilseed commodities
12	30 May, 2017	NCCSD, Ahmedabad	Special reference to climate change
13	26 Oct., 2017	JAU, Junagadh	Zone: VI & VII
14	28 Oct., 2017	JAU, Junagadh	Zone: VI & VII
15	30 Oct., 2017	JAU, Junagadh	All zone SLCC meeting

The mission of doubling farmers' income requires accurate information on certain indicators which reflect the farmers' income and welfare. For accounting farmers' income, past studies have largely used data regarding growth in agricultural output (VOP/ AgGDP/ GSDP), output and input price behaviour along with price spread, rise in wages and rising indebtedness. The income data were obtained from various sources viz. (i) Farm business income from CACP data; (ii) Aggregate and disaggregate farm income using CSO and NSSO data; and (iii) Income purely on the basis of Situation Assessment Survey

of NSSO. Apart from these secondary sources of farm income, scientific benchmark survey at taluka level is not available and without which it will be difficult to ascertain robust changes in income levels. Thereby, before devising and implementing income doubling strategies, it is equally important to conduct benchmark surveys with a sample size of at least 100 farmers at each taluka based on land possession as well as cropping pattern. The NITI Aayog and Inter-Ministerial Committee on doubling farmers' income have fixed the base year of income as 2016-17. Accordingly, the benchmark survey and the secondary data to be used should refer to 2016-17 as benchmark over which the farmers' income needs to be doubled by 2022-23. In such a case, doubling of real farmers' incomes within the next five years would require a mammoth agricultural growth rate of 10.46 per cent per annum which frankly had been never before achieved in the history of agrarian growth in independent India. But despite being an arid and semi-arid state with a high water-deficit scenario, Gujarat happens to be one of the few Indian states with consistent 7 per cent agricultural growth rate throughout the last decade. Thereby, it is in the realm of possibility for the State to achieve the goal of doubling farmers' income. But before discussing the strategies of doubling income in Gujarat, it is vital to see how good the State is positioned in terms of agriculture and allied sectors and how much prepared is the State for achieving the goal within the targeted year.

Potential and Challenges of Gujarat state in Doubling Farmers' Income

Potential
<ul style="list-style-type: none"> ● Agriculture growth rate at 9 % per annum throughout 2005-2015. ● Large scale adoption of GM technology, irrigation and power sector reforms, targeted lab-to-land extension programmes, diversification towards high value crops and state-of-the-art infrastructure, cold storage & processing facilities. ● Five crops (cotton, groundnut, wheat, sugarcane, fruits and vegetables) account for 71% of the total value of agri. output. ● Monopoly in seed spices and also in castor production (70% of India). ● Contribution to national production: 90% fennel, 65% cumin & 30% date palm and 35% of isabgol production. ● Immense potential for organic wheat in Bhal region (Bhaliya wheat durum – GI). ● Leading state in bio-fertilizer production and marketing. ● First state in India to have a University exclusively for Organic Agriculture.
Challenges
<ul style="list-style-type: none"> ● Presently, only 15% of the loan in the state is disbursed as investment credit. ● Yield rates of all major crops are only 50% to 75% of their potential yields. ● Available farm power is only about 1.20 kW/ha in Gujarat.

Potential of Gujarat Horticulture in Doubling Farmers' Income

Potential

- Area & production of horti. crops increased by 220% and 330% resp. during 2001 to 2015.
- 12% area under horticultural crops contribute 30% of state's total farm income.
- 10.19 % share of fruit production & 6.49% of vegetable production in India.
- Fourth leading state in fruit production & sixth leading state in vegetable production.
- Highest productivity: onion (25 mt / ha.) & potato (28.81 mt / ha).
- 2nd highest production of banana, papaya and lime in India.
- 2nd highest productivity of pomegranate and sapota in India.
- Biggest onion dehydration industry in the country comprising 80% of total dehydration units with processing capacity of 1 lakh tonne / annum.
- Kesar (GI) mangoes famous the world over with high export potential.
- Scope for HDP of mango in Saurashtra and South Gujarat ACZs.
- Protected cultivation & protective irrigation has given better returns in Gujarat.

Potential of in Agro-forestry, livestock and fisheries in Gujarat in Doubling Farmers' Income

Agro-forestry:

- Share of TOF (Trees Out-side Forest) is 2nd largest in India.
- Anand district has the highest density of trees (66.1 trees per ha) in non-forest areas of India.

Livestock and fisheries:

- 19 registered breeds (13%) out of 151 registered breeds of the country.
- Famous cattle breeds include Gir, Kankrej, Jaffarbadi, Mehsana, Banni, etc.
- 3rd largest milk producer (123 lakh MT) in 2015-16 and 7.33% growth in dairy sector during 2001-15.
- *Desi* advantage: Largest share of local cows Saurashtra (45%) & South Gujarat (36%).
- Livestock density in the tribal districts of Gujarat is highest in India.
- Long coastal-line of 1600 km | 4.3 lakh hectare inland water bodies | 716 fishing villages | 3rd largest fish producing state in India.
- Predominant fish breeds: Pomfret, Jew fish, Bombay duck, Shrimp, Lobster, Squid, Cuttle fish, Silver bar, Hilsa, Shark, Catfish and Mulletts.

2. Gujarat State Profile

To begin with, the agro-climatic features of Gujarat are fairly diverse (as presented in figure 1), with rainfall varying from 340 mm (Western arid region) to 1800 mm (Southern hills).

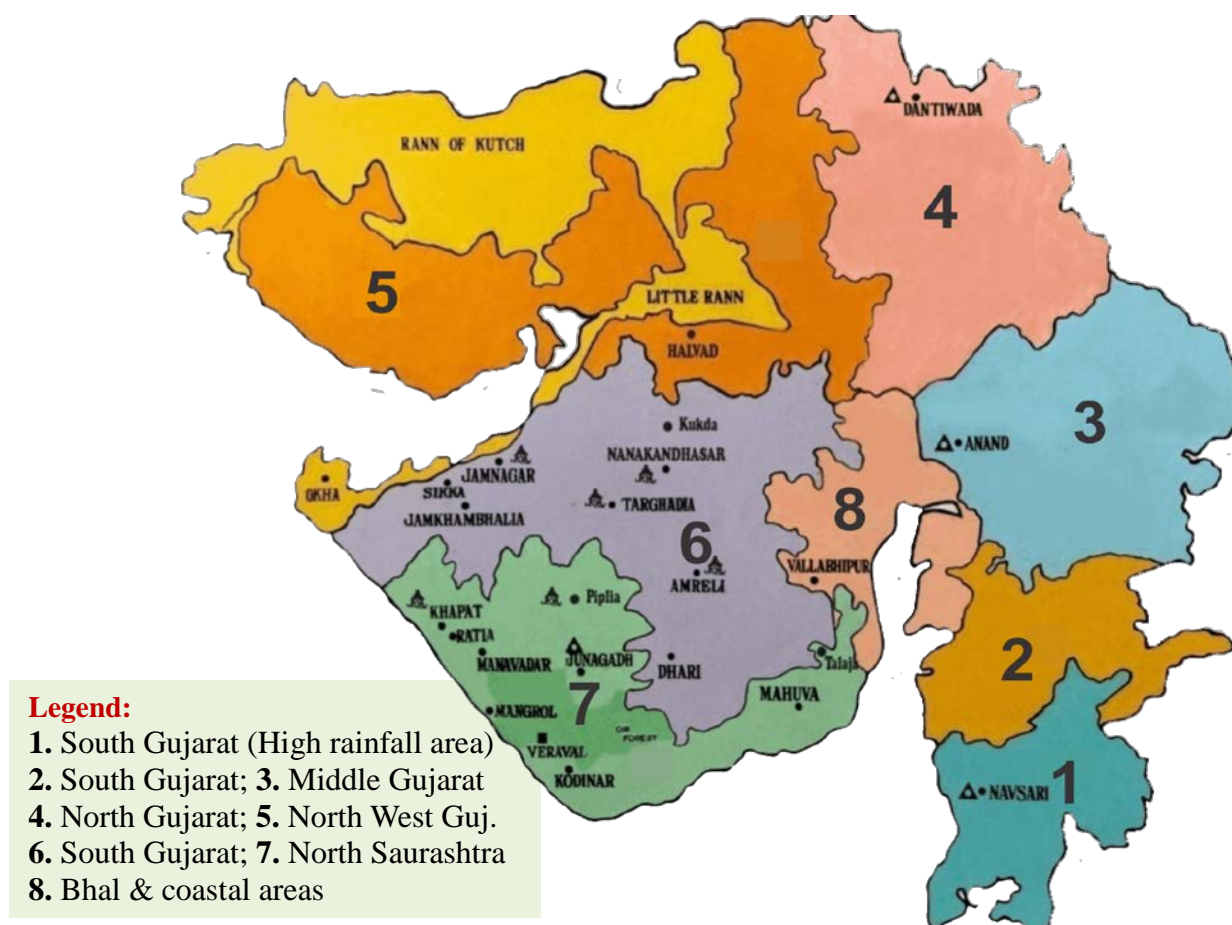


Figure 1 Agro-Climatic Zones of Gujarat State

Table 2 Major Characteristics of Agro-Climatic Zones of Gujarat

Agro climatic zone	Climate	Type of soil	Rainfall (mm)
South Gujarat	Semi arid to dry sub-humid with heavy rain fall	Deep black with few patches of coastal alluvial, laterite and medium black	> 1500
South Gujarat	Semi arid	Deep black clayey	1000-1500
Middle Gujarat	Semi arid	Deep black, medium black to loamy sand	800-1000
North Gujarat	Arid to semi arid	Sandy loam to sandy	625-875
Bhal and Coastal Area	Arid to semi arid	Medium black, poorly drained and saline	625-1000
South Saurashtra	Dry sub humid	Shallow medium black calcareous	625-750
North Saurashtra	Dry sub humid	Shallow medium black	400-700
North West Gujarat	Arid to semi arid	Sandy and saline	250-500

As shown in the Table 2 given above, Gujarat is divided into seven agro-climatic regions: (1) Southern Hills (Dangs and Valsad districts), having humid climate and 1793 mm average rainfall; (2) Southern Gujarat (Surat and Bharuch districts) with semi-arid climate, with 974 mm rainfall; (3) Middle Gujarat (Vadodara, Kheda and Panchmahal districts) having semi-arid climate, with 904 mm rainfall; (4) Northern Gujarat (Ahmedabad, Mehsana, Gandhinagar, Sabarkantha and Banaskantha districts) semiarid climate and average rainfall of 735mm; (5) North-west Arid (Kutch district) having extremely arid climate and 340 mm rainfall; (6) North Saurashtra (Amreli, Bhavnagar, Surendranagar, Jamnagar and Rajkot districts) having semiarid climate with 537 mm of average rainfall, and (7) South Saurashtra (Junagadh district); climate here is dry sub-humid with 844 mm average rainfall.

Cultivation of crops in each agro-climatic sub-division is conditioned by water availability among others. Nearly 20 per cent of the area of Gujarat is considered drought-prone, with high rainfall variability. The net cultivated area comprises 52 per cent of the reported area. As most of the arable land has been brought under cultivation, net sown area has ceased to grow. Land is increasingly becoming a binding constraint to agricultural expansion. Irrigation helps improve land productivity via crop intensification. Cropping intensity increased from 105 per cent in early-1960s to 113 per cent until early- 1990s. By early-2000s, the cropping intensity declined to 111 per cent and again got increased to 118% in 2015-16. A noticeable rise was seen in a few pockets in the middle and south Gujarat, while it continued to decline in the Saurashtra region. The other noteworthy feature of the land-use pattern is that forests occupy only 9.7 per cent of the reported area in Gujarat as compared to the national average of 21 per cent. Gujarat's agriculture, besides being weather dependent, is dominated by small landholdings. In 1995-96, the average size of operational holdings was 2.6 ha, which further declined to 2.1 ha in 2015-16. Of the total holdings, 63 per cent are of less than or equal to 2 ha.

Key particulars of Gujarat State as of 2016-17

Total Geographical Area: 196 lakh ha and 66% with < 750 mm rainfall

Gujarat comprises 24.94% of arid and 33.66% of semi-arid areas of the country.

Net Area Sown: 103 lakh ha (52%) | **Gross Cropped Area:** 139 lakh hectares (71%).

Gross Irrigated area: 44.71% | **Net Irrigated area:** 43.24%

Operational land holders: 48.86 lakh | **Average land holding:** 2.03 ha

Land holding: < 1 ha (18.1 lakh) | 1-2 ha (14.3 lakh) | 2 to 5 ha (10.8 lakh) |
5 to 10 ha (5.1 lakh) | >10 ha (49,000)

Cropping intensity : 118% | 70% of GCA under non-food crops.

Increase in total cropped area in last the 15 years: 2.5 million ha (i.e. 1 million ha by conversion of fallow lands and 1.5 million ha in double cropping).

Water harvesting on top priority with 1.75 lakh check dams & 2.25 lakh bori-bunds in the last decade.

Micro-irrigation (2016-17): 12.2 lakh ha | Drip: 6.5 lakh ha | Sprinkler: 5.7 lakh ha

Net irrigated area to increase to 64% in the next five years due to Sardar Sarovar Narmada Ltd.

Land use pattern of Gujarat agriculture

As of 2014-15, in the total geographical area of 196.0 lakh ha of the State, 99.63 lakh ha (more than 50 per cent) was under net cultivable area (Figure 3). About two-third of the area of the State falls under arid and semi-arid tropics and the rainfed area in the State was about 66 lakh ha. The gross irrigated area was 56.14 lakh ha accounting for 45.97 per cent of total cropped area in which about 12.16 lakh ha was found to be saline and alkaline.

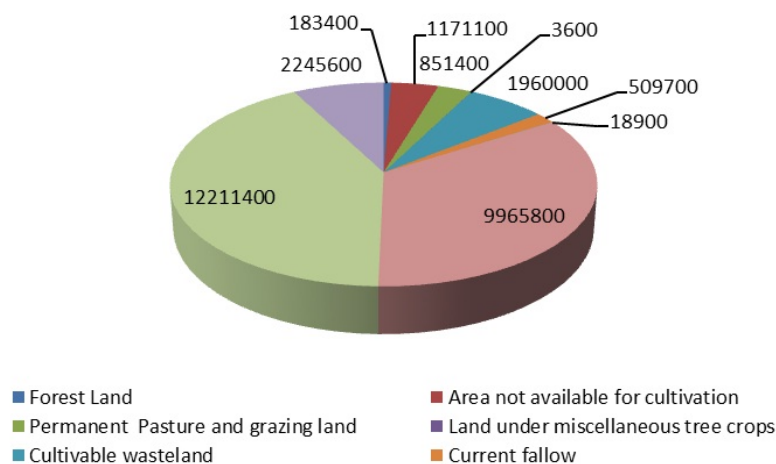


Figure 2 Land Use Pattern in Gujarat State in 2014-15

The gross cropped area was around 1.17 million ha. The cropping intensity across the State was 118.23 per cent and irrigation intensity was 132.62 per cent. Among the major crops the largest cropped area was occupied by cotton (18.95 lakh ha) followed by groundnut (16.31 lakh ha); wheat (13.21 lakh ha); pulses (8.24 lakh ha); rice (7.81 lakh ha); bajra (7.79 lakh ha); castor (7.06 lakh ha) and maize (5.13 lakh ha). The area under fruits and vegetables together comprised of 2.16 lakh ha in 2015-16. The total operational land holders in the State were 48.86 lakh with an average of 2.03 ha per land holder. Among the landholders, 37.16 per cent were marginal farmers, 29.25 per cent were small farmers, 22.10 per cent were semi- medium farmers, 10.49 per cent were medium farmers and 1.21 per cent were large farmers.

Land holding pattern in Gujarat

The size-wise distribution of operational holdings and area operated (Table 2) shows that in the year 2011-12, a majority of farm operators belonged to marginal and small farmer categories cultivating less than 2 hectares of land. Though they constituted about 62.9 per cent of total number of operational holdings, they operated only 26.8 per cent of total operational area. On the other hand, the large farmers (operating land area more than 10 hectares) and medium farmers (with operating land area of 4 - 10 ha) constituting only 24 per cent of total holdings occupied a substantial proportion (i.e., 43.9%) of total operational area.

Table 3 Land holding pattern of farmers in Gujarat

Sl. No.	Size class	Total holdings				Average size of holdings (ha)
		Number	Share (%)	Area (ha)	Share (%)	
1	Marginal (0-1 ha)	15,85,042	(34.0)	7,92,149	(7.7)	0.50
2	Small (1-2 ha)	13,45,348	(28.9)	19,59,288	(19.1)	1.46
3	Semi-medium (2-4 ha)	10,80,611	(23.1)	30,04,213	(29.3)	2.78
4	Medium (4-10 ha)	5,822,29	(12.5)	33,80,443	(32.9)	5.81
5	Large (> 10 ha)	67,784	(1.5)	11,33,171	(11.0)	16.72
6	All size groups	46,61,014	(100.0)	102,69,264	(100.0)	2.20

Source: GOG (2012)

Cropping Pattern in Gujarat

As seen in table 4, analysis of the cropping pattern in Gujarat brings out some unusual features. Up to early-1990s, bajra (pearl millet) and jowar (sorghum) were the main food crops and cotton and groundnut were the main non-food crops. Some significant changes have taken place in crop pattern of Gujarat in the post-liberalization period. Area under cereals which was around 40 per cent of the gross cropped area (GCA) in the early-1980s, declined to 36 per cent during TE 1992-93. Currently, the share of cereals is only 27 per cent (a decline of about 7 lakh ha since TE 1992-93). Area share of bajra that had remained constant at around 13 per cent till early-1990s has reduced to half in TE 2014-15. Similarly, area under jowar declined from 6.2 per cent of GCA to only 1.3 per cent during this period in 2009-10 and further decreased to 1.02 per cent in TE 2014-15.

Table 4 Changes (%) in cropping pattern in Gujarat: TE 1982-83 to TE 2014-15 ('000 ha)

Crop	1982-83	1987-88	1992-93	1997-98	2003-04	2009-10	2014-15
Rice	5.44	5.78	6.12	6.67	5.99	6.18	7.14
Jowar	10.19	10.65	6.18	3.98	1.71	1.32	1.02
Bajra	13.80	14.82	13.32	11.8	9.56	6.50	5.56
Wheat	5.64	4.26	5.42	5.83	5.20	9.17	9.52
Maize	2.82	3.48	3.51	3.80	4.36	3.55	4.08
All cereals	40.27	40.64	35.52	32.76	27.27	26.77	27.32
Gram	0.96	0.71	0.84	0.98	0.78	1.48	2.12
Arhar	2.86	3.97	3.97	3.54	2.92	2.26	3.04
All pulses	7.87	8.43	8.66	8.11	7.04	6.79	8.96
Foodgrains	48.14	49.07	44.18	40.86	34.31	34.11	36.28
Groundnut	19.79	17.78	17.62	16.57	17.89	15.80	14.92
Sesamum	1.22	1.29	2.39	2.53	3.39	2.16	2.14
Castor	1.79	2.12	3.14	3.79	3.02	3.43	3.76
oilseeds	24.65	23.63	26.67	25.99	26.89	23.79	23.02
Sugarcane	1.02	1.27	1.62	2.13	1.84	1.76	1.72
Cotton	14.06	12.42	10.65	14.00	15.42	20.48	18.92
Tobacco	1.10	1.29	1.29	1.22	0.86	0.45	0.43
Spices	1.22	1.00	1.82	1.58	2.18	4.41	4.38
Other crops	9.81	11.32	13.77	14.22	18.50	15.00	18.50
GCA	10883	9484	10750	11088	10948	11787	11784

Source: Crop & Season Reports, Department of Agriculture, GoG (Various years)

On the other hand, average area under wheat has more than doubled, from 5.4 lakh ha in TE 1992-93 to nearly 9.5 lakh ha in TE 2014-15 and now shares 34 per cent of the total cereal area. Area under rice has remained more or less stable at 5-6 per cent of the GCA. Acreage under groundnut that was 18-19 per cent of GCA throughout the 1980s, has declined to 15.8 per cent in the recent period. Castor has gained from 2.1 per cent of GCA in TE 1982-83 to 3.5 per cent in TE 2014-15. Substantial shifts in area under cotton have been witnessed during the post-reforms period. In early 1980s, cotton was the dominant cash crop occupying 14 per cent of the GCA. By early-1990s, its share dropped to 11.9 per cent comprising 10.6 per cent of GCA. Since then, its share has improved considerably. The share of cotton has doubled and reached 20.5 per cent by TE 2014-15. About 12.2 lakh ha of area has been diverted from other crops, mainly coarse cereals and pulses, towards cotton in the post-reform period. Other crops that are substituting coarse cereals, pulses and oilseeds (to a lesser degree) are the spices, fruits, vegetables, floriculture and medicinal plants. The total area under spices rose from around 2 lakh ha in TE 1992-93

to 4.3 lakh ha in TE 2014-15. High-value crops such as spices, fruits, vegetables and medicinal plants occupy one-fifth of the GCA. The share of these crops was 8 per cent in TE 1982- 83, which rose to 14 per cent TE 1992-93 and further to 16 per cent in TE 2014-15. These trends suggest that cropping pattern in the state has changed in favour of superior, more remunerative cereals like wheat and high-value crops such as oilseeds, cotton, spices, fruits and vegetables, floricultural and medicinal plants. Groundnut and cotton, being the main cash crops, have retained their dominant position in the cropping pattern. Area under coarse cereals has declined because of their lack of competitiveness over other crops. On the other hand, area under oilseeds such as castor, mustard and sesame has expanded significantly, mainly as these crops provide better returns and promote value-added agribusiness enterprises. Castor also has a high level of global demand. India imports about half of its demand for edible oils and the international prices are a determining factor of the prices of the oilseeds. Overall, cropping pattern in the state after mid-1990s is responding to the forces of globalization. Commercialization does show the signs of deepening, as the crops having greater market-orientation are consolidating their share in the farm economy of Gujarat. Crops such as cotton, oilseeds, fruits, vegetables, spices and flowers, amenable to processing and value addition, are on the increase. This calls for expansion of post-harvest facilities (including foreign investments in processing, refrigerated transport and cold storage). These crops inherently provide higher returns per unit of land, resulting in higher incomes and employment generation in the rural areas.

Development indicators

Seed requirement and availability in Gujarat

Seed is considered to be a catalyst of change in agriculture. As shown in table 3, there was significantly surplus availability of quality/certified seeds in Gujarat during both the seasons of 2011-12. Such a kind of abundant availability of quality/certified seeds has helped in enhancing agricultural production and productivity.

Table 5 Seeds requirement and availability (2011-12)

Kharif Crops	Demand (in qtls.)	Supply (in qtls.)	Surplus/ Deficit	Rabi Crops	Demand (in qtls.)	Supply (in qtls.)	Surplus/ Deficit
Paddy	85,500	86,000	500	Wheat	4,25,000	4,32,500	7600
Bajra	26,250	27,006	756	Bajra	15,000	17,762	2762
Moong	15,000	15,300	300	Moong	12,000	22,100	10,100
Arhar	200,00	20,100	100	Gram	26,500	27,004	503
Groundnut	5,17,621	5,17,621	0	Groundnut	36,500	38,700	2200
Castor	2500	36,864	34,364	Mustard	6500	5610	110
Cotton	74,508	74,990	482	-	-	-	-
Total	7,41,379	7,77,881	36,502	Total	5,20,500	5,43,676	23,176

Source: GOG (2012)

Seed replacement rate in Gujarat

The Green Revolution adopted in India during the late sixties and early seventies bears witness to this truth. And lately, during the decade of 2000s, *Bt* cotton seeds and hybrid maize seeds have shown spectacular results, particularly in Gujarat. To complement with good agricultural growth in the state, the availability of quality/certified seeds has been made available as required in various part of Gujarat. However, the seed replacement rate (SRR) for majority of crops has been quite low. Even in the case of cotton and groundnut which are the pride of Gujarat, SRR has been as low as 25.5 per cent and 24.9 per cent respectively (Figure 3). Besides mustard and bajra, the SRR needs further improvement in case of other crops.

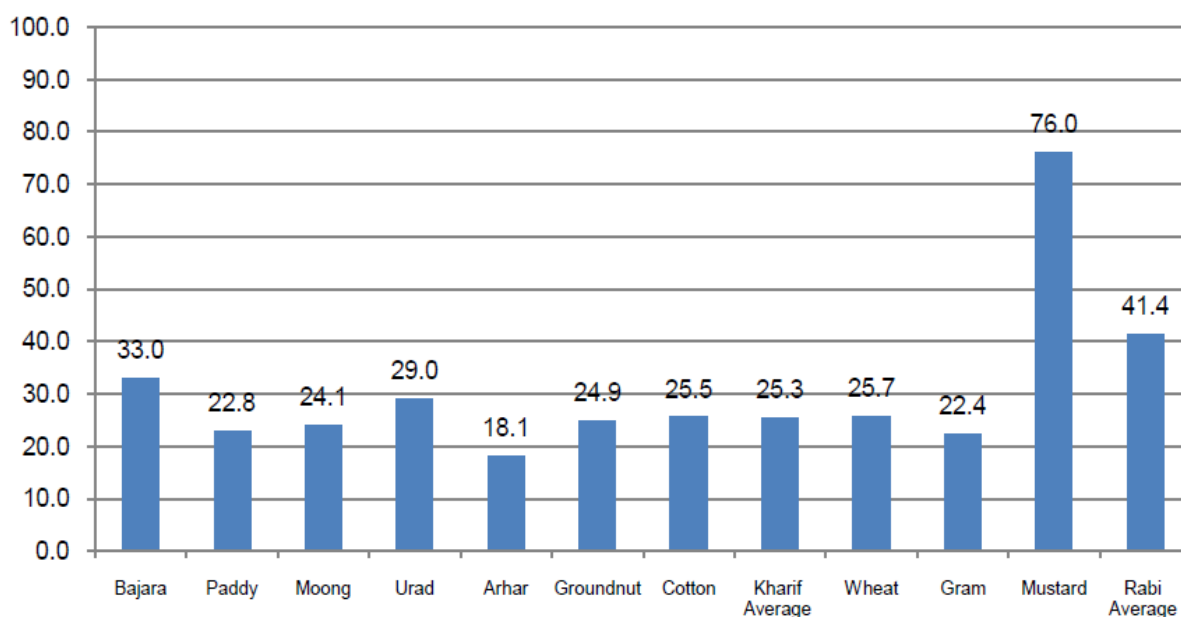


Figure 3 Status of seed replacement rate (SRR) in Gujarat (Source: Anon., 2016c)

Fertilizer consumption in Gujarat

Fertilizer consumption in Gujarat in the past decade is given in figure 4. The consumption of total fertilizer nutrients in Gujarat increased by from a total 0.51 million MT during 2000-01 to 1.565 million MT during 2013-14. During Kharif 2013, total nutrient consumption increased by 2.8% and in Rabi by 34.4% over the respective seasons in the previous year. Kharif: Rabi share in total consumption changed from 56:44 during 2012-13 to 50:50 during 2013-14. The consumption of N was at 1.159 million MT in 2013-14 and the same for P₂O₅ was 0.315 million MT and K₂O was 0.091 million MT. NPK use ratio was reported to be 12.8:3.5:1 in 2013-14. The per hectare consumption of total fertilizer nutrients was reported to be 119.5 kg in the same period.

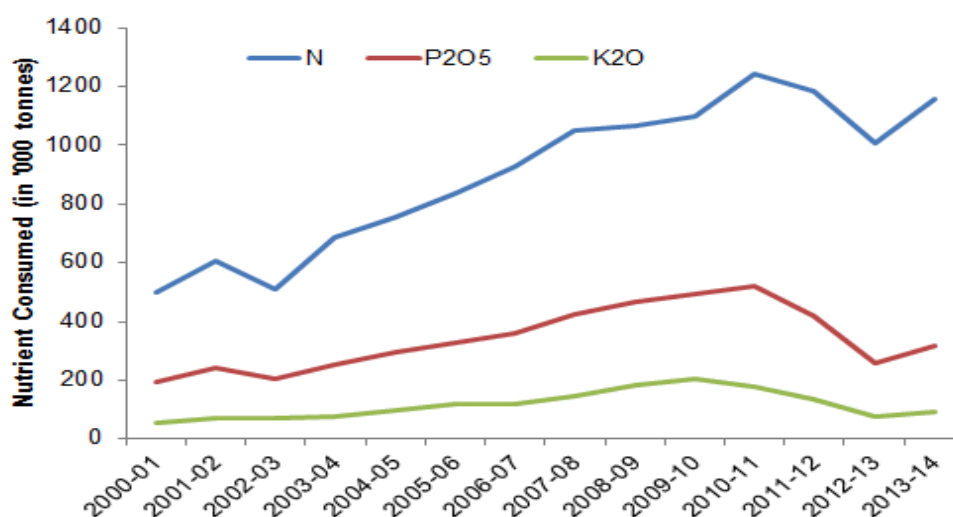


Figure 4 Fertilizer consumption in Gujarat over the last decade

Irrigation infrastructure in Gujarat

As of 2014-15, out of 117.4 lakh ha of cultivated land, about 49.4 lakh hectares area was irrigated. Thus, about 44.34 per cent of gross cropped area in the state was under irrigation. The net irrigated area in the state was 43.36 lakh ha and is projected to increase to 60 per cent within the next five years due to the

expansion under Narmada canal. Gujarat farmers rely on different sources of irrigation that include canals, tube wells, open wells and tanks. It may be noted that the share of canal irrigated area has remained unchanged at the level of 19 per cent and the combined irrigated area through tube wells and open wells has slightly declined from 79 per cent in 1990-91 to 76 per cent in 2014-15. However, the tube wells and open wells have been the major sources of irrigation in the state. Thus, the pressure on groundwater exploitation has considerably increased in Gujarat and in fact ground water has been over utilized in the state.

Shifting landscape of agriculture towards high-value and or high-yielding crops has been facilitated by irrigation development. As against 32 per cent of net cultivated area under irrigation in the period TE 1999-2000, the net irrigated area increased to nearly 42 per cent of the sown area in TE 2014-15. The dominant source of irrigation is through underground sources (78%), only 18 per cent is by canals and 4 per cent is by other sources such as tanks, and river lift. Recurrent droughts, introduction of high-yielding varieties and incentive-oriented pricing policy paved the way for extensive use of groundwater for farming. Groundwater with subsidized power to the farm sector had played an important role in sustaining the agrarian economy of North Gujarat. Here, 90 per cent of the total irrigated area is served by groundwater resources. Over-exploitation of groundwater causes drying of wells in parts of North Gujarat.

Falling groundwater table has resulted in increased initial investment in tubewell construction and has also added to variable costs of energy used for lifting water and well maintenance. It is reported that in North Gujarat the cost of irrigation amounts to nearly 36 per cent of the total input costs, with the result that the net return per unit of land for crops such as cotton and wheat remains the lowest in this region in comparison to other regions of Gujarat (Ranade and Kumar, 2004). The high cost associated with groundwater irrigation is affecting profitability of agriculture. Needless to add, groundwater over-exploitation with severely depleting water levels has serious equity implications. Shaheen and Shiyani (2005) in a study on access to groundwater in districts of North Gujarat have shown that Mehsana has the presence of company bore-wells in which farmers are shareholders. Economic access to groundwater in Mehsana is highly skewed towards small and marginal farmers. Farmers having low shares in bore-wells have been found to be better-off than farmers with higher shares in terms of access to the resource, relative to their share of investment in bore-wells. Formation of irrigation companies is an important mechanism for equity redistribution in this region as the small and fragmented landholdings make individual ownership of wells unviable.

Economic access to groundwater is skewed towards large farmers in Banaskantha where such informal bore-well organizations are absent, but the wells are shared within the family. In Gujarat, the total replenishable groundwater resource in 2010-11 was 17.3 km³/year, utilizable groundwater resource for irrigation was 15.6 km³/year and net draft was 10.2 km³/year. Gujarat has potential to develop irrigation for 5.9 million ha of rainfed area through water conservation technologies and practices. Up to 2010-11, nearly 1.01 lakh small water harvesting structures had been completed under the watershed development programmes. These are in the nature of check dams, bori-bunds and farm ponds/tanks. More intensive extension efforts are needed to popularize water saving technologies such as drip and sprinkler irrigation systems for sustainable use of groundwater. The ultimate irrigation potential through surface sources is assessed at 3.9 million ha, of which 1.8 million ha is through major and medium schemes. Sardar Sarovar Project (SSP) has a cultivable command area of 1.7 million ha. Minor irrigation has the potential to cover 0.4 million ha. Up to 2010-11, gravity flow irrigation from SSP had reached 72,000 ha. However, additional 2.15 lakh ha are being irrigated by lifting SSP water and transporting it by pipelines. Thus, even though the Narmada Canal has not delivered water to fields in the entire command, the completed network has enabled the farmers to tap water from the system. The gross

irrigated area through this could be in the range of 2.4 to 3.3 lakh ha. Further, Narmada water has replenished aquifers in North and Central Gujarat. Overall, the harnessed groundwater potential is around 2.04 million ha. Of ultimate irrigation potential by surface and ground water (excluding SSP); nearly 81 per cent has already been harnessed. Low soil moisture content, very high potential evapo-transpiration and aridity pose several limits to the choice of crops in Gujarat.

Dependency of state's economy on agriculture

Liberalization has boosted the process of agricultural commercialization in Gujarat . This was possibly aided by enhanced availability of water due to Sardar Sarovar Project (SSP) and some proactive Government initiatives such as subsidized electricity, extension services, soil health cards, mass based groundwater recharge through small water harvesting structures and spread of micro-irrigation. As shown in Table 5, the growth of aggregate output and land productivity for the major crops in Gujarat. Crop sector output in the period TE 1982-83 to TE 1992-93 was declining at – 2.12 per cent from 3.64 per cent recorded in TE 1972-73 to TE 1982-83, i.e., the phase coinciding with green revolution. With onset of liberalization (after TE 1992-93) decline in output growth continued. The output growth during TE 1999- 2000 and TE 2009-10, however, shows that early-2000s witnessed a significant trend break. Output after TE 1999-2000 has recorded unprecedented growth at 8.05 per cent, leading to growth in land productivity at 7.54 per cent from 0.14 per cent recorded in 1990s. Thus, early-2000s period can be considered a watershed after which output has recorded tremendous increase, making Gujarat the foremost state in India in terms of growth in value of agricultural output. The strong performance of Gujarat agriculture is also reflected in terms of increased crop yields in groundnut, wheat and rice; whereas the yield levels have been more or less sustained in all the major crops (Table 6).

Table 6 Annual compound growth rate (%) in crop sector of Gujarat

Particulars	TE 1972-73	TE 1982-83	TE 1992-93	TE 1999-00	TE 2010-11
	to	to	to	to	to
	TE 1982-83	TE 1992-93	TE 2002-03	TE 2009-10	TE 2014-15
Value of output	3.64	-2.12	-0.37	8.05	8.12
Land productivity	3.67	-0.15	0.14	7.54	7.78

Source: Crop & Season Reports, Department of Agriculture, GoG (Various years)

Table 7 Productivity (kg / ha) trends in major crops of Gujarat

Crop	TE 1982-83	TE 1992-93	TE 2002-03	TE 2004-05	TE 2009-10	TE 20014-15
Rice	1335	1332	1207	1483	1863	1902
Wheat	2316	2119	2223	2424	2689	2712
Jowar	566	597	733	876	1155	1190
Bajara	1194	891	1047	1170	1339	1268
Maize	1397	1193	1485	1436	1259	1250
Arhar	719	780	510	651	1001	1179
Groundnut	817	586	778	1111	1378	1562
Sugarcane	7422	8337	7056	7151	7069	7004
Cotton	205	239	1521	317	347	402

Source: Crop & Season Reports, Department of Agriculture, GoG (Various years)

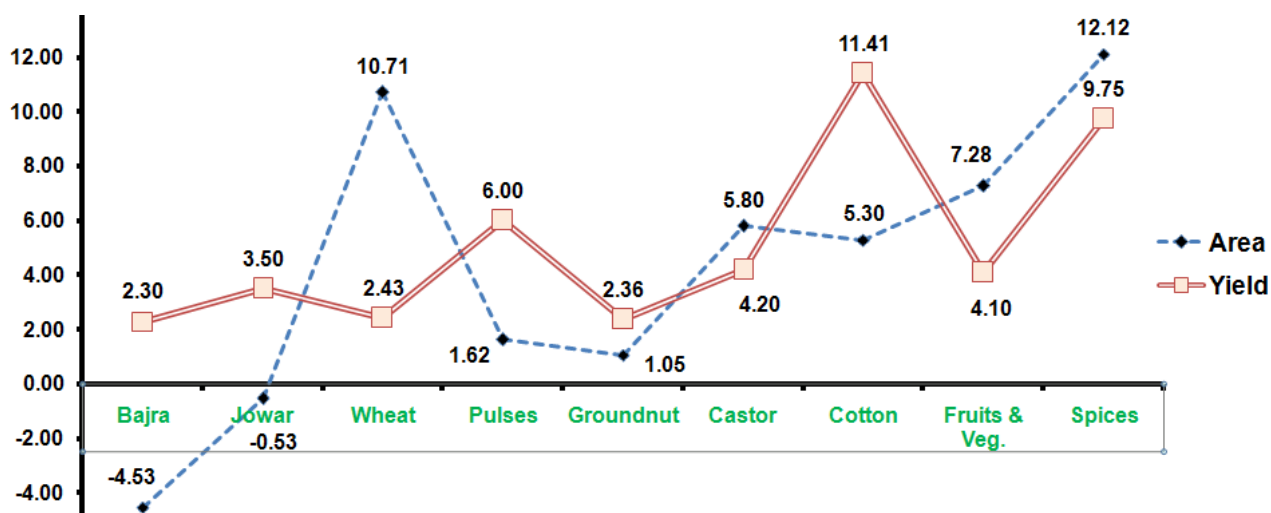


Figure 5 Area and yield growth rates of major crops in Gujarat during 2001 to 2015

Note: All the growth rates were found significant at 1% level Source: GOG (2012)

Rate of return to investments in Gujarat agriculture

The estimated values of marginal product (EVMP) of research investment are given in Table 8. The results revealed that additional investment of one rupee in research generated more than Re 1 on an average, in all the crops, except sesamum during the period 1990-91 to 2011-12. The highest marginal product of research was achieved in castor closely, followed by cumin and cotton, where additional investment of Re. 1 generated additional output of Rs. 22.37, Rs. 19.33 and Rs 17.42, respectively. The groundnut also generated very good additional output of worth Rs. 11.89 and except Bajra. Cereals and pulses also generated additional output of above Rs. 5 for every one rupee that is invested. Further the table also shows that during the period 1990-91 to 2011-12, the overall rate of return to public agricultural research investment turned out to be 29 per cent for wheat, 34.70 per cent for paddy, 55.40 per cent for arhar, 36.70 per cent for gram, 27.10 per cent for groundnut 26.80 per cent for mustard, 53.90 per cent for castor and 41.90 per cent for cotton, while the highest being 74.90 per cent for cumin crop in Gujarat.

Table 8 Rate of return to investments in Gujarat agriculture

Crop	Value of marginal product (in Rupees)	Internal rate of return (in per cent)
Wheat	6.45	29.00
Paddy	8.18	34.70
Bajra	1.33	--
Arhar	8.21	55.40
Gram	6.34	36.70
Groundnut	11.89	27.10
Sesamum	0.89	--
Mustard	7.06	26.80
Castor	22.37	53.90
Cotton	17.42	41.90
Cumin	19.33	74.90

Source: Dhandhalya *et al.* (2017)

District-wise performance of Gujarat agriculture

In the 2000s decade, wheat and high-value crops, such as cotton, spices, fruits and vegetables were responsible for the rise in output. Even though the food grain area declined, the increase in its output was quite high. The overall growth of non-food grain between 2001-02 and 2014-15 was, however, higher at 8 per cent than of food grains (6 per cent); an indication of increasingly commercialized and diversified nature of Gujarat's agriculture. The changes taking place in physical output for major crops are shown in figure 5. Among the major food crops, the yield growth of bajra (at 2.3%) between 2001 and 2015 could not offset the declining acreage under it. Jowar also recorded a decline in area growth (-0.53%) but the improvement in productivity at 3.5 per cent per annum.

Area under wheat has shown a statistically significant and phenomenal growth rate (10.7 per cent) and yield levels have also improved significantly (2.4 per cent) in the same period contributing to unprecedented rise in output. While the growth rate of area of pulses was modest at 1.6 per cent, its productivity showed a considerable breakthrough rising at 6 per cent. Among other food crops, potato, fruits & vegetables and spices (mainly chilly) have registered fairly high growth rates. The growth rate for area under spices was 12.1 per cent and its productivity also grew at 9.7 per cent significantly. State contributes 14-20 per cent share in major fruits and vegetables. Gujarat has recorded unprecedented growth in output of fruits and vegetables at 11 per cent contributed by very high growth in area (7.2 per cent) and productivity (4 per cent). The efforts of the Government to promote horticulture are actually bearing fruits. A few districts like Valsad are specializing in horticultural crops such as mango, sapota and cashew. With a view to double horticultural production and for simultaneous development of post-harvest infrastructure and marketing facilities, Gujarat State Horticultural Mission is being implemented in 15 potential districts. Output of potato has nearly doubled in the post-liberalization phase. Area growth (6%) is mainly responsible for this trend.

Sugarcane cultivation has largely been confined to the irrigated districts of Vadodara. Bharuch, Valsad, Kheda and Surat recorded high cane output growth in the decade of 1980s. However, cane cultivation is proving to be unsustainable, as can be seen from stagnation in yield and decline in area under the crop. Water logging and salinity, afflicting the canal-irrigated tracts where sugarcane is cultivated, are adversely affecting the yield of this crop. Gujarat is a major groundnut-producing state and its average contribution to the total production in the country is 37 per cent. In the post-liberalization phase, even though groundnut acreage is facing stagnation or replacement by other crops, its yield performance (2.36 per cent) is better owing to several years of good rainfall that facilitates early sowing. The area under sesame has recorded a huge growth at 5 per cent was also found to be between 2001 and 2015 which was not so earlier. Large area shifts under this crop (replacing coarse cereals) are somewhat undermined by the productivity decline, and the output growth is a modest 3 per cent annually. In contrast, while area under castor has remained more or less the same, the statistically significant growth in its output at nearly 5.8 per cent has attributed largely to improvements in productivity at 4.2 per cent. Overall, the output of oilseeds in Gujarat is growing at a high rate of 4.1 per cent almost entirely driven by the productivity growth (4.8 per cent). Oilseeds apart from technological inputs require effective measures for the post-harvest processing activities. Cotton is currently the single most important nonfood crop of Gujarat. There has been a marked improvement in cotton production in post-liberalization phase. Area under cotton increased at the rate of 5.3 per cent and its productivity grew at 11.4 per cent. During the period, this was the highest achievement for any single crop in Gujarat.

The single most important factor driving the growth in cotton is the widespread adoption of Bt cotton. Measures such as water harvesting through checkdams and water availability from the Narmada project and other irrigation projects pursued by the state, have aided the shift towards cotton quite significantly. Further, a strong local marketing system comprising agribusinesses and cooperatives, has helped to

deliver inputs and handle marketing of the output efficiently. A noteworthy fact is that benefits from Bt cotton in terms of yields have been scale-neutral. Bt cotton yields have been reported to be similar across different farm categories. The yield increases for Bt cotton are found to be 35 per cent higher than of traditional high-yielding varieties. Even after foregoing the higher cost of cultivation for Bt cotton due to higher seed cost, net profit is reported to increase by 75 per cent with adoption of Bt cotton. This explains the success of Bt cotton in Gujarat (Gandhi and Namboodiri, 2009).

Table 9 District-wise percentage share and compound growth rate of output value in Gujarat between 2001-02 and 20014-15

District	Total food grains		Other crops	
	% share	Growth rate (%)	% share	Growth rate (%)
Ahmedabad	6.36	8.99	3.99	4.62
Banaskantha	7.88	2.76	6.53	4.35
Bharuch	5.20	1.46	7.10	3.45
Dang	0.72	14.49	0.17	17.68
Gandhinagar	1.58	13.48	0.66	21.38
Kheda	14.06	5.64	7.34	3.81
Mehsana	9.35	5.18	6.21	1.00
Panchmahal	7.43	4.10	1.66	17.54
Sabarkantha	7.79	3.08	5.03	4.39
Surat	10.00	0.32	11.15	2.10
Baroda	7.03	-2.04	6.43	4.47
Valsad	5.23	2.24	4.63	2.79
Amreli	1.73	7.92	4.09	13.78
Bhavnagar	2.36	9.39	4.69	16.73
Jamnagar	1.45	14.00	3.86	17.80
Junagadh	4.40	18.88	10.33	7.28
Kutch	2.95	7.72	3.68	8.84
Rajkot	1.81	19.47	5.98	15.91
Surendranagar	2.67	5.04	6.46	9.34
Gujarat State	100	6.03	100	8.05

Source: Crop & Season Reports, Department of Agriculture, GoG (Various years)

Note: All the growth rates were found to be significant at 1 % level.

The district-wise growth rates of food grains and other crops are presented in table 10. It can be seen that the growth rates in food grains reported to be more than 10 per cent between 2001 and 2015 in the districts of Dang, Gandhinagar, Junagadh, Jamnagar and Rajkot. At the same time, for the crops other than food crops more than 10 per cent growth rate was reported in the districts of Dang, Gandhinagar, Panchmahal, Amreli, Bhavnagar, Jamnagar and Rajkot.

Drivers of agricultural development in Gujarat

The period after 1999-2000 saw a turn-around in Gujarat, as far as agricultural growth is concerned. Between 1999-2000 and 2014-15, Gujarat agriculture (including dairying) grew at a statistically significant rate of 10 per cent. Further, its contribution to state NSDP after 2004-05 has stabilized at 17-19 per cent. Thus, despite long-term declining share of agriculture sector in the state and severe output and income fluctuations, the period of 2000s was one of high growth. Relationship between the behaviour of agriculture sector and that of NSDP has strengthened in recent times. It is important to find out the crops which have actually contributed to this growth. This is crucial to identify the factors that are driving this growth. For this, the changes in gross value of total agricultural outputs (at current prices)

during the period from 1980-81 to 2006-07 were analyzed using data from Central Statistical Organization, and compared against that of individual produce. Our analysis shows that the increase in gross value of agricultural outputs in the state was in the tune of 41,150 crore rupees. Five major agricultural produce, which have contributed to the growth, are: milk, followed by cotton, horticultural crops, groundnut and sugarcane, whereas wheat and paddy take 6th and 7th place (Table 10). This clearly shows that dairy production remains to be frontrunner in Gujarat's agricultural growth parade.

Table 10 Drivers Gujarat's agricultural development from 1980-81 to 2014-15

Sr. No	Name of Crop and Dairy Product	Total Increase in Value Output (crore)	% Contribution to the Value Increase in Gross of Agricultural Output
1	Milk	8995.70	21.90
2	Cotton	6162.90	15.00
3	Horticultural crops	5691.40	13.80
4	Groundnut	4955.60	12.00
5	Sugarcane	2422.50	5.90
6	Wheat	1943.30	4.70
7	Paddy	1167.80	2.83

Source: Crop & Season Reports, Department of Agriculture, GoG (Various years)

Rural Infrastructure and work force

Concerted efforts by the government on enhancing the rural infrastructure and to improve the livelihood has been paying consistent dividends. The current status of rural infrastructure in Gujarat is summarized in Table 4.

Table 11 Infrastructure availability in rural Gujarat

Infrastructure	Achievement (Nos.)
Villages electrified	18610
Villages having agriculture power supply	15115
Villages having post office	8979
Villages having banking facilities	8251
Villages having primary schools	15501
Villages having primary health centres	1174
Villages having potable water supply	18697
Villages connected with paver approach roads	21505

Source: Agriculture Census, 2010-11

The workforce availability in the state summarized in Table 5 show that workers employed in non-farm sector form the major share (53 per cent) of total workers' profile. The number of cultivators and agricultural labourers are almost equal in number.

Table 12 Workforce profile of Gujarat state (in '000)

Type of workforce	Population (Nos.)
Cultivators	4747
Agricultural labourers	4492
Workers engaged in household industries	252
Other workers	10874

Source: Agriculture Census, 2010-11

Status of farmers' income in Gujarat as of 2016-17

At the outset, as Table 2 suggests, it is important to double the real income levels and not just the nominal incomes. Accordingly, the inflation factor needs to be adjusted while accounting the income change. Farmers' income in Gujarat is more diversified when compared to the whole of India. Past trends reveal that though during 2008-09 to 2013-14 farmers' average income at nominal prices grew at 14.8 per cent annually on an average, the real growth was only at 3.1 per cent per annum. The latest Situational Assessment Survey of NSSO (2014) also reveals that the nominal rise in farmers' income pan-India between 2002-03 and 2013-14 has been an impressive 11.4 per cent but the real income has only grown by 3.5 per cent. Besides, it is also necessary to ensure that the rise in income is of inclusive nature. In other words, if large farmers alone are the focus then doubling real-time farmers' income would be easily achievable. But that won't be inclusive growth as the nation's 80 per cent small and marginal farmers would be totally left out. Henceforth, more than average income of farmers, the median income (i.e. the middle-most income) is the one that needs to be doubled. NSSO (2014) findings further substantiate this claim as they show mean farmers' income in India to be around Rs. 6,250 per month but the median farmers' income was found to be only around Rs. 1800 per month. Similarly, in Gujarat though the average farmers' income was found to be Rs. 7900 per month, the median farmers' income turned out to be Rs. 2500 per month alone. As it could be seen from both Table 4 and Figure 5, the livestock component happens to assure an income of Rs. 1930 per month which is 24 per cent of farmers' income in the State against Rs. 763 per month in India (11.86 per cent). Moreover, the figures also reveal that farm income is just one of the components of farmers' income as they constitute only 37 per cent and 48 per cent of the same in Gujarat and India, respectively.

Table 13 Farmers' Income types and their doubling strategies

Type of Income	Doubling Strategy
Per capita farm income	Can be achieved with both on-farm (crop cultivation) and off-farm (livestock, poultry) activities.
Per capita income of agricultural households	Can be achieved by diverting members in a farm household to other non-farm and wage jobs alone.
Mean farm income	Can easily be doubled by encouraging large farmers farming alone.
Median farm income	Doubling not possible without including small and marginal farmers.
Nominal farm income	Inflation will take care of its doubling.
Real farm income	Doubling has to be achieved against prevailing inflation levels.
Per capita median real income of farmers	Cannot be achieved by leaving out small and marginal farmers of the State or by focusing on farm output alone. Needs an inclusive kind of approach.

Table 14 Average monthly farmers' income in Gujarat and India

Particulars	Net receipt from cultivation (Rs)	Net receipt from livestock (Rs)	Net receipt from nonfarm business (Rs)	Net income from wages (Rs)	Total income (Rs)	Total consumption expenditure (Rs)	Estd. no. of agri. Households ('00)
Gujarat	2933 (37.00)	1930 (24.36)	380 (4.79)	2683 (33.85)	7926	7672	39,305
India	3081 (47.95)	763 (11.86)	512 (7.96)	2071 (32.23)	6426	6223	9,02,011

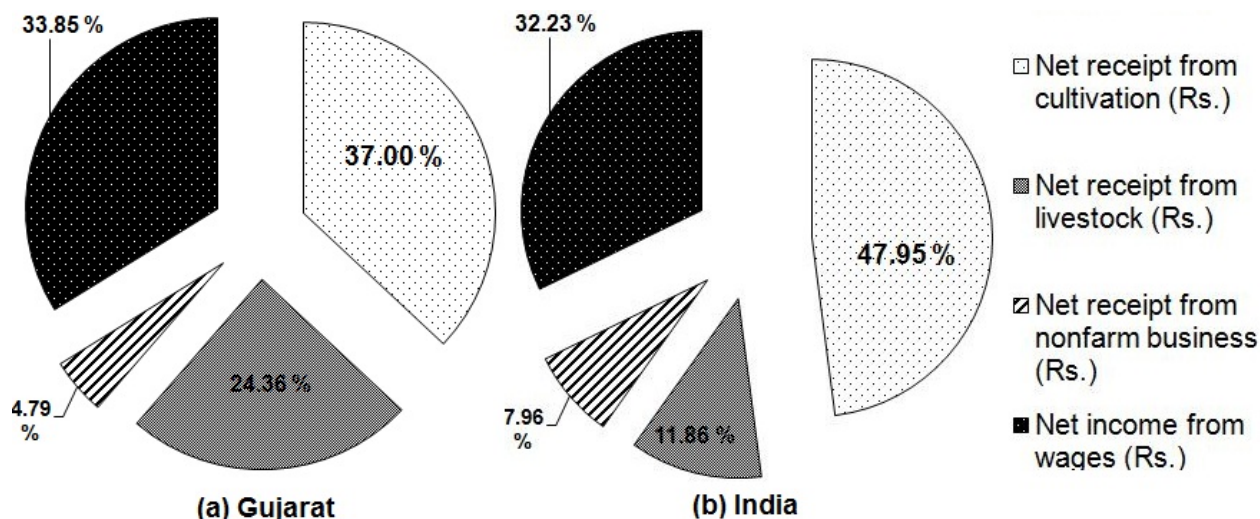


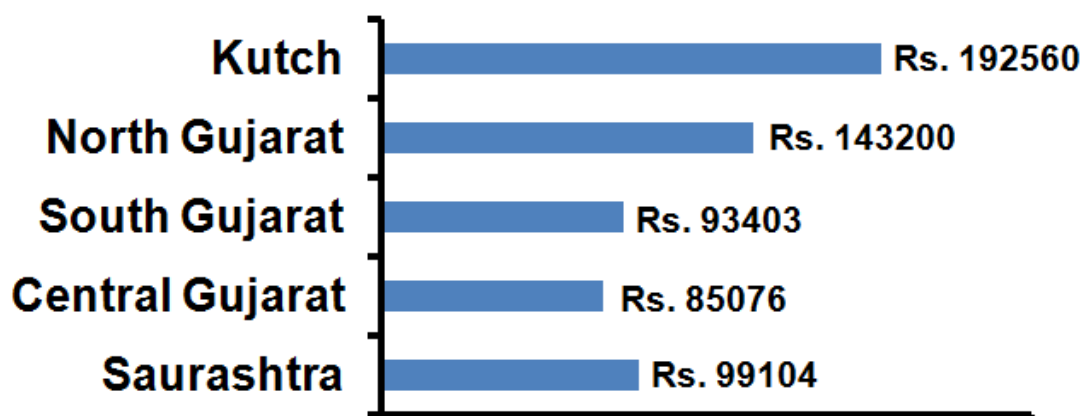
Figure 6 Sources of income distribution of farmers in Gujarat and India

Source: NSSO (2014)

As the base year for doubling farmers' income is fixed to be 2016-17, it is vital to see the farmers' income levels for the same year in Gujarat. As the income levels of 2016-17 were not readily available, the income data pertaining to 2012-13 of SAS (NSSO) were multiplied with the Consumer Price Index of Agricultural Labourers (CPIAL) decimal factor of 1.29 to arrive at the 2016-17 income levels. Both state level and regional level estimated figures of farmers' income are given below,

Table 15 Average farmer's income in Gujarat and India (2016-17) / annum*

Particular	Net receipt - farming (Rs.)	Net receipt - livestock (Rs.)	Net receipt - business (Rs.)	Net income - wages (Rs.)	Total income (Rs.)	Median income (Rs.)
Gujarat	45,403	29,876	5,882	41,533	1,22,694	38,514
India	47,694	11,811	7,926	32,059	99,474	28,251



*Nominal income of 2012-13 of NSSO is multiplied with CPIAL decimal factor of 1.29 (RBI)

Figure 7 Region-wise annual farmer's income in Gujarat (2016-17)*

3. Infrastructure for agriculture & agriculture development programmes

State Agricultural Universities

The four agricultural universities in Gujarat to cater the needs of agricultural education, research and extension of the state are as follows:

- **Junagadh Agricultural University (JAU)** offers education in agriculture and allied sciences i.e. Agriculture, Agril. Engineering, Fisheries, Veterinary Science & Animal Husbandary and Agri-Business Management and consists a total of seven colleges with its jurisdiction in ten districts of the state in Saurashtra region viz., Amreli, Bhavnagar, Jamnagar, Junagadh, Porbandar, Rajkot, Surendranagar, Devbhoomi Dwarka, Gir Somnath and Morbi covering about 32.82 per cent area of the Gujarat State. Besides, there are seven multidisciplinary main research stations, five main research stations and eleven Sub-Research Stations/ Testing Centres in the university. The extension component includes six Krushi Vigyan Kendras (KVKs), one Sardar Smruti Kendra (SSK), Centre of Excellence of Training in Groundnut, Centre of Excellence on Soil-Water Management and a T & V Scheme.
- **Anand Agricultural University (AAU)** is comprised of seven Colleges, seventeen Research Centers and six Extension Education Institutes working in nine districts of Gujarat namely Ahmedabad, Anand, Dahod, Kheda, Panchmahal, Vadodara, Mahisagar, Botad and Chhotaudepur.
- **Sardarkrushinagar Dantiwada Agricultural University (SDAU)** extends its jurisdiction to seven Districts of North Gujarat region viz., Banaskantha, Sabarkantha, Mehsana, Patan, Gandhinagar, Kachchh and Aravalli. It is aimed to serve the agricultural interest for the economic development of the farming community of North Gujarat region with 8 colleges, 28 Research Stations and 3 Krishi Vigyan Kendras (KVKs) in its ambit.
- **Navsari Agricultural University's (NAU)** jurisdiction covers seven districts of South Gujarat viz., Narmada, Bharuch, Surat, Tapi, Navsari, Dangs and Valsad and is comprised of ten colleges, seven polytechnic institutes, 20 research centres along with five KVKs and one SSK.

ICAR Research Institutes and regional research stations

- ICAR-Directorate of Groundnut Research, Junagadh
- ICAR-Directorate of Medicinal and Aromatic Plants Research, Anand
- Regional Research Stations of the ICAR- Central Arid Zone Research Institute, Central Institute of Arid Horticulture, Central Marine Fisheries Research Institute, Central Institute of Fisheries Technology, Central Inland Fisheries Research Institute

Initiatives in agricultural sector by Government of Gujarat

Soil Health Card: Pioneer State in implementation

Gujarat was the first state to launch the most lauded initiative of preparing Soil Health Cards for its farming community. This acts like a ration card, providing permanent identification for the status of cultivated land, as well as farmers' names, account numbers, survey numbers, soil fertility status and general fertilizer dosage. Some of the major achievements of the scheme are as follows:

- Soil Health Cards have been provided to 13,66,016 farmers as on 15.11.2016.
- At present, there are total **141** soil testing laboratories in Gujarat State.
- Soil Fertility Maps are prepared and distributed for about for **9300** villages.

***Krush*i Mahotsavs: The flagship event of GoG**

The Government of Gujarat introduced the concept of *krushi mahotsavs* in 2005 as an innovative approach in agriculture. *Krush*i *mahotsavs* pave way for horizontal transfer of technologies and promote scientific and sustainable method of crop production and development of agriculture and allied sector among farmers. Several studies have revealed enhanced of farm prosperity as well as better socio economic condition of the farmers as a result of successful *krushi mahotsavs*. Apart from providing guidance to the farmers, animal vaccination camps and artificial insemination activities are also carried out during such a flagship event. Guidance to farmers are provided for scientific farming, organic farming, farm mechanization, micro irrigation, crop value addition and information about various government schemes during *krushi mahotsavs*. It can be well said that *krushi mahotsavs* are nothing short of a unique ‘lab to land to market programme’ benefitting farmers on a larger scale with real-time information.

I-khedut Portal: An e-Extension milestone

To provide diverse agricultural information to farmers from technology to market price aspects, the online portal (<http://kcc.gujarat.gov.in>) for farmers was started by Department of Agriculture, Government of Gujarat. The portal has benefitted 17.13 lakh farmers as on June, 2016.

The salient features of the portal are as given below:

- Beneficiaries to get benefits of various agriculture related schemes;
- Detailed list of dealers providing agricultural machineries;
- Information of agencies providing agricultural credit;
- Latest technical information related to agriculture;
- Various APMC market price of agricultural commodities;
- Solutions related to problems in agriculture.;
- Details of agricultural land.

Jyotigram Yojana: One scheme, many benefits

Jyotigram Yojana is an initiative of the Government of Gujarat to ensure availability of 24-hour three phase quality power supply to rural areas and to supply power to farmers residing in scattered farm houses through feeders having specially designed transformers. The scheme separated agricultural feeders from domestic feeders resulting in agricultural connections such as irrigation pumpsets getting 24 X 7 assured electricity supply with good voltage. The scheme was dedicated to the nation by the erstwhile Hon’ble President of India, Dr. A. P. J. Abdul Kalam in 2006. Stockholm International Water Institute (SIWI) has commended the scheme saying it has radically improved the quality of village life, spurred non-farm economic enterprises, improved small-scale industries and halved the power subsidy in agriculture. Besides, Government of India also accepted Gujarat’s Jyotigram project as a flagship scheme in the 12th Five-Year Plan. In a short span of two and a half years, i.e. from October 2004 to March 2006, JGY involved erection of 1.6 million electric poles installation of 15,500 transformers and laying down of 75,000 kms of electric lines. As a result of

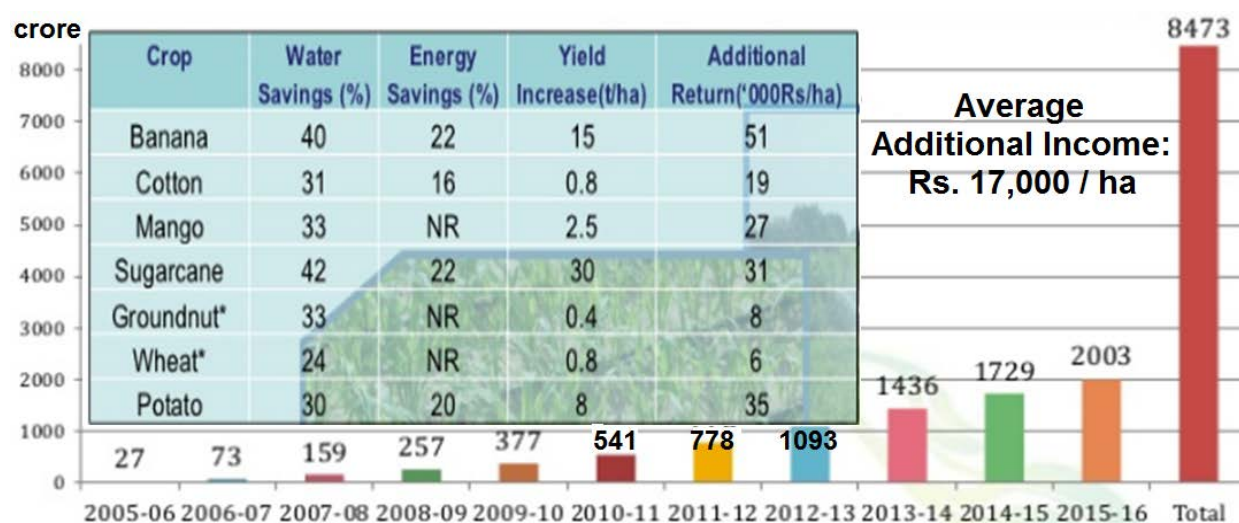
which the scheme has brought down transmission and distribution losses. The model is now being followed in most of the states.

Gujarat Green Revolution Company: Micro-irrigation redefined

Gujarat Green Revolution Company Limited (GGRC) promoted by Gujarat State Fertilizers & Chemicals Limited, Gujarat Narmada Valley Fertilizers Company Limited and Gujarat Agro Industries Corporation Limited has revolutionized the concept of micro irrigation systems (MIS) in the State. The Micro Irrigation Scheme is being implemented in a uniform mode by GGRC on behalf of the Government of Gujarat and the Government of India, since May 2005. Being a State with limited source of irrigation facilities, the main objective of the Micro Irrigation Scheme is to benefit the farmers by increasing agricultural production through the adoption of scientific water management techniques so as to usher in the Second Green Revolution. In pursuance of this objective, the State Government has embarked upon Jal Sanchay Abhiyan, (Drive for Storage of Water) in which the Micro Irrigation Scheme is an integral part of the Programme. The Micro Irrigation Scheme has been made more popular by providing electricity connections, on a priority basis, to those farmers who adopt Micro Irrigation Systems on their agricultural lands.

GGRC provides for the implementation of the Scheme in an integrated manner with the provision of financial assistance to beneficiary farmers for adopting MIS viz. drip/ sprinkler/ rain guns/ porous pipes. The company has been effectively utilizing ICT integration of Project, Financial and Management Information right from the start to such an extent that even physical inspection of farmer and material is carried out by GPS technology. The scheme was such a roaring success that from 16,000 ha (in 2005-06), the scheme has covered 10,34,930 ha (as of 2014-15) benefitting a total number of **6,40,853 farmers** and disbursing a total amount of **Rs. 2866.43 crore as subsidy**. In the tribal areas alone, 1,31,293 farmers have adopted MIS over a cumulative area of 1,78,745 hectares. Thereby, it is no coincidence for the scheme to get recommended by the Central Government to other States as well in the year 2012. The major field crops covered under MIS are groundnut, cotton, sugarcane and castor while the major horticulture crops covered under the scheme include potato, banana, mango, papaya and vegetables.

Additional Income realized by Gujarat farmers due to Micro Irrigation Systems (MIS)



Source: GGRC (2016)

Promotion of Sardar Package

For increased adoption of MIS and to maximize benefits from the same, the Government of Gujarat has come up with an innovative Sardar Package containing the following components such as:

1. **Micro Irrigation Systems (MIS):** For ensuring water, energy, labour, fertilizer saving technology coupled with the increase in the yield.
2. **Solar Pump:** For promoting eco-friendly system in lifting irrigation water through pump.
3. **Protected Cultivation Structures:** To further save water, energy, labour coupled with high quality of produce with increase in yield.
4. **Water Soluble Fertilizers:** For precise use of fertilizers by the way of application through Drip Irrigation System to enhance fertilizer use efficiency.
5. **Bio-fertilizers:** To facilitate organic farming among farmers.

Check-dam movement: A success with no parallels

With 20 per cent area of the State having 71 per cent of the water resource and 80 per cent area of the State having 29 per cent water resource, the natural distribution of water is also skewed in Gujarat. The Saurashtra region once faced endless series of droughts for almost three decades. But since 2000, the area has become self-sufficient due to the construction of check dams that prevents wastage of precious rainwater. Nowhere else in the world have check dams been built on this scale. Since 2000, the state has built 126,000 check dams at an average cost of Rs 5 lakh to Rs 6 lakh each. About 55,000 of those dams were constructed in Saurashtra alone. The check-dams have increased the period of water availability by at least four months. They have become central to efforts to promote agriculture and have immensely contributed to achieve double digit growth in agriculture throughout the last decade.

Though the check-dam movement gained traction in the early 1990's in Gujarat through community-led initiatives in the Saurashtra region, the State government helped things along in 2000 with its Sardar Patel Participatory Water Conservation Project. Through this scheme, the state bears 80 per cent of the cost of building a check-dam and farmers or NGOs would have to pitch in the remaining 20 per cent of the cost. Andhra Pradesh, Karnataka, Maharashtra, Odisha and Rajasthan have started following in Gujarat's footsteps in check-dam movement.

Canal-top solar power project: First ever, best ever

In the year 2012, the Government of Gujarat carried out a unique project of constructing solar panels over the canals to reduce water loss due to evaporation and to increase sustainability in the command area. Soon it became the world's first Canal-top Solar Power Project. It aims to utilize the 19,000 km long network of Narmada canals across the state for setting up solar panels to generate electricity. Accordingly, in the year 2012, the world's first one megawatt (MW) solar power project was set up at Chandrasan village, in Mehsana district of Gujarat. Solar panels were fixed over a 750-metre stretch of an irrigation canal. Unlike many solar power projects, this one did not consume large amounts of land since the panels were constructed over the canals, and not on additional land. The Chandrasan project has been found saving 9 million litres of water every year. At present, Gujarat has about 458 km of open main canal, while the total canal length including sub-branches is about 19,000 km and Sardar Sarovar Narmada Nigam Ltd. (SSNNL) is in the process of extending the canal network to 85,000 km. As of now, even by utilizing only 10 per cent of the existing canal network of 19,000 kilometres, more than 2,200 MW of solar power generating capacity can be

installed by covering the canals with solar panels. In addition to that, 11,000 acres of land can be potentially conserved along with about 20 billion litres of water saved per year.

Interlinking of rivers in the State: Leading among pioneers

As per International standards if per capita availability of water is less than 1700 m³/year, the region is “water stressed”, and if less than 1000 m³/year, the region is “water scarce”. In Gujarat, Saurashtra, North Gujarat and Kutch regions are not just water scarced but also water parched as the per capita water availability is 540, 343 and 719 m³ / year, respectively. Thereby, to fulfill the water requirement of water scarce areas, the State is expediting efforts in full-swing to divert excess water from surplus basin to water deficit areas. The State has already taken up very important and pioneering steps for interlinking rivers. A few among them are given here as follows:

Inter basin transfer of water from Narmada main canal to en-route rivers: This plan is executed to divert the flow of Narmada water available during flood through Narmada main canal to eleven other rivers of Gujarat viz. Heran, Orsang, Karad, Mahi, Saidak, Mohar, Watrak, Sabarmati, Khari, Rupen and Banas. Besides, the scheme also leads to the filling of about 700 small / large village Tanks / Ponds by Narmada water.

Sujlam-Suflam Spreading Channel: This spreading channel is proposed to divert overflowing flood water from Kadana dam by gravity to the water deficit areas of Panchmahals, Gandhinagar, Sabarkantha, Mehsana and parts of Banaskantha districts. The length of the proposed channel is 332 km and is expected to help in recharging 21 rivers which include Khari, Watrak, Meshwo, Mazam, Rupen, Pushpavati, Saraswati and Banas River. It is also expected to benefit 70,000 ha in seven districts of the state.

Interlinking of coastal rivers in Saurashtra region: The Government of Gujarat has also expediting an ambitious plan to interconnect rivers through spreading channels in order to prevent salinity ingress along the coastal belt of the Saurashtra. The total length of spreading channel is planned to be 360 Km. Apart from addressing salinity ingress, it is also expected that rain water stored in the channel will recharge the aquifers of ground water and surrounding area.

Table 16 Varieties released for cultivation in Gujarat

Crop	Varieties released by SAUs in Gujarat	Important contribution
Wheat	GW-89 (1984), GW-496 and GW-503 (1989), GW-273 (1997), GW-322 (2002) and GW-366 (2006).	Remarkably increased the yields of wheat.
	GW-496	Largely adopted by the farmers due to its superiority in yield, resistant to rust and high adaptability in the soil and climate of the state
	GW-366	Gaining popularity having attractive bold grain size and high yield.
Rice	GR-101 in 1984, GR-103 in 1990, GR-6 in 1991, Gurjari in 1997, Dandi and GR-7 in 2000, GR-8 in 2001, GR-12 in 2004, GAR-13 in 2009 and GAR-1 in 2010	Increased productivity of paddy with improved resource use efficiency of inputs.
Groundnut	GG-2 in 1986 (bunch type), GG-20 (semi-spreading) and GG-12 (spreading), in 1991, GG-13 (spreading) in 1994, GG-7 in 2000	The variety GG-20 is performing well, covering about 80 per cent of the total groundnut area in the state.
	GJG-HPS-1 in 2008, GJG-9 and GJG-31 in 2010	Varieties released by JAU are gaining traction among farmers due to its high yield potential and export quality.

Cotton	G. Cot. Hy. 6 in 1979, G. Cot. 13 in 1981, G. Cot. Deshi Hy.7 in 1984, G. Cot. Hy. 8 in 1987, GH-10 in 1995 and introduction of high yielding Bt. cotton varieties.	Gujarat state has been catapulted to be a leading state in cotton production.
Cumin	Gujarat Cumin-1 in 1982, Gujarat Cumin-2 in 1992, Gujarat Cumin-3 in 1998 and Gujarat Cumin-4 in 2003	Improved productivity levels over the decades.
Bajra	GHB-30 and GHB-32 in 1985, GHB- 526 & 558 in 2002, GHB-538 in 2004 and GHB-757 and GHB-732 in 2007	Moderately increased the productivity of bajra, particularly in summer season.
Castor	GCH-2 in 1985, GCH-4 in 1986, GCH-5 in 1994, GCH-6 in 2000, GCH-7 in 2006 and GC-3 in 2009	Gujarat has recorded 70 per cent of India's castor production since 1980's.
Arhar	BDN-2 in 1984, GT-100 in 1992, GT-101 in 2003 and GT-Hy-1 in 2004	Have become highly popular among the farmers as these varieties require only 2-3 irrigations after end of the monsoon.
	BDN 2 and GT 101	
Gram	GG-1 and GG-2	60 per cent irrigated and 80 per cent rainfed area under gram cultivation in the state covered by chickpea varieties.
	Gujarat Junagadh Gram-3	High yield potential, earliness, large sized seeds with attractive yellow colour and wilt resistance. It covered sizable irrigated area of the state.
Til	G. Til.1 in 1979, G. Til.2 in 1994, G.Til-10 in 2003 (black Til), G.Til-3 in 2005 and G.Til-4 in 2010	Improved productivity levels over the decades.
Mustard	Gujarat Mustard-1 in 1989, Gujarat Mustard-2 in 1995, Gujarat Mustard-3 in 2006 and Gujarat Dantiwada Mustard-4 in 2011 in the state	Improved productivity levels over the decades.

Gujarat's agro-vision

Gujarat is at the forefront of national exports of floricultural products, spices, castor, sesame, cotton, psyllium and processed fruits and vegetables, indicating comparative advantage of Gujarat in these products. Such developments were given policy support in the Gujarat Agro-Vision 2010 document that emphasized relationship between primary and secondary sectors through development of agro-industries. It has also been felt that barren and wastelands that occupy nearly 5 lakh ha could be well utilized by diverting less-productive dryland crops to horticultural crops.

The Government of Gujarat has adopted strategies that are geared to overcome constraints faced in cultivation of these crops. Some of them are: 1) Supply of good quality planting material (grafts, saplings and seeds) for horticultural crops; 2) Introduction of new crops; 3) Cultivation on waste/fallow land, border plantation, inter-cropping and crop rotation; 4) Increasing productivity by using sophisticated technology such as micro-irrigation systems; 5) Promoting corporate/contract farming, export oriented production practices; 6) Strengthening of marketing societies; 7) Provide training to farmers for post-harvest packaging and orchard management; and 8) Establishment of export zones for onions and fruits & vegetables processing.

4. Productivity gaps & major constraints

Gujarat agriculture is dotted with serious challenges on both production and marketing fronts but when it comes to the former there seems to be as much challenges bestowed default by nature as that of operational and adoption constraints prevailing in the farming sector (Figure 4). Accordingly, the State is characterized by erratic and uncertain rainfall coupled with large inter-annual rainfall variability. Besides, the hard rock hydrogeology prevailing in the State only helps in rendering it highly vulnerable to frequent water scarcity conditions and droughts. This has led to the unintended overexploitation of groundwater leading to surge in salinity levels and lands becoming virtually useless. As groundwater alone accounts to more than 80 per cent of irrigation requirement in irrigation, it is no coincidence that the gross mismanagement of the resource has lowered the water table in many parts of the State and has the escalated cost of cultivation. On the other hand, rapid urbanization and land use changes have drastically decreased the infiltration rate of the soil and have diminished the natural recharging capacity of aquifers as well.

Apart from all these natural or inherited challenges, low key awareness on non-monetary inputs and limited technology adoption among the farmers is also a cause of worry. For instance, the State is found to have very low seed replacement ratio (SRR) among all the major states. The SRR in wheat, *desi* cotton, pulses, groundnut and soybean are less than 50 per cent. Apart from that there is also the case of low rate of replacement of varieties and cultivation of unsuitable crops and varieties. As varieties which are more than 20 years old are still in vogue, the change in cropping pattern and sequences are not adequately coping with the ongoing implications of climate variability. The challenges being both uni-directional and bi-directional with each other, as shown in figure 4, further complicate the agrarian distress and render adaptation difficult.

Driving Forces	Restraining Forces
<ul style="list-style-type: none"> ✓ Good Varietal performance in terms of yield and recovery. ✓ Remunerative price for produce and timely payment. ✓ Adequate technology back stopping. ✓ Capacity building & farmer-led extension. ✓ Linkage-partnership between research-extension-farmer-industry continuum. ✓ Industry backing and support. ✓ Remunerative and stability compared to other agricultural crops. ✓ Group dynamics among farmers ✓ Non-farm rural employment opportunities. 	<ul style="list-style-type: none"> ✓ Fragmentation of land holdings ✓ Water and labour crisis ✓ Increasing cost of production ✓ Pest and Disease incidences ✓ Wild animal menace. ✓ Lack of mechanization and small tools and machinery ✓ Climate change effect – biotic and abiotic pressure ✓ Lack of quality planting materials. ✓ Inadequate farmer field schools and FPOs. ✓ Non-availability of credit and inadequate crop insurance coverage. ✓ Lack of policy and credit orientation for developing rural non-farm employment.

As shown in figure 4, there is existence of yield gap as much as 50 per cent in the top productivity states in India. Most of the farmers do not follow scientific seed treatment practices and neglect the importance of non-monetary inputs despite the fact when they have become immensely relevant in the

current context of climate variability and change. For example, the rice is transplanted at 30 to 33 hill / m² against the requirement of 20 to 25 hills / m². Similarly, maize is cultivated with 1.75 lakhs plants / ha against the need of 1.30 to 1.40 lakhs plants / ha alone and groundnut farmers use 130 – 140 kg / ha against 100-125 kg / ha. Apart from that, both under and over use of fertilizers leading to deficiency or toxicity of certain elements in the soil coupled with development of soil salinity is also a common feature. Use of natural nitrification inhibitors and enriched organic manures is not widely prevalent. And most importantly, farmers still adopt surface irrigation methods without calculating amount and time of water requirements.

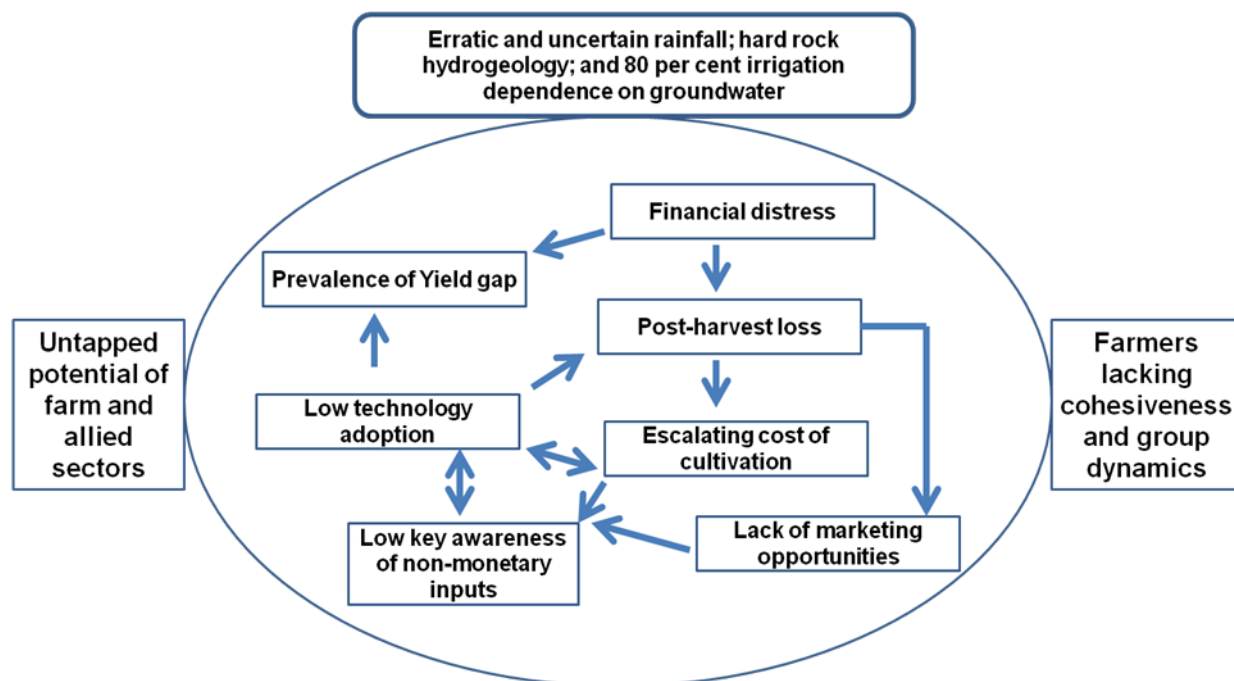


Figure 8 Key challenges in improving farmers' income

When coming to crop cultivation, most farmers still practice hand weeding and inter-culturing operations without considering crop-weed competition period. Farmers adopt haphazard and indiscriminate use of agro chemicals for controlling pests and diseases. As a matter of fact, while spraying, insecticides and fungicides are liberally mixed and applied without worrying about the incompatibility of the chemicals. Even on the post-harvest front the scenario is not pleasing as nearly 20 to 25 per cent post harvest farm output losses due to improper handling. Even with high value horticultural crops, there is lack of awareness regarding high density plantation (HDP), canopy management, pruning, soil and leaf analysis, mulching and ratooning. On the marketing side, despite the modifications in APMC Act allowing contract farming and direct marketing, the efficacy of such reforms is not up to the mark. Direct marketing of farmers account barely 5 per cent of volume transacted. Though the e-NAM intervention has started paying dividends, it is still in the nascent stage and neither farmers are adequately aware about its benefits, nor are facilities and coverage up to the mark. Operationalization of minimum support price is not widely practiced and it doesn't cover all the food crops either.

Challenges for doubling farmers' income in Gujarat

1) Groundwater depletion: Gujarat agriculture is dotted with serious challenges on both production and marketing fronts but when it comes to the former there seems to be as much challenges bestowed default by nature as that of operational and adoption constraints prevailing in the farming sector. Accordingly, the State is characterized by erratic and uncertain rainfall coupled with large inter-annual

rainfall variability. Besides, the hard rock hydrogeology prevailing in the State only helps in rendering it highly vulnerable to frequent water scarcity conditions and droughts. This has led to the unintended overexploitation of groundwater leading to surge in salinity levels and lands becoming virtually useless. As groundwater alone accounts to more than 80 per cent of irrigation requirement in irrigation, it is no coincidence that the gross mismanagement of the resource has lowered the water table in many parts of the State and has the escalated cost of cultivation. On the other hand, rapid urbanization and land use changes have drastically decreased the infiltration rate of the soil and have diminished the natural recharging capacity of aquifers as well.

2) Lack of awareness on non-monetary inputs: Apart from all these natural or inherited challenges, low key awareness on non-monetary inputs and limited technology adoption among the farmers is also a cause of worry. For instance, the State is found to have very low seed replacement ratio (SRR) among all the major states. The SRR in wheat, *desi* cotton, pulses, groundnut and soybean are less than 50 per cent. Apart from that there is also the case of low rate of replacement of varieties and cultivation of unsuitable crops and varieties. As varieties which are more than 20 years old are still in vogue, the change in cropping pattern and sequences are not adequately coping with the ongoing implications of climate variability. The challenges being both uni-directional and bi-directional with each other further complicate the agrarian distress and render adaptation difficult. When coming to crop cultivation, most farmers still practice hand weeding and inter-culturing operations without considering crop-weed competition period. Farmers adopt haphazard and indiscriminate use of agro chemicals for controlling pests and diseases. As a matter of fact, while spraying, insecticides and fungicides are liberally mixed and applied without worrying about the incompatibility of the chemicals. Even on the post-harvest front the scenario is not pleasing as nearly 20 to 25 per cent post harvest farm output losses in Gujarat is due to improper handling. Even with high value horticultural crops, there is lack of awareness regarding high density plantation (HDP), canopy management, pruning, soil and leaf analysis, mulching and ratooning.

3) Limitations of area and yield expansion: There are certain problem areas in Gujarat agriculture that may be reviewed in the light of the recent record of achievements. Take the case of pulses which are an important component of diet in the state and a principal source of protein. On an average, area under pulses in Gujarat comprises 4 per cent of the total area in the country. Gujarat produced on an average 6 lakh tonnes of pulses during the period 2008- 09 to 2010-11. Area under pulses has been around 7-8 lakh ha and area expansion has been far from satisfactory. Further, only 12.3 per cent of area under pulses is irrigated. Heartening feature is that the average productivity of pulses in Gujarat (775 kg/ha) is far above the national average (659 kg/ha). Yield expansion has accelerated notably after 2000-01 and is responsible for a considerable rise in production of pulses. The gross value of gram has grown at 14.4 per cent, arhar on the other hand, has shown a strong decline in output value. The task of sustaining high growth in pulses would be difficult without area expansion and irrigation. Systematic efforts are required for increasing both area under pulses and stabilizing productivity at a higher level. Of the ultimate irrigation potential of around 65 lakh ha through surface and groundwater resources, total irrigation potential of surface water created up to 2010 is nearly 49 per cent. Nearly 76 per cent of the irrigation potential created is being utilized in the state (GoG, 2012). The SSP will provide annual irrigation benefits in about 18.45 lakh hectares. However, the distribution network for this is considerably underdeveloped. Distribution system for only 3.48 lakh ha or 19 per cent of command area is completed. The command areas of some major irrigation projects in Gujarat are facing problems of water-logging and salinity. Efforts are needed for evolving a more efficient system of water management. The other issue of importance is that nearly 58 per cent of the cultivated area in Gujarat is still rainfed. Hence, evolving dry farming technologies should receive much higher priority in all future efforts. Further need is to disseminate available dryland technologies to resource-poor farmers in the

rained regions. Besides promoting dryland technologies, emphasis on technology-based agricultural growth is needed, facilitated by increasing expenditure and credit-flow to remove pro-irrigation bias. Watershed development for raising yields of largely rainfed crops to cover oilseeds, pulses, fruits and vegetables, would yield promising results.

4) Existence of yield gap: There is existence of yield gap in Gujarat as much as 50 per cent of other top productivity states in India. Most of the farmers do not follow scientific seed treatment practices and neglect the importance of non-monetary inputs despite the fact when they have become immensely relevant in the current context of climate variability and change. For example, the rice is transplanted at 30 to 33 hill / m² against the requirement of 20 to 25 hills / m² in the State. Similarly, maize is cultivated with 1.75 lakhs plants / ha against the need of 1.30 to 1.40 lakhs plants / ha alone and groundnut farmers use 130 – 140 kg / ha against 100-125 kg / ha. Apart from that, both under and over use of fertilizers leading to deficiency or toxicity of certain elements in the soil coupled with development of soil salinity is also a common feature in Gujarat. Use of natural nitrification inhibitors and enriched organic manures is not widely prevalent. And most importantly, farmers still adopt surface irrigation methods without calculating amount and time of water requirements.

5) Implications of climate change: Ray et al. (2009) suggested that the mean temperature over Gujarat state has increased by 0.07°C in past 40 years (1969-2009). In addition, region-wise analysis revealed that increase is more over coastal Saurashtra region as compared to that of the remaining regions. Patel *et al.* (2017) projected climatic data (2071 to 2100) by PRECIS model for different stations (Anand, Vadodara, Junagadh, Bhavanagar, Bhuj, Rajkot and Kesod) of Gujarat to study the impact of climate change on major crops of the state. The findings showed that the annual rainfall during projected period would be 15 to 101 per cent higher than the base line rainfall (1961-90). Maximum temperature would increase by 2.8 to 7.7 0C, while minimum temperature would increase by 3.8 to 5.2 0C in different parts of Gujarat when compared to the base period. In addition, it was also revealed that climate change will adversely affect the yields of different crops including wheat, maize, pearl millet, paddy and groundnut. The maximum yield reduction (-61 %) is projected in wheat and lowest in pearl millet (-8 %). Maize during kharif season would be more affected (-47 %) than the rabi season (-10 %). Similarly pearl millet in summer season will be least affected (-8%) than kharif season (-14 %).

6) Traditional marketing problems: On the marketing side, despite the State has modified APMC act allowing contract farming and direct marketing, the efficacy of such reforms is not up to the mark. Direct marketing of farmers account barely 5 per cent of volume transacted. Though Gujarat is the frontrunner state in e-NAM, it is still in the nascent stage and neither farmers are adequately aware about its benefits, nor are facilities and coverage up to the mark. Operationalization of minimum support price is not widely practiced and it doesn't cover all the food crops either. Despite a well-functioning cooperative structure, it has not succeeded in ensuring adequate supply of credit for weaker sections of the society. Of the total advances made by credit institutions in the state as of March 2011 (Rs.1,87,803 crore), only 7.5 per cent have gone to the weaker sections (Rs. 11,605 crore). Advances for agricultural purposes comprise 20.2 per cent of the total advances. It needs to be noted that district-wise distribution of Kisan Credit Cards (KCC) is rather skewed and districts like Kheda, Ahmedabad, Surat and Bharuch have a very low ratio of KCC per thousand operational holdings. Overall for Gujarat, 508 KCC per 1000 holdings have been reported, showing considerable mismatch in outreach (State Level Bankers' Committee, 2011). Concerted efforts are also needed for ensuring success of new experiments, such as, farmers' clubs.

5. Potential for development of horticulture, livestock, fisheries, agro-forestry and post-harvest processing

Agricultural sector potential

Gujarat is the major producer of cotton, groundnut, castor and sugarcane. The other major crops produced in the State include rice, wheat, jowar, bajra, maize, pigeon pea and gram. Among them, the production and yield of cotton, castor, and groundnut are notably high in Gujarat accounting for 33 per cent of both cotton and groundnut production in the country. Besides, the state has the recognition for the highest area, productivity and not less than 70 per cent of castor production in the country. Another notable feature is the accordance of GI status to Bhaliya wheat (*a.k.a* Daudkhani wheat) grown in Bhal region of Gujarat for its desirable qualities like high carotene, low water absorption and high protein content. While various studies have shown that GI Bhaliya wheat receives 25 per cent premium price opposed to other wheat varieties and 40-50 per cent higher price than the bread wheat varieties, still there is also immense potential for the State to promote organic cultivation of Bhaliya wheat to improve farmers' income.

Horticultural sector potential

The total area under horticulture crops and their production are continuously on the rise in Gujarat. Among horticultural crops, Gir Kesar mango and Kutchi date palm of the State have been bestowed with GI status in the country. Besides, the State holds first position in the production of cumin, fennel and date palm; and 2nd place in the production of banana, papaya and lime. More than 90% of the fennel in the country is produced by Gujarat alone. Besides, the state enjoys first position in the productivity of coconut and banana and second in the productivity of pomegranate and sapota. It has the highest productivity in the country for onion (25 MT/ha.), potato (28.81 MT/ha.) and the world's highest productivity of potato (87 MT/ha) has been reported from Deesa of Gujarat's Banaskantha district. A number of good integrated pack houses, air cargo complex and gamma irradiation projects have been established by Gujarat Agro Industries Corporation. In addition, onion dehydration industry of the state is the biggest in the country.

Animal Husbandry and Fisheries' sector potential

Gujarat is the home to the world acclaimed milk cooperative, Amul. Animal husbandry sector has played a pivotal role in socioeconomic development of the State providing employment and source of income for lakhs of farm families. The State is rich in various indigenous pure breeds including Gir and Kankareji breeds of cow; Mahesani, Surti, Jaffrabadi and Bunni breeds of buffalo; Marwari and Patanvadi breeds of sheep; Sirohi, Surti, Mehsani, Kuchchhi, Gohilwadi and Zalawadi breeds of goat; and Kutchi and Kharai breeds of camel and Kathiyavadi breed of Horse. Gujarat possesses 19 registered breeds forming 13 per cent of the total 151 registered breeds in the country. As per Livestock Census (2012), the State possesses 27,128,200 livestock contributing 5.30 per cent to the total 512,057,000 livestock population in India. It has been a consistent performer and leader in milk production and attained 3rd position in India with milk production of 122.62 lakhs metric tons in 2015-16. Besides, the State has a notable 7.33 per cent average growth rate in milk production during the last decade. Apart from that, Gujarat has a long coastal-line of 1600 km and is dotted with several important ports of which many like Veraval, Porbandar, Pipavav, Okha and Sikka are located in Saurashtra region as well. Important commercial varieties of fish including silver bar, shark, catfish, mullets *etc* are caught in large quantities.

Potential of Agro-forestry sector

ALUS (Alternate Land-Use Systems) esp. in barren/waste lands & farm bunds

1. *Acacia fortilis* plantation (3m X 3m spacing) is most appropriate for getting maximum biomass and monetary return up to Rs. 75,000 to 1.25 lakh / ha (in 2016-17 prices).
2. Minor fruit crops and medicinal & aromatic plants as crop diversification or cultivation in marginal lands and field bunds can improve income levels up to 40 per cent.
3. Tree species of 4-6 years of rotation age such as *Ailanthus* (match stick tree), *Melia dubia* have the potential to generate 40% additional monetary return.
4. Silvi-pasture system (Amla + *Dichanthium annulatum*) can improve fodder supply @ 20%, increment Amla yields by 20% and enhance net returns up to Rs. 6500 / ha/ annum.
5. *Ailanthus excelsa* (6.0 X 3.0 mt spacing) based agri-silviculture system (Ardu + Green gram) can increment farmers' income by 25%.
6. India's paper demand to increase by 53% by 2022: Trees with good pulpwood materials are heavily demanded by paper and pulp industry.
7. Advantage for Gujarat: Semi-arid districts (Anand, Nadiad, Mehsana & Gandhinagar) are with high tree cover and are already wood surplus districts.
8. Silvi-medicinal systems have the next big income potential: Teak + *Ocimum spp* such as *O. tenuiflorum*, *O. gratissimum* and *O. basilicum* increase net returns by Rs. 80,000/ha (2014-15 prices). Farmers may get additional income from such land-uses till teak trees come to harvest.
9. *Melia dubia* trees on farm bunds: 150-170 trees / hectare: 13-14 years rotation can yield timber for door & furniture of Rs 15,000 per tree value and 2-3 year rotation can yield 10 to 12.5 tonnes of pulpwood of Rs 4,000 per tonne value.

Potential of Agro-forestry sector

1. **Groundnut:** Cluster based emphasis on HPS groundnut for exports & table purpose in Junagadh, Kutch, Jamnagar, Porbandar & Bhavnagar will enhance farmers' income up to 25% in 3 years.
2. **Oilseed sector:** Mechanization in production and post-production will reduce per unit cost of production up to 50%.
3. **Fruits & Vegetables:** 30% of F & Vs are lost in Gujarat accounting for Rs. 9,000 crores in the state. Processing at least 10% at farm gate level will increase farmers' income by 15 to 20%.
4. **Cluster based Agro Processing Centre for all crops:** Primary processing, grading and milling of produce may increase the market rate by about 10 to 30%.
5. **81% cold storages suitable only for Potato.** Need to be upgraded for multi commodities.
6. High potential for improving fish processing facilities, esp. in Saurashtra zone.

6. Role of Technologies

The strategies for doubling farmers' income in Gujarat by 2022-23 have been devised under the following major heads which are as follows:

- 1) Increasing the productivity of crop and animal sectors;
- 2) Leveraging marketing avenues in crop and animal sectors;
- 3) Leapfrogging post-harvest and value-addition prospects;
- 4) Promoting on-farm ancillary activities;
- 5) Invigorating organic farming;
- 6) Other key strategies for doubling farmers' income.

This particular component has been further categorized into the following sub-heads:

- a. Zeroing in on water management problems;
- b. Facilitating farm mechanization;
- c. Proliferating market led extension and e-extension opportunities;
- d. Managing Yield gap and reducing costs;
- e. Alleviating farm financial distress;
- f. Doubling the current level of exports;
- g. Encouraging agro-forestry;
- h. Harnessing solar potential;
- i. Promoting Agro-tourism;
- j. Promoting rural non-farm employment sector;
- k. Leveraging Pradhan Mantri Fasal Bima Yojana (PMFBY).

a) Strategy & action plan for enhancing production, cost reduction, quality improvement and generating additional income:

1. Increasing the productivity of crop and animal sectors:

a) Agriculture

Sl. No	Issue	Status	Action Plan (Including policy reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
1.	<p>Low Seed Replacement Ratio (SRR)</p> <p>Low rate of replacement of varieties & cultivation of unsuitable crops and varieties.</p> <p>Low awareness on scientific Seed treatment techniques</p>	<p>The SRR in Wheat, Desi Cotton, Pulses, Groundnut and Soybean are less than 50 % in Gujarat.</p> <p>Currently, the change in cropping pattern and sequences are not adequately coping with the ongoing implications of climate variability.</p> <p>Varieties which are more than 20 years old are still in cultivation.</p> <p>Changes have to be brought in wheat, tobacco, maize, pearl millet and groundnut cultivation.</p> <p>Most of the farmers do not follow scientific seed treatment practices.</p>	<p>a. Replacement of local and inferior quality seeds with high quality seeds.</p> <p>b. Conversion of breeder seed to foundation and certified seeds on university farms.</p> <p>c. Promote Seed village concept for certified and TFL seed production.</p> <p>d. Crop and variety should be selected on the basis of climatic factors, edaphic factors, resource availability and market situation.</p> <p>e. Adequate quantity seed of the new and high yielding varieties need to be made available along with applicable new packages of practices.</p> <p>f. Encourage scientific seed treatment practices for protection against diseases and pests.</p> <p>g. Promote seed inoculation with bio-fertilizers.</p>	<p>a. Seed certification agency should encourage NGOs/ PSUs as well as SAU farms for seed production of improved varieties.</p> <p>b. SAUs and ICAR centres should be facilitated for large-scale breeder seed production.</p> <p>c. University farms need to be facilitated for converting breeder seeds of improved varieties to foundation and certified seeds</p> <p>d. NGO/Public Sector participation need to be encouraged for producing timely certified and TFL seeds.</p> <p>e. Training extension functionaries and progressive farmers.</p> <p>f. Research in the context of climate variability implications.</p> <p>g. Production of required quantities of breeder seed of new improved varieties.</p> <p>h. Imparting training to extension functionaries and progressive farmers on scientific seed treatment and seed inoculation.</p>

Sl. No	Issue	Status	Action Plan (Including policy reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
2.	Less exposure of farmers to non-monetary inputs	Most of the farmers neglect the importance of non-monetary inputs despite the fact when they have become immensely relevant in the current context of climate variability and change.	<ul style="list-style-type: none"> a. Selection of biotic & abiotic stress resistant varieties. b. Timely sowing/planting c. Providing optimum plant geometry. d. Irrigating at critical growth stages. e. Timely adoption of crop protection practices. f. Timely harvesting. g. Practicing system of intensification in rice, sugarcane, wheat & cotton. 	Imparting training to extension functionaries of SAUs, ICAR centres, Line departments, NGOs, and progressive farmers on the efficacy of non-monetary inputs in the context of climate change scenario.
3.	Expedite Integrated Nutrient Management	<p>Either under or over use of fertilizers leading to deficiency or toxicity of certain elements in the soil coupled with development of soil salinity.</p> <p>Use of natural nitrification inhibitors and enriched organic manures is not prevalent.</p>	<ul style="list-style-type: none"> a. Guiding farmers to use recommended dose of nutrients as per soil test. b. Balanced nutrition with organic / inorganic / biofertilizers c. Supplementing deficient nutrients. d. Reducing soil-water-air pollution. e. Incentivizing slow release fertilizers. 	<ul style="list-style-type: none"> a. Imparting training to extension functionaries of SAUs, ICAR centres, Line departments, NGOs, and progressive farmers to ensure proper use of the soil health card b. Production of biofertilizers in PPP mode.
4.	Promoting Precision Agriculture	Most of the farmers are unaware of precision farming technologies	<ul style="list-style-type: none"> a. Mapping soil fertility status including secondary and micronutrients b. Laser land leveling c. Application of fertilizer based on STR and site specific nutrient management. 	<ul style="list-style-type: none"> a. Imparting training to extension functionaries & progressive farmers on precision agriculture b. Demonstrating crop specific precision farming techniques with real time models.

Sl. No	Issue	Status	Action Plan (Including policy reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
5.	Prioritizing Micro-Irrigation Structures (MIS)	Farmers still adopt surface irrigation methods without calculating amount and time of water requirements. Indiscriminate use of water especially in canal command areas.	a. MIS need to be made compulsory through incentivized schemes. b. Prioritize water conservation practices. c. Persuading farmers to practice irrigation at critical growth stages. d. Promoting furrow, band and foliar irrigation methods. e. Promoting Laser land leveling to increase irrigation efficiency.	a. Imparting training to Extension functionaries and progressive farmers on improving WUE and FUE. b. Policy interventions promoting the availability of crop-specific superior grade liquid fertilizers/ secondary/ micronutrients at affordable rates.
6.	Leverage Integrated Weed Management	Most farmers still practice hand weeding and inter-culturing operations without considering crop- weed competition period.	a. Take preventive measures to check weed dispersion. b. Consider crop-weed competition period for effective & economical weed control. c. Cultivation of green manure crops. d. Intercrop with cover crop to check weed.	a. Imparting training to extension functionaries and progressive farmers on economical and effective weed management practices. b. Testing new and efficient molecules to be used as weedicides
7.	Prioritize Integrated Pest /Disease Management	Farmers follow haphazard and indiscriminate use of agro chemicals for controlling pests and diseases. While spraying, insecticides and fungicides are liberally mixed and applied without worrying about the incompatibility of the chemicals.	a. Select pest tolerant or resistant variety b. Popularize cultivation with trap crops. c. Follow integrated approach for effective and economical pest control. d. Follow mechanical control measures to control pests/ diseases	a. Imparting training to extension functionaries and progressive farmers on IPM and IDM. b. Promoting safe use and application of chemicals. c. Prioritizing training of input dealers. d. Research on new or emerging/recurring pests and diseases by SAUs and ICAR centres.

Sucess story 1. Mulching with Drip in Groundnut



Name : Pedhadiya Kishorbhai Laljibhai
Village : Sumari Dhutarpur
Block : Jamnagar
Dist. : Jamnagar
Educational Qualification :9th Standard
Contact No. : 925419324

- Selecting agriculture as a hobby as well as a business and with a desire to do something new in Agriculture, he interacted with Agriculture scientists during Krishi Mahotsav.
- By participating in various ATMA project trainings at Jamnagar on a regular basis, he was inspired to undertake modern scientific agricultural practices like organic farming, micro irrigation, mulching etc
- He experienced minimal problems of weed. Due to less evaporation, congenial environment was created for peg and pod formation, leading to better production.
- He got benefit by adopting mulching with drip irrigation technique in Groundnut.
- Other farmers too got inspired and adopted this technique.



Details of income from Groundnut

(Area- 1 ha.)

Year	Area	Income (in Rs.)	Expenditure (in Rs.)	Net Profit (in Rs.)
2008-09	1800	37,000	11,000	26,000
2009-10	2700	87,000	10,000	77,000
2010-11	3700	1,38,000	15,000	1,23,000



Sucess story 2. Castor Cultivation



Name : Rajendrabhai Ghirdharbhai Patel
Village : Nardipur
Block : Kalol
District : Gandhinagar
Age : 49 years
Education: 10th Std Land holding: 3.5 hectare
Mo : 9998788888

- Rajendrabhai has been engaged with cash crop cultivation for 34 years. In the beginning, he was doing farming of castor in a traditional way.
- Due to less production and remuneration, he thought of adopting new technology in agriculture.
- To achieve this goal, he joined ATMA project and got information about pit method of castor crop during on farm demonstrations.
- In the pit method, pits are prepared in the month of April and as sunlight falls directly in the pits 100 % control is attained over wilt and root rot diseases.
- In this method, he planted GCH-7 variety of castor by digging pits at a distance of 7 feet between two lines and 6 feet between two plants (7x6 feet).
- Due to application of farm compost in root zone area, 50 % saving in fertilizer was ensured and water holding capacity in root zone area increased, partially overcoming the water shortage.
- For this achievement, he was awarded “Best ATMA Farmers Award” of Taluka level in 2009-10 & “Best ATMA Farmers Award” of District level in 2013-14.

Details of income from Castor

Year	Area	Income (in Rs.)	Expenditure (in Rs.)	Net Profit (in Rs.)
2010-11	0.46	1,38,762	16,235	1,22,527
2011-12	0.69	2,65,980	27,350	2,38,630
2012-13	1.61	4,83,714	78,890	4,04,824



Sucess story 3. Cotton cultivation



Name : Renish Chandulal Bhalodiya
Village : Lalpur
Block : Lalpur
District : Jamnagar
Age : 42
Education : B.Com. LLB Land :1-69-97 ha.
Contact No. : 9427226659

- Renishbhai adopted the family occupation of farming, after completing his higher studies.
- Initially he started traditional farming so his expenditure was higher and yield lower.
- He aspired for new age farming and hence joined ATMA project.
- During Exposure visit of ATMA project, he gained knowledge about modern scientific practices including drip irrigation.
- He replaced the old irrigation system with drip irrigation
- Due to water saving, he could irrigate a larger area with same amount of water, leading to higher production.
- He got multiple benefits due to adoption of drip like less pest infestation and hence lesser cost of pesticides, lesser weed resulting into lesser expense on weedicide as well as labour to apply the same. Reduction in land pollution was an added advantage.
- He also used bio-product like Trichoderma, Neem Oil and biveriya instead of costly chemical pesticides.
- He was given a letter of appreciation by none other than the former President of India, Dr.A.P.J. Abdul Kalam for his extensive use of bio-pesticides for plant protection.
- He was given District Level **Best ATMA Farmers Award** for the year of 2013-14 for his achievement.
- He is now a source of inspiration for all the other farmers of the locality. About 100 to 150 farmers associated with ATMA project in his area, adopted drip over about 50 to 60 hectares of land; thanks to the efforts of Renishbhai.

Income From Cotton cultivation (1 ha.)

Year	Production (kg/ha.)	Yearly Sales (Rs.)	Expenditure (Rs.)	Net Income (Rs.)
2010-11	2240	1,12,000	18,020	93,980
2011-12	2750	1,30,625	17,330	1,13,295
2012-13	3850	1,82,875	10,850	1,72,025



Sucess story 4. Paddy Cultivation



Name : Patel Javerbhai Mangadbhai
Village : kadhiya
Block : Balashinor
Dist : Mahisagar
Age : 62 year
Education : S.Y.B.com, Land-1-56-61 R.
Contanc : 9427853736

- Jhaverbhai Mangalbhai Patel was doing traditional rainfed Paddy farming.
- He gained guidance of System of Rice Intensification (S.R.I.) method of Paddy from scientist and officers of ATMA Project in *KRISHI MAHOTASAV* held by Government.
- As a part of scientific farming he did soil analysis of his farm to check the deficiency of soil elements. By knowing soil deficiency, he applied necessary nutrients and started getting good crop yield with superior quality.
- He got an increase in yield at a lower cost of production by following the recommendations of agricultural university like selection of good varieties of planting material, timely sowing as well as cropping, integrated pest and disease management, right application of recommended fertilizers and irrigation.
- Earlier he used to get 6000 kg yield per hectare with old cultivation practices. After adopting new SRI technique, the period of maturity shortened and the yield increased to 8500 kg yield/hectare.
- Adoption of latest scientific farming techniques made farming easy and speedy as well as decreased the cost of labour and fertilizers, resulting in increase in income.
- Inspired by the experience of Jhaverbhai, other farmers also got inclined towards the SRI method and are earning well today.
- In the year 2013-14, “**Best Atma Farmer Award**” was also given to Jhaverbhai at the District level for adopting new SRI technology and being a source of inspiration for other farmers.

Details of income of the Paddy crop

Year	Production (Kg.)	Price / KG Rs.	Income (Rs.)	Expenditure (Rs.)	Net Profit (Rs.)
2011-12	6000	15	90,000	32,925	57,075
2012-13	7000	15.54	1,08,780	57,075	51,705
2013-14	8500	17.20	1,46,200	67,175	79,025



Success story 5. Sugarcane cultivation



Name : Jagdishbhai Bhimabhai Patel
Village : Kharvan
Block : Mahuva
District : Surat Age: 67 Years
Qualification: S.S.C.
Land : 03-56-34 Ha.
Contact No. : 9913663958

- Jagdishbhai associated himself with the business of agriculture after retirement from his job as a teacher.
- He was interested in farming so he started cultivation of Sugarcane, Paddy, Vegetable crops etc.
- As he wanted to adopt advanced technology in agriculture, he joined the ATMA scheme and received guidance. He also got information about Paddy and sugarcane cultivation from Navsari Agriculture University.
- He used Japanese technology to cultivate paddy crop using green manure and organic manure.
- He used scientific methods to get crops of Sugarcane and Paddy alternately.
- He got information about tissue culture in Sugarcane from Vasantdada Sugar Institute during the exposure visit.
- In Sugarcane cultivation, he reared a healthy variety of seed prepared by tissue culture. He provided single eye bud treatment and planted in a pair of row maintaining 5 feet distance in two rows and 2.5 feet distance in two columns.
- By using this system for plantation, sufficient sunlight was received, and sugarcane produced was healthy with thick girth so weight increased and got good rates on sales.
- As per recommendation by scientists, he used sufficient amount of organic manure & bio fertilizers along with chemical fertilizers.
- He reduced expenses on chemical pesticides by using Trico cards for biological control of sugarcane borer pests.
- Inter-cropping like Green Gram and Gram were cultivated with sugarcane crop. He installed drip irrigation system that saved fertilizers and water and got qualitative sugarcane stalks with equal growth of sugarcane.
- By using drip irrigation system weed problems was solved as well as labour cost was decreased.
- He was honoured with many Awards due to incorporation of advance technology in sugarcane cultivation which are as follows.
- Shreshth Adarsh Khedut Award from Mahuva Sugar Factory.
- Shresath Kisan Puraskar Award from Vibrant Gujarat Agriculture Summit in 2013.
- District Level “Best ATMA Farmers Award” from ATMA in the year 2013-14.

Details of Income

Year	Details of Crop	Production	Income in Rs.	Expenses in Rs.	Net Profits in Rs.
2010-11	Paddy (1 acre)	3360 kg	57,600	20,500	37,100
2011-12	Sugarcane (1 Hectare)	160 Tons	3,52,000	78,000	2,74,000
2012-13	Sugarcane (1 Hectare)	170 Ton	3,70,000	75,000	2,95,000



Success story 6. High Productivity in Potato



Name : Parthibhai Chaudhary
Village : Dangiya
Block : Datiwada
District : Banaskantha
State : Gujarat Age : 56 years
Education : B.Com Land : 28.8 Hac
Contact No: 9825609449

- He achieved, highest production of 5500 Kg/Ha of Canabak variety of Potato in March 2008.
- He has shown a new way to farmers by using highly modernized implements in his own farms viz. chizer-plough, planter, digger and grader, thereby reduced labour in agriculture and enhanced use of agricultural implements.
- He achieved financial gain of Rs. 1 crore 17 lacs from revolutionary production of 1300 tonnes of potato from 28.8 hec. of his own farms.
- He conducted Seed production program of Groundnut GG-2 and GG-20 and Black Gram (Udad) by Gujarat State Seed Corporation Ltd.
- Being influenced by his achievements, other farmers of nearby villages got inspired to start farming under his guidance.



Details of Income from Potato

(Rs. in Lakh)

Year	Total Income	Total Expenditure	Net Profit
2010-11	166.00	33.83	132.00
2011-12	201.00	44.70	156.63
2012-13	253.08	51.89	201.19



b) Horticulture:

Sl. No	Issue	Status	Action Plan (Including policy reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
1.	Lack of availability of quality planting material	Shortage of quality planting materials of fruits, vegetables and flowers crops. Planting materials obtained from outside the state are not quarantined.	<p>a. Establish plug nurseries for fruit, vegetables and flowers.</p> <p>b. Increase subsidies for nursery along with restructuring nursery modules with latest infrastructure prices.</p> <p>c. Strengthen domestic quarantine to avoid introduction of new pests/disease into state.</p>	<p>a. Establish new nurseries on priority calculating demand- supply gaps.</p> <p>b. Develop planting materials suitable for processing and exports through PPP mode.</p> <p>c. Encourage Tissue culture research and dissemination.</p>
2.	Diversifying area toward high value horticultural crops	Only 16 percent of gross cultivated area in the state is under horticultural crops. Efficient utilization of land by growing vegetables & Fruits simultaneously is not taken up on a large scale.	<p>a. Increase awareness regarding profitability of horticultural crops.</p> <p>b. Increase area under horticultural crops by diversifying area toward remunerative fruit crops and intercropping.</p> <p>c. Popularize research and adoption of minor fruit crops (such as jamun and jackfruit).</p>	<p>a. Cultivable barren lands (5 lakh ha in Gujarat) need to be brought under horticultural crops.</p> <p>b. Soil reclamation and breeding measures need to be promoted in marginal lands.</p> <p>c. Popularize adoption of remunerative minor fruit crops and medicinal & aromatic crops.</p>
3.	Increase productivity of horti. crops through high-tech technology	Lack of awareness regarding HDP, canopy management, pruning, soil and leaf analysis, mulching, ratooning <i>etc.</i>	<p>a. Conduct training on different high-tech technologies in horticulture crops.</p> <p>b. Promote & standardize PoP for protected cultivation of vegetables and flowers during off-season.</p>	<p>a. Awareness through Demonstration and training.</p> <p>b. Arrange farmers' visits to Ultra High Density Mango Plantations.</p> <p>c. Promote affordable protected cultivation.</p>

Success story 7. Cultivation of Vegetable Crops



Name : Hasmukhbhai K. Patel
Village : Shahpur
Block : Gandhinagar
District : Gandhinagar
Age : 44 Year
Study : B.A. Land:3.5 Ha.
Mobile No. 9898631601

- Hasmukhbhai has been a farmer since last thirty years. In his farming he used chemical fertilizer and pesticides.
- He received knowledge of organic farming and yogik farming from Brhahmakumari Trust in 2008
- He received exposure to drip irrigation, organic farming, mulching and trellis (mandap) system from ATMA, Agriculture Department and officers of Agricultural University.
- He saved water by using drip irrigation and thus provided water to larger area of land.
- Vegetable crop can be retained longer and plucked easily through the trellis (mandap) system.
- In this system, spraying of chemicals also becomes easy which results in reduced weeds and increased production
- Officers from various countries of the world visit his farm to watch vegetable cultivation being scientifically undertaken by him.
- He attended various programme of ATMA and provided knowledge of organic farming to other farmers.
- He received “**Best ATMA Farmer Award**” at District level for his achievement for the year 2013-14.

Income Details

Year	Crop Name	Area Sq. Mts.	Income Rs.	Cost Rs.	Net Profit Rs.
2010-11	Tomato	4400	2,83,950	1,92,206	91,744
2011-12	Brinjal	4700	1,18,992	38,978	80,014
2011-12	Bitter Gourd	5600	5,51,725	2,88,571	2,63,154
2012-13	Okra	3300	55,722	13,580	42,142
2012-13	Tomato	4800	3,43,550	2,33,158	1,10,392



Success story 8. Water Melon and Tomato Cultivation under Mulch and Drip Irrigation



Name : Mahendrabhai Karshanbhai Desai
Village : Ishvariya Block : Kutiyana
Dist : Porbandar
Qualification : 9th Std.
Land : 3 acre
Contact No. : 9426223788 Age:- 48 years

- Received technical help and guidance through continuous contact with Krushi Vignan Kendra, Khapat.
- Cultivated watermelon in his 0.34 hectare land using advanced technology such as mulching and drip irrigation.
- Cultivated Tomato under net house in 0.10 hectare land using mulching and drip irrigation system.
- Large scale production of Tomato can be obtained as temperature is maintained in net house.
- Selling Tomatoes in off season earned him good rate of return from the market.
- With the use of drip irrigation and mulching, high quality and abundant production can be obtained at low cost.
- Inspired other farmers to adopt modern technologies like plastic mulching and drip irrigation and became a model for others.

Production and profit During last Three years

(Rs. in Lakh)

Year	Watermelon (Kiran)			Tomato (Laxmi)		
	Production/ (kg/ha)	Expense/ (Ha)	Profit/ (Ha)	Production/ (Ha)	Expense/ (Ha)	Profit/ (Ha)
2009-10	35,600	0.70	2.11	1,60,200	0.75	2.15
2010-11	3,636	50.78	2.25	1,81,818	0.75	2.40
2011-12	36,400	0.80	2.50	1,82,000	0.75	2.60



Success story 9. Cucumber and Capsicum Cultivation under Green House



Name : Poonambhai Dahyabhai Patel
Village : Bhalej
Block : Umreth
Dis. : Anand
Age : 56 Year
Study : HSC Land Holding: 1.44 Ha.
Contact No.: 9409061186

- In past, Poonambhai did farming of Banana, Tobacco, Potato and vegetables by conventional techniques of cultivation and received low and irregular income. He contacted ATMA and participated in farmers trainings at different places. Finally, he decided to adopt Hi-Tech farming of Capsicum and Cucumber.
- He constructed green house with the help of Government schemes. He adopted mulching and drip irrigation techniques in the green house.
- Seedlings are sown after drenching in Streptocyclin and Oreofungi.
- The Basal Doze of basic fertilizers of DAP and Potash with organic fertilizers like Trycomil and Biomyacin are applied.
- Green house maintains the right atmosphere to suit the crop, which offers protection against diseases and pests and also reduce the pesticides cost. To control and maintain temperature they have fitted exhaust fans and thermometers are installed.
- Having seen the profitability and Hi-Tech farming of Poonambhai, other farmers of the village were inspired and they to have installed green houses on their farms. These farmers are selling their produce of Capsicum in Delhi, Rajasthan and Haryana.
- He has also received **Progressive Farmer Award** from ATMA for his Hi-Tech farming of Vegetable in Green House in the year 2013-14.

Income Details

(Area per acre)

Year	Crop	Production (kg / Acre)	Income (Rs.)	Expenditure (Rs.)	Net Profit (Rs.)
2010-11	Cucumber	15 Tons	75,000	25,000	50,000
2011-12	Cucumber	27 Tons	4,86,000	1,70,000	3,16,000
2012-13	Chilli- Bholar	40 Tons	8,26,630	2,75,000	5,51,630



Success story 10. Vegetable Farming in Net House



Name : Hathiyabhai Harbhambhai Odedara
Villages : Bharvada Blcok : Porbandar
Dist. : Porbandar Land : 0.52 Ha.
Age : 53 years
Education: 12th Science
Contact : 9979051967

- Hathiyabhai was farming vegetables in the open fields where the expenditure was more and profits were less.
- He got inspired in the trainings organized by the ATMA Project and Junagadh Agriculture University about vegetable cultivation in net houses.
- He started organic farming of vegetables in the net houses in an area of 0.52 hectares after getting subsidy from the government schemes.
- He started to grow Palak, Green Peas, Tandaljo and Curry Leaf in the net house.
- By farming in net house, temperature can be maintained and the loss from pests and diseases can be reduced.
- Seed germination being higher in the net house and he got benefit of high seed rate and low seed cost.
- He received daily income from selling the vegetables. He earns more profit as he does not involve any agent, and sells himself.
- He inspired others farmers through Radio talk in programme “**Sajjatano Sang Lave Khetima Rang**”
- He was awarded with “**Sardar Patel Krushi Sansodhan Purashkar**” in the year of 2011-12 and District level “**Best ATMA Farmers Award**” in the year of 2013-14.

Detail of Income from Vegetables

Year	Production (Kg / Ha.)	Expenditure (Rs.)	Income (Rs.)	Net Profit (Rs.)
2010-11	5,400	1,44,000	24,000	1,20,000
2011-12	7,200	2,16,000	18,000	1,98,000
2012-13	18,000	3,60,000	12,000	3,48,000



Success story 11. Rose Farming



Name : Parmar Ramsing Kasnabhai
Village : Kamboi
Block : Limkheda
Dist : Dahod
Study : 10th Std.
Age : 44 yrs
Land : 02.02.34 Ha.
Contact : 9979367617

- Ramsingbhai used to cultivate traditional crops like Wheat, Maize, Tuber and Paddy and was getting lower production and lower returns.
- He was guided by KVK scientist at Farmer Training Centre, Dahod in a programme organized by ATMA, about cultivation of Roses in a scientific way.
- He prepared the land as per the guidance and planted roses in pits at a distance of 3x3. He also adopted drip irrigation
- He used 3 trollies of organic manure for basal application and thereafter used 100 kg DAP, 50 kg Potash and 50 kg ASP, as recommended by the scientists.
- He sprayed Neem oil on rose plants to keep them pest free.
- After 3 months, rose plants were trimmed so that more branches would grow, leading to production of more roses.
- He used to do regular weeding and earthing, as the plants grew.
- Since more than five years now, he is earning well by marketing beautiful roses.
- During the year of 2013-14 he was awarded “**Best ATMA Farmers Award**” at District level.

Income from Roses

(Area - 0.40 Ha.)

Year	Crop	Income (Rs.)	Expenditure (Rs.)	Net Profit (Rs.)
2010-11	Rose	1,26,000/-	70,824/-	55,176/-
2011-12	Rose	1,55,000/-	22,500/-	1,32,500/-
2012-13	Rose	1,57,500/-	24,000/-	1,33,500/-



Success story 12. Flower Cultivation



Name : Pravinbhai Nathubhai Bhuvra
Village : Bhat Simroli
Block : Keshod Distirct : Junagadh
Education: 10th Std Age : 40 Year
Land : 1.90 Ha.
Contact : 9913939994

- Pravinbhai was previously cultivating crops such as Ground Nuts, Cotton, Pulses, Wheat and Cumin conventionally.
- He thought of doing specialized farming to overcome very low income obtained from conventional farming.
- As per market demand, he was inspired to cultivate flowers though the training and exposure visit by ATMA.
- He started to cultivate Roses and Marigold.
- He got all information of Goti(Kalkati), Sevanti and Daisy flower varieties from State Training Program of ATMA Project.
- He adopted Drip Irrigation farming due to shortage of irrigation water in his area.
- He purchased Goti plant from Kolkata and other seedlings from Ahmedabad.
- Flower Cultivation reduced farming expenses, labour cost and other cost.
- He started to grow flowers round the year and also getting high yield to meet market demand of flowers.
- He sold his flowers directly to marketing yard and flower shops to get good returns.
- He also started to make Gajra Designs and Fulhar Designs for marriage functions and earn additional income from his flowers.
- By flower decoration business he doubled his average income.
- He was also awarded with District level “**Best ATMA Farmers Award**” for the year of 2013-14.
- He also motivates other farmers of his area to take part in various training programs of farmers.

Income from Flower Cultivation

(Area - 1.90 Ha.)

Year	Crop	Income (Rs.)	Exps. (Rs.)	Net Profi (Rs.)
2010-2011	Rose, Marigold	3,90,000	70,000	3,20,000
2011-2012	Rose, Marigold, Sevanti, Daisy	4,20,000	55,000	3,65,000
2012-2013	Rose, Marigold, Sevanti, Daisy	4,60,000	45,000	4,15,000



Success story 13. Pomegranate Farming



Name : Genabhai Dargaji Patel

Village : Aagathana (Sarkari Golicha)

Block : Lakhani

District : Banaskatha

State : Gujarat

Education : 12th Std.

Contact No: 9925557177

Age: 53 years

Arm: 5 Ha.

- Total 5500 trees of Pomegranate.
- Panchamrut (cow urine + cow dung + Jaggery + pulses flour) and vermicompost is given to each tree every month as organic fertilizer
- This produces red, shiny, big and good quality fruits.
- Each tree is covered by bird net to protect fruits from birds
- Farmers of Gujarat and Rajasthan have visited his farms.
- Inspired from his farming, approximately 2.50 lakh trees were planted in neighboring villages.
- Awarded with 'Krushi na Rishi Award Year-2009, “Rajasthan Haldiar Times Award and “Best ATMA Farmers award” in the year of 2012.
- He has been awarded the Padma Shri Award in the year of 2017 by the Government of India.

Income Details

(Rs. In Lakhs)

Year	Production (Ton / Ha)	Selling Price	Income (Ha)	Expenditure (Ha)	Profit (Ha)
2010	09	161	14.49	1.20	13.29
2011	12	75	09.00	1.50	07.50
2012	26	66	17.16	2.00	15.16



c) Livestock sector:

Sl. No	Issue	Status	Action Plan (Including policy reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
1.	Improving availability of feed and fodders	Huge shortage of dry and green forage in the state.	<ul style="list-style-type: none"> a. Improve fodder production by utilizing proven fodder varieties. b. Development of pasture lands in the villages. c. Use of industrial and agro-forestry by-products to curtail cost of animal feeding. d. Encourage farmers to establish fodder banks. e. At least 50 acres land in every village should be identified for the fodder banks. f. Switch over towards forage, fodder production and storage, e.g. Fodder cowpea- Lucern + chicory cultivation will ensure availability of green fodder throughout the year. 	<ul style="list-style-type: none"> a. Increase availability of high-grade seeds. b. Identify district-wise areas for surplus fodder crop and intimate the <i>gram panchayat</i> through mobile apps wherever there is shortfall in fodder production. c. Use crossbred fodder sugarcane & NB -21. d. Identification and use of different industrial by-products especially groundnut, maize and rice industry. e. Timely collection of agro-forestry by-products and use them with the consultation of animal nutritionists. f. Develop district-wise data base on cattle and buffalo productivity, availability of different feed resources and animal requirement. g. Develop area specific mineral mixtures considering mineral availability and requirement.

Sl. No	Issue	Status	Action Plan (Including policy reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
2.	Promote Breeding of livestock animals	Semen supply from good proven bulls needs to be operationalized throughout the state. Upgradation of indigeneous breeds is yet to be prioritized.	a. Assure semen supply of good proven bulls on subsidized rates for Artificial Insemination in dairy animals. b. Upgradation of indigenous breeds through selection and crossbreeding of non-descriptive animals with the semen of proven bulls. c. Promote oestrus synchronization program all over the state.	a. Bulls testing at molecular level. b. Performance evaluation of good pedigree bulls at field level. c. Implementation of Progeny testing at field level. d. Execute village level infertility camps at regular intervals. e. Different oestrous synchronization modules should be implemented at village level
3.	Formulate housing Management for livestock sector	Scientific rearing of calves and heifers is not widely practiced in the state.	Scientific rearing of calves and heifers to minimize mortality in calves and infertility problems in heifers.	a. Conducting local vocational courses for creating awareness on scientific animal husbandry practices. b. Extensive short duration research on animal shelter.
4.	Formulate Health management of livestock animals	Diagnostic facilities for infectious diseases and their management are not done on regular basis.	a. Operationalize mechanism for diagnostic facilities of infectious diseases as well as their reporting and vaccination. b. Timely reporting of infectious diseases need to be prioritized. c. Develop modalities for prompt and accurate diagnosis, along with	a. Execute health checkup camps at village level at regular intervals. b. Conduct testing of infectious materials in state registered laboratories. c. Timely vaccination against diseases including FMD, brucellosis, and Hemorrhagic septicemia (HS).

Success story 14. Animal Husbandary



Name : Meenaben Atulbhai Patel
Village : Shekhadi
Block : Petlad
District : Anand
Land Holding : 5 Ha
Contact : 9913106071

- Meenaben Patel was doing animal husbandry by conventional method.
- The cost of production was high with less profits and production.
- Joined ATMA Project and obtained information on ideal animal husbandry.
- Then she started animal husbandry by advanced and scientific methods.
- Made concrete cattle shed and flooring.
- Started to give mixed fodder (dry and green) after cutting by chaff cutter.
- Installed tubewell so that water can be available to the cattle for 24 hours.
- To maintain hygiene and cleanliness of the cattle, she gave bath to all the cattle and cleaned the shed daily.
- She also made arrangements of fans in the cattle shed so as to give relief to the cattle from heat
- In the year 2011 she made a godown to store fodder for the cattle.
- She purchased a milching machine to save time.
- Vaccination of cattle is done from time to time to protect animals from diseases
- Zero mortality of animal has been found at her place for the last 3 years
- Employees of AMUL dairy visits her cattle frequently, whenever they came to Shekhadi Dudh Utpadan Mandali
- She was awarded with “**Best ATMA Farmers Award**” at State level in the year of 2014-15.

Income from Animal Husbandry

Year	Income (Rs.)	Expenditure (Rs.)	Net Profit (Rs.)
2012-13	11,91,000	11,51,000	4,54,000
2013-14	15,35,936	8,72,600	5,93,336
2014-15	15,60,840	8,92,520	6,68,320



d) Poultry sector

Sl. No	Issue	Status	Action Plan (Including policy reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
1.	Develop efforts for Breeding in poultry sector	Large existing demand for location specific poultry bird varieties in Gujarat state.	Development of location specific varieties for rural/ backyard poultry farming.	<ul style="list-style-type: none"> a. Develop crossbred by crossing native / non-descript breeds with high yielding breeds/strains. b. Disseminate already developed superior germplasm suitable for backyard poultry farming
2.	Prioritize feed & nutrition development for poultry sector	Available suitable crop residues are only partially utilized as poultry feeds.	<ul style="list-style-type: none"> a. Promote maize and soybean cultivation for utilizing as poultry feed. b. Reduce feed cost of commercial poultry farming. c. Provision for poultry feed at subsidized rate for rural/ backyard poultry farmers. 	<ul style="list-style-type: none"> a. Promote maize and soybean growers by providing seeds of high yielding varieties at a subsidized rate. b. As soybean De-oiled cake (DOC) is being used in poultry feed, improve soyabean processing facilities. c. Explore the possibilities of usage of alternative poultry feed resources for partial replacement of major poultry feed ingredients.
3.	Formulate health management in poultry sector	Emerging issues of poultry disease diagnostic facilities need to be addressed on regular basis with timely interventions.	Diagnosis and control measures for emerging and re-emerging diseases of poultry.	<ul style="list-style-type: none"> a. Establish poultry disease diagnostic facilities at regional levels and schedule appropriate vaccinations. b. Short duration training on package of practices for rearing of birds and health management.

Success story 15. Ideal Poultry Farm



Name : Ajitkumar jagamalabhai Gohil
Village : Mitiyaja
Block : Kodinar
District : Gir Somnath
Age : 26 Years
Education : 10th Std.
Land Holding : 2 Ha.
Contact : 92282 4018

- Ajitbhai, along with agriculture raised chicken and sold eggs and chicken for the local market.
- Local practices earned him less income and profit.
- After joining ATMA project, he received training related to broiler chicken farming and got full information by visiting different poultry farms in Bhavnagar district.
- In the first year, he raised 200 Cobb variety of Broiler chickens in area of 500 square feet. In the first lot, he raised 500 chickens and got good profit.
- Now, he raises 400 Cobb variety of Boiler chickens in area 1000 square feet. In the first lot, he raises 1000 chicken.
- Prepared High-quality lots by destroying bacteria and other parasites as well as keeping the farm clean.
- Prepared manure from chicken droppings which is used in different crops.
- Developed new species of chicken and which mature in a short time.
- He received District level “**Best ATMA Farmers Award**” in the year of 2013-14 for ideal poultry farming.

Details of income from poultry farming

Year	No. of Chickens	Total Income (in Rs.)	Expenditure (Rs.)	Net Profit (Rs.)
2010-11	200 Cobb	3,65,750	2,74,425	91,325
2011-12	300 Cobb	5,39,000	3,78,625	1,60,375
2012-13	400 Cobb	8,20,050	5,51,025	2,69,025



Success story 16. Successful Poultry Farming



Name : Husainbhai Alibhai Sherashiya
Village : Chandrpur
Block : Wakaner
District : Morbi
Area of Cultivation : 1.25 Ha
Education : 10th Std.
Age : 48 Years
Mobile : 7405563486

- Husainbhai was doing farming of Cotton crop using drip irrigation system but he did not get sufficient income.
- After joining ATMA project, he got training on poultry farming from Anand Agricultural University.
- He made a poultry farm to ensure supplementary income along with a agriculture.
- In the very first year, he started with 5000 chicks in the poultry farm and as of now he has 7000 Chicks in the poultry farm.
- Chicks get their food through food feeder system. An automatic water supply system has also been installed, so that chicks get water whenever they require.
- To prevent the death of the chicks due to heat waves / high temperature, he has installed water fogger on the rooftop of the poultry farm.
- To prevent loss due to diseases and insect-pest, regular cleaning of poultry farm is ensured.
- He makes fertilizer from chicken waste and utilizes in farming to reduce the use of chemical fertilizers.
- Supplementary income from poultry farming partially covers up the loss due to failure of crop at times.
- He was honoured with “**Best ATMA Farmers Award**” for Ideal Poultry farming during the year of 2013-14.

Income from Poultry Farming

Year	Number of Chicks	Total Income (in Rs.)	Expenditure (in Rs.)	Net Profit (in Rs.)
2010-11	5,000	19,50,000	16,00,000	3,50,000
2011-12	6,000	24,00,000	18,50,000	5,50,000
2012-13	7,000	28,00,000	20,40,000	7,60,000



e) Fisheries sector:

Sl. No	Issue	Status	Action Plan (Including policy reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
1.	<p>Fresh water fish production:</p> <ul style="list-style-type: none"> • Low per ha productivity in ponds & lakes. • Reservoirs lack quality fingerlings • Low catchability • Poor utilization of resources • Untapped ornamental fish Trade 	<p>Fish production in ponds:</p> <ul style="list-style-type: none"> • Nation- 2400 kg/ha • State – 500 kg/ha <p>Fish production in reservoirs:</p> <p>- Nation:</p> <ul style="list-style-type: none"> • 50 kg/ha/yr (Small) • 12kg/ha/yr (Medium) • 11 kg/ha/yr (Large) <p>-State:</p> <ul style="list-style-type: none"> • 55.66 kg/ha/yr (Small) • 35.01 kg/ha/yr (Medium) • 47.36 kg/ha/yr (Large) 	<ul style="list-style-type: none"> a. Production and stocking of stunted yearling and ranching programmes. b. Species diversification & establishment of hatcheries. c. Exploitation and technological advancement in ornamental fish culture. d. Maximum utilization of water bodies. e. Small scale and commercial fish feed plant. 	<ul style="list-style-type: none"> a. Promote cage and pen farming policies in reservoirs and lakes. b. Strengthen existing and creation of additional infrastructural facilities c. Conduct research, training and extension programmes. d. Ensure optimum utilization of water resources for maximizing production. e. Improve location specific and economically feasible technology generation. f. Design and develop advance fish harvesting methods g. Establish disease diagnosis centres. h. Ensure economical and critical fish farming inputs.

Sl. No	Issue	Status	Action Plan (Including policy reforms)	Implementing Strategy
(1)	(2)	(3)	(4)	
2.	Brackish water fish production: <ul style="list-style-type: none"> •Lack of quality seed. •Depletion of coastal water bodies. •Lack of insurance cover. 	<ul style="list-style-type: none"> •Only 5.8 % is allotted of the brackish-water area is allotted for fish culture. •Disease diagnosis laboratories do not exist. •Poor species diversification. •Lack of infrastructure facilities. 	<p>a. Develop & domesticate commercially important fin fishes' brood stocks and SPF, SPR, SPT brood stocks for shrimps.</p> <p>b. Promote species diversification & establishment of hatcheries.</p>	<p>a. Implement research, training and extension programmes on optimum utilization of water resources for maximizing per ha production.</p> <p>b. Promote location specific and economically feasible technologies generation</p> <p>c. Establish disease diagnosis centres / laboratories.</p> <p>d. Provide insurance cover to shrimp/ fish crop.</p> <p>e. Develop proper policies at par with agriculture sector.</p> <p>f. Promote land allotment on the basis of carrying capacity of water bodies.</p>
3.	Marine-water Capture fisheries: <ul style="list-style-type: none"> • Low catch per unit • Poor or unexploited fisheries resources. 	<ul style="list-style-type: none"> • Mariculture policy does not exist. • Poor mechanization of fishing crafts and gears • Poor species diversification 	<p>a. Designing fishing gears, crafts, methods & equipments.</p> <p>b. Effective utilization & outreach programmes on Potential Fishing Zones (PFZ).</p>	<p>a. Promote cage, pen, seaweed, oyster, and mussel farming policies in marine waters.</p> <p>b. Species diversification by including seaweeds molluscs.</p> <p>c. Promote research, training and extension programmes.</p> <p>d. Promote sea ranching programmes and marine ornamental fish culture.</p>

Success story 17. Fish Farming



Name : Uttambhai Dayalbhai Patel
Village : Binvada
Block : Valsad
District : Valsad
Age : 56 Years
Education : SSC
Land : 2.36 Ha
Mobile No : 9228824121

- Uttambhai Patel was doing fishery business during monsoon season and it was difficult to subsist.
- Joined the ATMA project during the year 2009 and took training for fisheries.
- Fisheries Department organised his visits to various fish ponds made by farmers in Anand and Dakor area, which helped him to get more information.
- Along with fisheries business through scientific methods, he also started the vegetable farming.
- He used fish pond water for his agriculture farming.
- He took a pond on lease from the Gram Panchayat, in which Rohu, Katla, Ramas, Rinrigel and Halwa and various other breeds were grown.
- He used poultry fertilizer to feed fishes which enhanced quality production.
- For these achievements he was honoured with “Best ATMA Farmers Award” during the year of 2013-14 at district level.

Detail Of Income From Fisheries

Year	Income (Rs.)	Expenditure (Rs.)	Net Profit (Rs.)
2010-11	1,75,000	61,000	1,14,000
2011-12	2,52,000	70,580	1,81,420
2012-13	3,57,120	89,650	2,67,470



Success story 18. Fresh Water Aquaculture for Pearl Production



Name : Bhargavbhai S. Desai
Village : Talavchora
Block : Chikhli
District : Navsari
Age : 35 Years
Education : M.B.A
Contact : 85111 04554

- Due to out of the box thinking and his willingness to do something new, he got training of Pearl production from Central Institute of Freshwater Agriculture, Bhubneshwar and is carrying out pearl production successfully from fresh water oysters.
- He grows oysters in his own pond of 2 Hectares by scientific methods. He injects decorative images of different size, shape and designs into the oysters through this method pearls of Rs.500/- to 50,000/- per pearl can be produced.
- He produces aesthetic jewellery and articles with attractive designs i.e. Ganesha, Saibaba, and religious symbols of Islam & Christianity.
- Cultured pearls are more beautiful with proper size, shape, design and also have more shine than natural pearls. During 2 years of rearing 10,000 to 12,000 numbers of cultured pearls are produced from 1 hectare.
- In 2006, he recovered two a natural pearls from his pond having size of 48 carat with whitish pink color which were approved by The Gem & Pearl Testing Laboratory, Bahrain. The market price of this Pearls ranges from Rs 300 to 400 Lacs.
- By doing Fisheries along with pearl production, approximately 2 Ton of fish per Hectare are also produced.

Income Detail From Pearl Production

Detail	Traditional Pearl Production Technique	Modern Pearl Production Technique
Production	Approx. 50 To 200 Pearl / Ha	10,000 To 12,000 Pearl / Ha
Expenditure	Rs. 0.50 Lakh / Ha	Rs. 17.50 Lakh / Ha
Income	Rs. 1.00 Lakh / Ha	Rs. 28.75 Lakh / Ha
Profit	Rs. 0.30 Lakh / Ha	Rs. 11.25 Lakh / Ha



2. Promoting on-farm ancillary activities:

Sl. No	Issue	Status	Action Plan (including policy reforms)	Implementing strategy
	(1)	(2)	(3)	(4)
1.	Promoting on-farm honey production (Apiculture)	At present, there is no prevailing scheme / project on honey production or apiculture popularization in the state.	<p>a. Purchase, distribution and maintenance of honeybee colonies.</p> <p>b. Increasing awareness on bee conservation by avoiding pesticide usage at the time of flowering.</p>	<p>a. Devise mechanism for purchase of honeybee colonies.</p> <p>b. Identify farm pockets and distribute honeybee colonies to farmers.</p> <p>c. Train farmers on apicultural activities.</p> <p>d. Conduct research on beekeeping especially on bee breeding and nucleus colonies.</p>
2.	Incentivizing mushroom cultivation	A viable venture with low input and high income. However, expertise is critically lacking in the state on profitable production and marketing.	<p>a. Prioritize training on mushroom cultivation and marketing.</p> <p>b. Strengthen spawn laboratory and other infrastructure among stakeholder agencies.</p>	<p>a. Promote training on different aspects of mushroom cultivation and marketing.</p> <p>b. Create awareness on functional / nutritional benefits of mushroom.</p> <p>c. Develop Spawn availability and substrate pasteurization centers along with dehydration facilities.</p> <p>d. Incentivize mushroom growers association.</p>

3. Invigorating organic farming:

1.	Increasing area under organic farming	<ul style="list-style-type: none"> The state is most suited for organic farming as a significant portion of its agricultural land is rainfed. Pioneer state to establish first ever Organic University in the country. 	<p>a. Demonstrate and organize training on different organic farming techniques.</p> <p>b. Conduct research on organic farming techniques</p> <p>c. Promote use of bioagents.</p>	<p>a. Provide special attention for bringing rainfed areas under organic mode.</p> <p>b. Bring area under cultivable barren lands into organic horticulture cultivation.</p> <p>c. Develop protocols for organic production based on the entire cropping system approach.</p> <p>d. Develop preferential policy instruments by declaring one or two organic districts</p>
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Success story 19. Honey bee Keeping



Name : Chandrasinhbhai Konkani
Village : Rambhas
Block : Aahwa
District : Dang
Age : 40 Years
Education : Diploma in Agri.
Contact : 9099370139
Land : 3.15 Are.

Details:

- He is rearing three types of honey bees out of eight types found in Dangs.
- Owing to his hardwork, dedication and heredity knowledge, he invented new type of honey box and honey pot for rearing of honey bees.
- He produced quality honey with 30-40 % increase in production by putting honey box in maize crop.
- He produced quality honey with 30-40 % increase by putting honey box in Cashew and Mango crops.
- He gives training and guidance as an expert to other farmers for rearing of honey bees in workshops for rearing honey bees.
- He was awarded with State level best “**Best ATMA Farmers Award**” for the year of 2011-12.

Details of income from Apiculture

(Rs in Lakhs)

Year	Production	Expenditure	Net Profit
2009	260 kg	0.14	0.43
2010	340 kg	0.16	0.64
2011	420 kg	0.20	1.25



Success story 20. Organic Farming and Value Addition



Name : Manharbhai Chhotubhai Patel
Village : Umbhel
Block : Kamrej
District : Surat
Land : 04-72-10 Ha.
Contact No. : 9909593924

- Earlier, Manharbhai used to do farming traditionally.
- Got less yield with low benefit and high costs.
- Got information about value addition in turmeric by joining ATMA Project.
- Started farming in advanced and scientific manner as well as provided value addition in turmeric
- Started with organic farming in turmeric.
- Then started storing dry turmeric instead of green turmeric.
- Then processed it into turmeric powder and sold it.
- Marketed turmeric powder from his home.
- With his own instincts, Manharbhai keeps on improvising his farming from time to time.
- Visits Agriculture University regularly and followed their recommendations for organic farming.
- Inspired by his success, other farmers of Gujarat also started farming with his guidance during their visit to his farm.
- In 2012 he was honoured with District Level Award for organic farming by ATMA
- He was also awarded “**Sardar Krushi Sanshodhan Award**” by the Agriculture Department in the year 2002 and was entitled as a “**krushi Na Rushi**” since 2009.
- He received the “**Best ATMA Farmer Award**” in the year of 2014-15 at the State level



Profit from Green Turmeric

Year	Income (Rs.)	Expenditure (Rs.)	Net Profit (in Rs.)
2012-13	51,600	26,400	25,200
2013-14	2,09,000	57,650	1,51,350
2014-15	2,11,000	60,000	1,51,000

Profit from Dry Turmeric Powder

Year	Income (Rs.)	Expenditure (Rs.)	Net Profit (in Rs.)
2012-13	1,29,000	66,000	63,000
2013-14	5,22,500	1,44,125	3,78,375
2014-15	5,27,500	1,50,000	3,77,500



Success story 21. Banana Cultivation through Organic Farming



Name : Bhimani Kantilal Ravjibhai
Village : Ratnapar (Mau)
Block : Mandvi
District : Kutch
Education : 9th Std.
Age : 50 Years
Area : 4.00 Ha.
Contact No. : 7567531275

- Kantilal Bhimani was doing traditional farming and cultivating Cotton and Castor crop in his farm.
- In conventional farming, he was not getting sufficient production. For getting modern farming knowledge, he met various scientists, government officers and ATMA officers.
- With scientific approach and his own knowledge, he decided to do organic farming.
- Firstly he prepared Jivamrut with the use of Cow Urine, Dung and different plants and used it in Banana crop.
- He started supplying Jivamrut as pesticide and nutrient through drip irrigation in his farm.
- Bio-fertilizer prepared entirely from Cow urine, Dung and different plants, proved to be good for health and environment.
- He used Jivamrut, so nitrogen content of the soil increased and growth of plant became fast.
- Spraying Jivamrut on plants gave protection against diseases and pests. It also reduced the termites in the soil.
- With use of organic farming, fruit became sweeter, good in quality and hence got good price in market.
- He sold Jivamrut prepared by him in his village and nearby Talukas and also in Ratnagiri District in Maharashtra to get additional income.
- Due to organic farming, expense on chemical fertilizer, pesticides and labour charges decreased. He got increase in production and income with this approach.
- For his approach, he was honored by Hon. Chief Minister with “**Sardar Patel Krushi Award**” for year of 2010, “**Khedut Gaurav Award**” in the year of 2011 by Navsari Agriculture University and “One MP, One Idea Award” in the year of 2013.
- In order to acknowledge his achievements, he was also awarded State level “**Best ATMA Farmers Award**” for the year of 2013-14.

Details of Income from Banana

Year	Total Production (K.G.)	Average Market Rate/ Per K.G. (Rs.)	Total Sale (Rs.)	Total Expenditure (Rs.)	Total Profit (Rs.)
2010-11	28,000	5.00	1,40,000	80,000	60,000
2011-12	30,000	6.25	1,87,500	50,000	1,37,500
2012-13	30,000	7.50	2,25,000	70,000	1,55,000



Success story 22. Organic Farming using Cow Urine and Dung



Name : Laljibhai Dosabhai Parmar
Village : Siddhpur
Block : Jam-Khambhaliya
District : Devbhumi Dwarka
Land : 1.5 Ha.
Contact : 9428570337

- Earlier, Laljibhai was engaged in traditional farming.
- The returns were hardly enough to cover the increasing costs.
- Got information regarding organic farming and cow based farming after joining ATMA.
- Bought Gir cow to undertake cow based farming in a modern and scientific way.
- Prepared and utilized his own “Jivamrut”.
- Started utilizing cow urine, cow dung and butter milk from cow's milk to control disease and pest in crop.
- Adopted drip irrigation to save water.
- Started producing quality crops in higher quantities. He also created his brand and started marketing his agriculture produce under the brand name. This led to increase in his income.
- Laljibhai also increased fertility of soil by using of cow dung in his farm.
- Set up gobar gas plant and used it for cooking.
- On the whole, he obtained higher production and better returns with less expenditure by doing cow based farming.
- He was awarded State level “**Best ATMA Farmers Award**” in the year of 2014-15.

Income Details

Year	Total cattle	Lactating Cattle	Income / Year (Rs.)	Cost / Year (Rs.)	Net Profit / Year (Rs.)	Net Profit Lactating Cattle Yearly
1st Year	5	2	3,04,000	1,00,000	2,04,000	1,22,000
2nd year	6	3	4,59,000	1,30,000	3,29,000	1,01,000
3rd year	6	3	4,86,000	1,30,000	3,56,000	1,18,500



7. Value-Chain Development, Market Linkages & Trade Potential

a) Value-Chain Development:

Sl. No	Issue (1)	Status (2)	Action Plan (including Policy Reforms) (3)	Implementing Strategy (4)
1.	Improving farm pre- and post- harvest management techniques in crop sector	Nearly 20 to 25 per cent post harvest farm output losses in the state due to improper handling.	<p>a. Demonstrate and organize training on different pre- & post- harvest techniques.</p> <p>b. Promote farm gate processing.</p> <p>c. Incentivize low-cost processing technologies through start-ups</p>	<p>a. Promote taluka level cold chains, rural godowns and village level agro-processing industries and commodity based value-chains.</p> <p>b. Establish Quality Certification Laboratories at APMC level</p>
2.	Improve recycling of crop residue at farm-level	<p>Only 5 to 10 per cent farm waste get utilized in the state.</p> <p>Immense potential for recycling residues in fruit crops.</p>	<p>a. Organize training on available technologies of value addition of crop residues.</p> <p>b. Prioritize research on residue recycling of fruit crops.</p> <p>c. Commercializing crop bio-mass.</p>	<p>a. Create awareness about crop recycling measures through demonstration and training.</p> <p>b. Develop technologies for waste recycling of all horticultural crops.</p>
3.	Improve milk quality & introduce value addition in livestock sector	<ul style="list-style-type: none"> • Poor hygienic quality of milk. • There is no value addition in milk at farmers' level such as conversion of milk into dahi, lassi, shrikhand, khoa, paneer etc. 	<p>a. Promote clean milk production.</p> <p>b. Increase shelf-life and quality of milk.</p> <p>c. Encourage small scale start-ups for value added dairy product units.</p>	<p>a. Awareness training for farmers on clean milk production and increasing shelf-life.</p> <p>b. Promote Community milking.</p> <p>c. Promote machine milking.</p> <p>d. Establish farm cooling practices using affordable technologies.</p>
4.	Promote post-harvest technologies in fisheries sector	<ul style="list-style-type: none"> • Poor infrastructure facilities. • Fewer manufacturing units for value added products 	<p>a. Create infrastructure facilities like fish loading & unloading devices and onsite ice making machines</p> <p>b. Establish hygienic fish collection (mobile vans), marketing and cold chain facilities.</p>	<p>a. Strengthen existing harbour infrastructure facilities.</p> <p>b. Create additional infrastructural facilities in fish market.</p> <p>c. Conduct research, training and extension programmes.</p>

Success story 23. Drum stick Farming and Value Addition



Name : Dipenkumar Mukundbhai Shah
Village : Kunjarav
Taluka : Anand
District : Anand
Age : 39 years
Education : B.Com.
Land : 10 Ha
Contact No : 9727727077

- Farmers of Anand district mainly cultivate tobacco, but he wanted to start something new and started Drumstick farming in his 3 acres farm.
- Initially, he sold the pods but later he decided to produce powder from leaves and sell them to pharmaceutical companies.
- Harvested green leaves, dried them under net shed and with the help of pulverized mill, produced powder. 3 kg of dried leaves are obtained from 10 kg of green leaves, which is pulverized to 2.5 kg of powder.
- He also produced powder from the pulp of pods. 2 kg of powder is obtained after drying 10 kg of pods.
- This powder is supplied to pharmaceutical companies for production of medicines for relief and cure of joint pain & other ailments.
- The processing of drumstick results in four to five times more income than selling drumstick pods.
- He was honoured with '**Best ATMA Farmers Award**' at District level for the year of 2010-11.

Drumstick farming and its value addition details

(Rs. In Lakh)

Year	Production Kg/Ha.	Income/Ha.	Expenditure / Ha.	Net Profit
2010-11	20,000	2.00	0.40	1.60
2011-12	30,000	4.50	1.00	3.50
2012-13	40,000	5.50	1.10	4.40



Success story 24. Value Addition in Ginger and Turmeric



Name : Deveshbhai Rameshbhai Patel
 Village : Boriyavi
 Block : Anand
 District : Anand
 Age : 32 Years
 Education : B.E
 Land : 10 Ha.
 Contact No : 7016809898

Details:

- Produced best quality Ginger and Turmeric through organic farming. He did value addition by grading, packing and marketing and increased his income substantially.
- As per his experience, through value addition in the turmeric and ginger making, South Powder (dry ginger powder) and turmeric powder the income can be increased by 1.5 to 2 time rather than by selling in the raw form.
- He has been honoured with “Jagjeevanram Award” at National level, “Sardar Patel Krushi Sansodhan Award” and “**Best ATMA Farmers Award**” at State level.

(A) Ginger Details for Cost Per Hectare

(Rs. In Lakh)

Years	Production / (KG)	Income/ Ha.	Profit	Production of Processing (KG)	Income	Net Profit
2009-10	15800	3.95	2.73	3160	7.11	4.37
2010-11	18200	5.46	4.13	3640	9.10	4.96
2011-12	21000	7.35	5.81	4200	12.6	6.79

Turmeric Details for cost per hectare

(Rs. In Lakh)

Years	Production / KG	Income/ Ha.	Profit	Production of Processing (KG)	Income	Net Profit
2009-10	18,000	2.95	2.57	3,600	6.30	3.35
2010-11	22,000	6.05	4.11	4,500	9.00	4.89
2011-12	25,200	7.56	5.00	5,040	11.34	6.34



b) Market Linkages:

Sl. No	Issue	Status	Action Plan (including Policy Reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
1.	Leverage market intelligence for all major agricultural crops	Forecasting / market intelligence system for all agricultural commodities / major crops is grossly inadequate in the state.	<p>a. Robust price forecasting techniques need to be utilized on a full-time basis.</p> <p>b. Market intelligence mechanism for horticultural crops need to be studied.</p>	<p>a. SAUs need to have a separate Market Intelligence Centre in Agricultural Economics Department.</p> <p>b. Fairly accurate estimates on price forecasting should be made available to the farmers well before the harvest season.</p> <p>c. Training farmers to utilize and appreciate market intelligence services.</p>
2.	Promote contract farming and direct marketing, wherever feasible	<p>Though the State has modified APMC Act allowing contract farming and direct marketing, the efficacy of such reforms is not up to the mark.</p> <p>Direct marketing of farmers account barely 5 per cent of volume transacted.</p>	<p>a. APMCs need to encourage contract farming.</p> <p>b. Better coordination between Farmers, Industry and APMC.</p> <p>c. Facilitate contract farming with a mechanism of assured pricing.</p>	<p>a. Devise appropriate policies to make the contract farming enterprising.</p> <p>b. Ensure participation of small and marginal farmers by the firms entering into the agreement of contract farming</p> <p>c. Establish Special Agricultural Zones (SAZ) to cater to special farm trade groups with specific requirements.</p> <p>d. Promote direct marketing by modernizing market infrastructure at taluka level.</p>

Sl. No	Issue	Status	Action Plan (including Policy Reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
3.	Leapfrogging Electronic-National Agricultural Market (E-NAM)	Though Gujarat is the frontrunner state in E-NAM, it is still in the nascent stage and neither farmers are adequately aware about its benefits, nor are facilities and coverage up to the mark.	<p>a. Speedily link all APMCs and Market Yards in Gujarat to E-NAM.</p> <p>b. Encourage large <i>mandis</i> to actively participate in e-NAM.</p> <p>c. Wide publicity of e-NAM benefits</p>	<p>a. Create awareness about E-NAM and its usefulness to the farmers esp. small & marginal.</p> <p>b. Incentivize and award farmers with maximum transactions through E-NAM.</p> <p>c. Establish select “Organic Markets” for agricultural commodities under E-NAM.</p>
4.	Involve cooperatives in marketing of horti. produce	At present cooperatives are not involved in and marketing of horti. produce.	Promote cooperatives for marketing of horti. produce.	Plan exposure and motivation to co-operatives in the state through visits to successful co-operatives in India.
5.	Leveraging Farmers Producers Organization(FPOs)	<ul style="list-style-type: none"> • Number of FPOs in the state is one of the lowest in India. • The potential of FPOs among small and marginal farmers is yet to be realized in the state. • External Commercial Borrowings (ECBs) is currently permitted for NGOs and NBFCs engaged in micro-finance alone and not for FPOs. 	<p>a. FPOs should be allowed to market members’ produce directly to buyers of their choice, through all platforms, physical or electronic.</p> <p>b. Extend tax exemption to FPOs at par with Cooperatives.</p> <p>c. Incentivize FPOs for creation and maintenance of rural agriculture infrastructure.</p> <p>d. Ensure provisions for easy issue of licenses to FPOs to trade in inputs.</p>	<p>a. Provide collateral free loans upto Rs.25 lakh to the FPOs.</p> <p>b. Rate of interest for FPOs should be at par with the rate charged to individual farmers for crop loans.</p> <p>c. Group insurance schemes should be established for members of FPO.</p> <p>d. Extend external commercial borrowings (ECBs) for FPOs.</p> <p>e. Single state-wide license with every point of sale for all agri. inputs which will facilitate FPOs dealing with agro-inputs.</p>

Sl. No	Issue (1)	Status (2)	Action Plan (including Policy Reforms) (3)	Implementing Strategy (4)
6.	Innovate livestock marketing	Awareness among small and marginal farmers about marketing prospects in livestock is highly skewed.	<p>a. To conduct certificate course on creating awareness.</p> <p>b. Develop regulated livestock market for selling live animals.</p>	<p>a. Conduct local vocational courses for creating awareness among small and marginal livestock keepers about rearing, marketing, bank loan facilities and establishment of cattle, buffaloes, sheep, goats and poultry farms.</p> <p>b. Develop Apps related to livestock management to disperse quick scientific information.</p> <p>c. Establish indigenous milk cooperatives for facilitating production and marketing of desi (A2) milk.</p>
7.	Accelerate marketing for poultry products	Partially existing demand for poultry products in the state	Promotion of consumption of poultry products, wherever possible	<p>a. Creating awareness regarding nutritive value of poultry products through media and mass coverage.</p> <p>b. Promoting local / indigenous poultry breeds and their products.</p>

c) Trade Development:

Sl. No	Issue	Status	Action Plan (including Policy Reforms)	Implementing Strategy
	(1)	(2)	(3)	(4)
1.	Doubling the current level of exports	Share of India in world exports is very low and hardly 1.5 % on an average during the last decades. Farm level awareness on SPS measures is still very poor.	Double the current level of 1.70 lakh crores worth of agri. exports within 5 years. Boost to RTAs(Regional Tariff Agreements) to address the issue of Non-Technical Barriers such as TBT and SPS Measures and to attract investment	<p>a. Promote Crop Stewardship Programs, Good Agricultural Practices (GAP) and Certification procedures.</p> <p>b. Promote Global Commodity Boards like California Walnuts, Washington Apples for our own farm produce like Talala Kesar Kheri or Kutchi Dates.</p> <p>c. Promote quality consciousness and health safety issues among farmers for both domestic and international trade.</p>

Specific strategies to improve export potential of Gujarat:

1. **Special Agricultural Zone (SAZ) may be established in the peri-urban and semi-urban areas.**
2. **Commodities needed by urban population** like fruits, vegetables, flowers, milk and eggs can be targeted.
3. **Export oriented and industrial use crops** can also be focused.
4. The land in SAZ may be preserved exclusively for agriculture.
5. On the model of Special Economic Zones (SEZ), incentives may be given to farmers in the SAZ areas.
6. Promoting Crop Stewardship Programs, Good Agricultural Practices (GAP) and Certification, formation of **Global Commodity Boards (like California Walnuts, Washington Apples)** for Kesar mango will add fillip to the export potential of the state.

8. Policy and Investment Requirements and Role of Government

Sl. No	Issue	Status	Policy & Institutional Requirements	Role of Government	Agency/ Organization Stakeholders' Responsibilities	Expected Outcome
(1)	(2)	(3)	(3)	(4)	(5)	(6)
1.	Zeroing in on water management problems	Currently, 57.52 % of area of Gujarat is under rainfed agriculture. Only 20 % of the rainfall gets utilized in the state.	Promote rainwater harvesting. Enhance groundwater irrigation efficiency. Using waste water from dairy and other domestic effluents	<ul style="list-style-type: none"> a. Promote in-situ conservation, water harvesting and management at farms. b. Encourage raised beds with block furrow irrigation. c. Incentivize roof-water harvesting in rural/ urban areas. d. Promote and train Water User Groups (WUGs) on a large-scale. e. Enhance subsidy on 5 HP solar water pumps on cooperative basis to farmers' groups. f. Train farmers on biodegradable mulching practices. g. Divert urban run-off to recharge zones. h. Ensure steps for reducing BOD and COD levels of effluent irrigation water. i. Conduct crop-water balance and optimal crop planning studies at taluka levels. 	CADA; DRDA; GWDA; GLDB; GGRC; Department of Agriculture, Department of Horticulture and SAUs need to promote water harvesting and conservation measures using training programmes and workshops.	<p>Yield may increase upto 30%</p> <p>Additional 5 lakh ha in the state may get irrigated.</p> <p>Increase in median farmers' income by 5%</p>

Sl. No	Issue	Status	Policy & Institutional Requirements	Role of Government	Agency/ Organization Stakeholders' Responsibilities	Expected Outcome
(1)	(2)	(3)	(3)	(4)	(5)	(6)
2.	Facilitating farm mechanization	Available farm power is only about 1.20 kW/ha in Gujarat, which is less than the national average. Farmers' skill-sets need to be improved.	PPP mode production of machinery for top down and bottom up approach. Providing vocational skills to youth on farm machinery.	<ul style="list-style-type: none"> a. Promote need based affordable farm machineries especially for small and marginal farmers. b. Identify and train rural/urban youth on skills relating to repair, maintenance and innovation of small tools. c. Incentivize entrepreneurs for farm machinery production through start-ups. d. Innovate and proliferate panchayat level custom hiring centers (CHCs). e. Establish Agricultural Engineering Directorate at state levels for better proliferation of farm mechanization. 	Department of Agriculture, Department of Horticulture, KVKs, NABARD, NGOs and SAUs should conduct exposure programmes on on-farm economical mechanization.	<p>Reduction in cost of cultivation.</p> <p>Improvement in resource use efficiency.</p> <p>Increase in median farmers' income by 5-10 %</p>
3.	Proliferating market led extension & e-extension opportunities	Market led extension is a low key affair in the state. Utilization of available e-extension services is very poor.	Promote use of market price information and market intelligence services. Assure affordable high speed internet connectivity in villages.	<ul style="list-style-type: none"> a. Promote use of market intelligence and market information services in extension trainings and programmes. b. Improve awareness and use of e-extension programmes like i-khedut, e-krisi kiran and other mobile applications via e-extension programmes. 	Department of Agriculture; Department of Horticulture; KVKs; ATMA and SAUs need to improve farmers' awareness on market intelligence.	Increase in median farmers' income by 2-5 %

Sl. No	Issue	Status	Policy & Institutional Requirements	Role of Government	Agency/ Organization Stakeholders' Responsibilities	Expected Outcome
(1)	(2)	(3)	(3)	(4)	(5)	(6)
4.	Managing yield gap and reducing costs	Yield rates of all major crops in Gujarat are only 50 per cent to 75 per cent of their potential yields.	<p>a. Strengthening the distribution of quality inputs.</p> <p>b. Improvising farm mechanization.</p> <p>c. Increasing the production and utilization of bio-agents.</p>	<p>a. Follow-ups of krishi mahotsavs by line departments to improve adoption of technologies.</p> <p>b. Increasing budget on 'Farmers Inter-State Exposure Visits and Training Scheme' .</p> <p>c. Improving farm mechanization by innovating small implements and proliferating custom hiring centres (CHCs) .</p> <p>d. Encouraging use of green manures, biofertilizers and biopesticides among farmers through awareness programmes.</p>	<p>Department of Agriculture, Department of Horticulture, SAUs and ICAR centres need to conduct training programmes.</p> <p>Short duration research on yield gap management and cost-reduction may be taken by SAUs and ICAR centres</p>	<p>Reduction in per unit output cost.</p> <p>Increase in median farmers' income by 5-10 %</p>
5.	Alleviating farm financial distress	<p>Financial distress alone accounted for 38.7 per cent of farmer suicides in India.</p> <p>Presently, only 15 % of the loan is disbursed as investment credit.</p>	<p>Provisioning farm credit avenues on marketing, storage and consumption.</p> <p>All financial benefits, mainly the subsidies in different forms, should be provided and transferred directly to farmers account through e-governance.</p>	<p>a. In line with self-liquidating production loans, short duration marketing loans may also be considered.</p> <p>b. Increase the proportion of investment credit.</p> <p>c. Operationalize credit linked warehousing facilities at APMC level.</p> <p>d. Promote pledge financing through a network of rural godowns and negotiable warehousing receipt system to reduce distress sale</p>	<p>NABARD and other banking and non-banking financial institutions, Central and State Warehousing Corporations need to support farming through affordable financial loans and incentives.</p>	<p>Increase in median farmers' income upto 10 %</p>

Sl. No	Issue	Status	Policy & Institutional Requirements	Role of Government	Agency/ Organization Stakeholders' Responsibilities	Expected Outcome
(1)	(2)	(3)	(4)	(5)	(6)	
6.	Doubling the current level of exports	Share of India in world exports is very low and hardly 1.5 % on an average during the last decades. Farm level awareness on SPS measures is still very poor.	Double the current level of 1.70 lakh crores worth of agri. exports within 5 years. Boost to RTAs(Regional Tariff Agreements) to address the issue of Non Technical Barriers such as TBT and SPS Measures and to attract investment	d. Promote Crop Stewardship Programs, Good Agricultural Practices (GAP) and Certification procedures. e. Promote Global Commodity Boards like California Walnuts, Washington Apples for our own farm produce like Talala Kesar Kheri or Kutchi Dates. f. Promote quality consciousness and health safety issues among farmers for both domestic and international trade.	APEDA, MPEDA, other Export Promotion Organizations and SAUs need to conduct training programmes on SPS standards and certification procedures.	Increase in median farmers' income by 2-5%
7.	Encouraging agro-forestry	Potential of agro-forestry lies untapped in the state	Barren lands and field bunds can be utilized such as: 1. Boundary plantation 2. Silvi- pastoral system 3. Agri-Horti system 4. Horti-Pastoral system 5. Horti-silvi system 6. Industrial agroforestry system.	a. Tree species with 8-10 years rotation age such as Ailanthus (match stick tree), araduso (Melia dubia) can be taken up in marginal lands and affected soils. b. Encourage tissue culture labs to produce clones which may further reduce the rotation age upto four years.	Forest Department, local government agencies, NGOs and SAUs need to promote agro-forestry in the state through appropriate awareness and training programmes.	Increase in median farmers' incomes by 2-5%

Sl. No	Issue	Status	Policy & Institutional Requirements	Role of Government	Agency/ Organization Stakeholders' Responsibilities	Expected Outcome
(1)	(2)	(3)	(4)	(5)	(6)	
8.	Harnessing solar potential	Solar infrastructure is not affordable by majority of the farmers even after the prevailing subsidy.	Making solar infrastructure affordable. Ensuring incomes by assured power purchase agreements	<p>a. Conduct training programmes for improving awareness on on-farm solar infrastructure.</p> <p>b. Mandating Power Purchase Agreements (PPAs) for 25 years with feed-in tariffs of Rs 8-9 / unit.</p> <p>c. Devise strategies in as such a way that solar infrastructure need to benefit small and marginal farmers as well.</p>	GEDA, NGOs, NABARD and SAUs need to research on affordable solar infrastructure.	<p>Solarising the groundwater economy will mitigate climate change implications.</p> <p>Increase in median farmers' income by 2-5%</p>
9.	Promoting Agro-tourism Rural/ Agricultural Environment+ Farm Commodities + Tourism Services = Agro tourism	<p>As of 2014-15, the potential of Indian agri-tourism industry is Rs 4,300 crore, while the global agri-tourism market is \$10 billion USD.</p> <p>Though prospects are immense, agro-tourism in Gujarat is still at nascent stage.</p>	<p>Promote active participation of all stakeholders in the agro-tourism sector.</p> <p>Corporate sector need to join hands with the line departments for commercial development of agro-tourism.</p>	<p>a. Promote active participation of all stakeholders including experts, local communities, hoteliers, tour operators and government agencies.</p> <p>b. Organize agro-eco-tourism in a more integrated way by using the local resources and local folklore in the farms to attract the tourists.</p> <p>c. Establish Agro Rural Tourism (ART) centers to protect ecology by avoiding plastics, promoting greenery, supporting biodiversity and conserving water bodies to benefit agro-tourism sector.</p>	Gujarat Tourism; Department of Agriculture; Department of Horticulture; Forest Department, SAUs and NGOs need to facilitate agro-tourism in the state with intense research and training programmes.	<p>Farmers tend to have offseason earnings.</p> <p>Increase in median farmers' incomes by 2%</p>

Sl. No	Issue	Status	Policy & Institutional Requirements	Role of Government	Agency/ Organization/ Stakeholders' Responsibilities	Expected Outcome
(1)	(2)	(3)	(4)	(5)	(6)	
				<p>d. Establish Agro-Technology Parks (e.g. Mango orchard based bee keeping farms or greenhouse based floriculture or olericulture) for quality production on commercial scale which may also serve as agro-tourism destinations.</p> <p>e. Develop hortiSilvi-pastoral or agri-horti-silvi culture system to boost agro-eco tourism.</p>		
10.	Promoting rural non-farm employment sector	<p>Creation of non-farm employment opportunities within the rural areas seems to be somewhat dormant as of now.</p> <p>Only 5 % of labour force in the 20-24 age category have vocational skills compared with as much as 96% for South Korea.</p>	Provide appropriate assistance to small scale sector in rural areas in terms of information base, availability of technology, technology transfer, improved credit availability and infra-structural and marketing support.	<p>a. Prioritize skill training programmes to sufficiently reflect the market demand by roping in industries as one of the collaborators.</p> <p>b. Simplify licensing procedures, laws and regulations for developing small scale enterprises in rural areas.</p> <p>c. Ensure rural works programmes achieving the twin objectives of creation of rural infrastructure and additional incomes.</p> <p>d. More than subsidies and welfare schemes, ensure entitlements (raw materials, credit and markets) of rural enterprises as an industry.</p>	Government of Gujarat, Central Government, NABARD, Banking and other financial institutions need to prioritize policy measures for uplifting rural non-farm employment sector.	<p>The assets created (e.g. roads, culverts) by rural programmes can boost the marketing of rural products, thus indirectly helping the non-farm production and incomes.</p> <p>Increase in median farmers' incomes by 10-15%</p>

Sl. No	Issue	Status	Policy & Institutional Requirements	Role of Government	Agency/ Organization/ Stakeholders' Responsibilities	Expected Outcome
(1)	(2)	(3)	(3)	(4)	(5)	(6)
11.	Leveraging Pradhan Mantri Fasal Bima Yojana (PMFBY)	<p>Crop and livestock insurance in Gujarat has not attracted farmers sufficiently.</p> <p>Awareness among farmers about the benefits of PMFBY is being promoted by the State government machinery.</p> <p>The modalities of Crop Cutting Experiments (CCEs) are cumbersome.</p> <p>The man-power involved in conducting CCEs is also grossly insufficient.</p>	<p>a. Prioritize crop and livestock insurance an integral part of farming among all sections of farming community.</p> <p>b. Strong need of awareness creation about insurance products.</p> <p>c. Encourage PPP mode in agricultural insurance and provide private insurers the same level of subsidy on par with government agencies.</p> <p>d. Promote group insurance for small and marginal farmers under FPOs.</p>	<p>a. May be made compulsory for all farmers so that a non-loanee farmer is not pushed to extremes in case of crop-loss.</p> <p>b. Ensure one hundred per cent subsidy on premium at least for a few years in case of small and marginal farmers.</p> <p>c. Promote PMFBY similar to general insurance with the help of commission agents.</p> <p>d. Design crop insurance products with a village as a unit representing similar crops or cropping patterns.</p> <p>e. To increase competition, instead of selecting one agri-insurance player through bid system for a district, all the districts should be made open to all the players.</p> <p>f. A separate Agriculture Insurance Regulatory Authority needs to be established.</p> <p>g. A Toll Free Agri Insurance number should be launched.</p>	<p>Department of Agriculture, Department of Horticulture, SAUs need to conduct training programmes and workshops on PMFBY.</p> <p>GoG and Central Government need to ensure effective steps for expanding the scope of PMFBY among all the sections of farming communities.</p>	<p>Reduction in farm distress.</p> <p>Farmers belief in institutions will considerably improve.</p> <p>Will pay way for financial inclusion.</p> <p>Increase in median farmers' incomes by 5-8%, given that farmers tend to take up risks and adopt good cultivation practices once they are assured of compensation.</p>

Success story 25. Development of Low Cost Farm Implements



Name : Umeshbhai Bhikhabhai Domadiya
Village : Vadal
Block : Junagadh
District : Junagadh
Age : 35 Years
Education : Technical ITI
Land Holding : 24 Acre
Contact : 99090 60222

- Doing farming in 24 acres of land. He is also making farm implements for the last 15 years. Till date he has developed about more than 30 different implements like, Mini Tractor, Inter culturing Tools, Mini Trailer, Trolley, Automatic Seed Drill, Bed Leveling Tool, Onion Re-planter, Rotavator substituting tool, Implements with seed rate maintaining meter etc.
- Transplanting tools of onion crop, powered by tractor and farm yard manure drill are the main implements which are frequently used among the farmers. He uses such implements in agricultural operation and also make changes if necessary. He also repairs all farm implements himself.
- The Transplanting of onion with transplanting implement can be carried out very efficiently with lower cost. By traditional method of Transplanting, 1.2 acre area can be covered, while using this Transplanting equipment 3.2 acre area can be covered per day.
- By using this Farm Yard Manure Drill, 20 tones per day manure can be drilled, whereas using tractor, 3 tones per day manure only can be drilled.
- Developed Modern Farm Implements and by adopting farm mechanization in farming received wide response from farmers.
- Honored by “**Sardar Patel Award**” by State Government and “**Progressive Farmer Award**” by Mahindra Tractors Limited.

Saving of farming expenditure using onion transplanter

(Rs. in lakh)

Year	Area (Ha.)	Total saving in labour expenditure for onion transplanting by onion transplanter
2010	18	2.95
2011	44	7.34

Saving of farming expenditure with automatic compost applicator

(Rs. in lakh)

Year	Area (Ha.)	saving in total labour expenditure
2012	32	0.16
2013	80	0.40



9. Implementation Plan and Institutional Responsibilities

1. Increasing the productivity of crop and animal sectors

a) Field crops:

Sl. No	Issue (1)	Agency / Organization/ Stakeholders' Responsibilities (5)	Expected Outcome (6)
1.	Low Seed Replacement Ratio (SRR)	SAUs, ICAR centers, Department of Agriculture, Seed Certification agencies, and NGOs need to undertake large scale seed production and distribution programmes.	Increase in productivity by 20 % Increase in median farm income by 5-10 %
2.	Low rate of replacement of varieties & cultivation of unsuitable crops and varieties.	a. Line Departments, KVKs and Extension departments of Agricultural Universities and NGOs should impart training. b. Universities and ICAR centres need to take up short term research work for addressing the problems. c. Breeder seed should be provided by the crop breeder concerned.	Increase in productivity by 5-10% Increase in median farm income by 5-10 %
3.	Low awareness on scientific Seed treatment techniques	Line Departments, KVKs and Extension departments of Agricultural Universities should impart training on seed treatment.	Increase in productivity by 5-10 % Increase in median farm income by 5-10 %
4.	Less exposure of farmers to non-monetary inputs	Line Departments, KVKs and Extension departments of Agricultural Universities need to impart rigorous training.	Increase in productivity by 10-15 % Increase in median farm income by 8-10 %
5.	Maintain optimum plant population	Line Departments, KVKs and Extension departments of Agricultural Universities will impart training and ensure the availability of good quality seeds/planting materials.	Increase in productivity by 5-10 % Increase in median farm income by 5-10 %

Sl. No	Issue	Agency / Organization/ Stakeholders' Responsibilities	Expected Outcome
	(1)	(5)	(6)
6.	Expedite Integrated Nutrient Management	Line Departments, KVKs and Extension departments of Agricultural Universities should impart training. SAUs and ICAR centres should take up the research programs.	Reduction in cost of cultivation by 5 to 8 % Increase in productivity by 10-15 % Increase in median farm income by 8-10 %
7.	Promoting Precision Agriculture	SAUs, line departments and KVKs should impart training to identified farmers and extension workers. SAUs and ICAR centres should take up short duration research programs.	Increase in productivity by 5-10 % Increase in median farm income by 5-10 %
8.	Prioritizing Micro-Irrigation Structures (MIS)	a. State Department on irrigation and water use should plan and design efficient water harvesting systems b. SAUs, Line Departments, KVKs and ICAR centres need to impart training on crop-specific WUE and FUE measures.	Increase in productivity by 15-20 % Increase in median farm income by 10-12 %
9.	Integrated Weed Management	Line Departments, KVKs and Extension departments of Agricultural Universities should impart training.	Increase in productivity by 10 % Increase in median farm income by 7-10 %
10.	Prioritize Integrated Pest /Disease Management	a. State regulatory authorities need to seize spurious products from market. b. KVKs, SAUS, and Line Departments should impart training. c. SAUs / ICAR centres need to training to input dealers and progressive farmers alike.	Increase in productivity by 12-15 % Increase in median farm income by 10-12 %

b) Horticultural crops:

Sl. No	Issue	Agency / Organization/ Stakeholder' Responsibilities	Expected Outcome
(1)	(1)	(5)	(6)
11.	Lack of availability of quality planting material	State Department of Horticulture, NHM, NHB and SAUs need to work in tandem for establishing nurseries and conduct crop-specific training programmes.	Increase in productivity & reduction in cost of cultivation by 12-15 % Increase in median farm income by 10 %
12.	Diversifying area toward high value horticultural crops	State Department of Horticulture, NHM, NHB and SAUs, ICAR centres need to create awareness on horticultural crops through demonstration and training. Promoting research on site-specific crop diversification studies.	Increase in production of horti. crops by 5-10% Increase in median farm income by 5 %
13.	Increase productivity of horti. crops through high-tech technology	State Department of Horticulture, SAUs, and KVK need to organize crop-specific effective training programmes.	Increase in productivity by 10-15% Increase in median farm income by 10 %

c) Livestock sector:

Sl. No	Issue	Agency / Organization/ Stakeholder' Responsibilities	Expected Outcome
(1)	(1)	(5)	(6)
14.	Improving availability of feed and fodders	Department of Animal Husbandry, Department of Agriculture and Dairy Cooperatives. RFOs, GCMMF and NDDDB, SAUs and Kamdhenu University should conduct training programmes.	Increase in milk production by 20-25% Increase in median farmers' income by 5 %
15.	Promote Breeding of livestock animals	SAUs and Kamdhenu University should undertake breeding and upgradation of dairy animals. SAUs, Dept. of Animal Husbandry, Gandhinagar, Milk Unions and Kamdhenu University should conduct training programmes and ensure semen supply and its	Increase in milk production by 30-35 % Increase in median farmers' income by 5 %
16.	Formulate housing Management for livestock sector	SAUs, Dept. of Animal Husbandry, Gandhinagar, Milk Unions and Kamdhenu University should conduct site-specific training programmes.	Increase in milk production by 5-10 % Increase in median farmers' income by 2 %
17.	Formulate Health management of livestock animals	SAUs, Dept. of Animal Husbandry and Kamdhenu University need to conduct training programmes on the aspects of health management. Dept. of Animal Husbandry should carry out diagnostic facilities on regular basis.	Increase in milk production by 20-25 % Increase in median farmers' income by 2.5 %

d) Fisheries sector:

Sl. No	Issue	Agency / Organization/ Stakeholder' Responsibilities	Expected Outcome
(1)	(1)	(5)	(6)
18.	Fresh water fish production:	Fisheries Department, CIFRI, CIFA, CIFE, KVK, SAUs and Kamdhenu University need to conduct location specific research and transfer of technology. The stakeholders need to conduct training programmes on combating climate variability issues.	May result in increased per ha fish production, social upliftment and employment generation. Increase in median farmers' income by 2.5 % in the state.
19.	Brackish water fish production:	Fisheries Department, CIBA, CAA, MPEA, GPCB, KVKs, SAUs and Kamdhenu University need to promote location specific research and transfer of technology.	Increase in median farmers' income by 2%
20.	Marine-water Capture fisheries	Fisheries Department / CMFRI/ CIFNET/ INCOIS/ CIFE/ MPEADA/ FSI/ GOG/ GOI need to promote training programmes.	Increased catch per unit effort efficiency and export earnings. Increase in median farmers' income by 2%

e) Poultry sector

21	Develop efforts for Breeding in poultry sector	SAUs, ICAR centres and Kamdhenu University need to prioritize breeding efforts in poultry sector.	Increase in poultry production by 30-35 % Increase in median farmers' income by 5 %
22	Prioritize feed & nutrition	SAUs, Kamdhenu University, ICAR centres, Dept. of	Increase in poultry production by
23	Formulate health management in poultry sector	State Animal Husbandry Department, GOG need to promote diagnosis and control measures.	Increase in median farmers' income by 1%

2. Leveraging marketing avenues in crop and animal sector:

Sl. No	Issue	Agency / Organization/ Stakeholder' Responsibilities	Expected Outcome
	(1)	(5)	(6)
1.	Leapfrogging Electronic-National Agricultural Market (E-NAM)	Department of Agriculture, APMCs and SAUs should conduct training programmes and workshops for facilitating farmers on E-NAM usage and benefits.	The distance to the market yards will no longer be a issue to the farmers. Increase in median farmers' income by 5%.
2.	Operationalize Minimum Support Price (MSP) mechanism	Government of Gujarat and Central Government need to take steps for operationalizing MSP	Increase in median farmers' income by not less than 20%.
3.	Involve cooperatives in marketing of horti. produce	State Department of Horticulture and APEDA need to provide policy support.	Increase in median farmers' income by 5%
4.	Leveraging Farmers Producers Organization(FPOs)	Department of Agriculture, Department of Horticulture and SAUs need to facilitate FPOs with periodic trainings and workshops. NABARD, banking and non-banking financial institutions, Government of Gujarat and Central Government should incentivize FPOs.	Small and marginal farmers may effectively function as a group. Reduction in cost of cultivation. Farmers may achieve better prices through bargains. Increase in median farmers' income by 10%
5.	Leverage market intelligence for all major agricultural crops	SAUs, ICAR centres, Department of Agriculture & Cooperation, GoG and APMCs need to build awareness on market intelligence and its delivery mechanism.	Both producer's & consumer's surpluses will increase. Increase in median farmers' income by 10%
6.	Promote contract farming and direct marketing, wherever feasible	SAUs, ICAR centres, Department of Agriculture & Cooperation, GoG and APMCs need to train farmers on contract farming and direct marketing	Assured income even at the times of market glut. Increase in median farmers' income by 5%

Sl. No	Issue	Agency/ Organization Stakeholder's Responsibilities	Expected Outcome
	(1)	(5)	(6)
7.	Innovate livestock marketing	SAUs, Kamdhenu University, Department of Animal Husbandry and Milk Unions need to conduct exposure programmes	5 % increase in milk production Increase in median farmers' income by 2%
8.	Accelerate marketing for poultry products	Animal Husbandry Department, Health and Family Welfare Department, SAUs should undertake research and training.	Promotion of indigenous breeds. Increase in median farmers' income by 2%

3. Leapfrogging Post-harvest and Value-Addition Prospects:

1.	Improving farm pre- and post-harvest management techniques in crop sector	Department of Horticulture, Dept. of Agriculture, State Agril. Marketing Board, NHM, MOFPI, GAIC and SAUS should conduct training on pre- and post-harvesting.	<ul style="list-style-type: none"> • Reduction in crop loss. • Increase in median farmers' income by 10 %
2.	Improve recycling of crop residue at farm-level	Department of Agriculture, Department of Horticulture, SAUs and ICAR centres need to conduct waste recycling training.	<ul style="list-style-type: none"> • Increase in productivity. • Reduction in cost of cultivation. • Increase in income by 10 %
3.	Improve milk quality & introduce value addition in livestock sector	Department of Agriculture; NABARD and SAUs and Kamdhenu University need to conduct awareness programmes.	Production of hygienic premium quality milk at farm-level.
4.	Promote post-harvest technologies in fisheries sector	EIA, MPEDA, CIFT, Fisheries Department, SAUs and Kamdhenu University need to take up promotional programmes in post-harvest technologies.	Increase in value added exports and foreign exchange earnings. Increase in median farmers' income by 5%

4. Promoting on-farm ancillary activities:

Sl. No	Issue	Agency/ Organization/ Stakeholders' Responsibilities	Expected Outcome
	(1)	(5)	(6)
1.	Promoting on-farm honey production (Apiculture)	Department of Agriculture, Department of Horticulture, KVKs, Forest Department, NGOs and SAUs need to promote apiary through training programmes and research.	Additional income to farmers by increase in crop yields and quality. Increase in median farmers' income by 1%
2.	Incentivizing mushroom cultivation	Department of Agriculture, Dept. of Horticulture, KVKs, NABARD, APEDA, NGOs; and SAUs need to conduct training programmes on production and marketing of mushroom products.	Crop by-products / wastes can be effectively utilized. Increase in median farmers' income by 1%

5. Invigorating organic farming:

Sl. No	Issue	Agency/ Organization/ Stakeholders' Responsibilities	Expected Outcome
	(1)	(5)	(6)
1.	Increasing area under organic farming	Department of Agriculture, Department of Horticulture, NHM, NHB, PSUs, SAUs and ICAR centres need to conduct programmes for promoting organic cultivation in the state.	Initially 10-15% decrease in farm yields but higher price premium for farm outputs by 10-15 % Reduction in cost of production. Improvements in soil health (physical and biological properties) and reduce chemical load in the soil.. Increase in median farmers' income by 5-10%

10. Summary & Recommendations

Crop output in Gujarat after 2000-01 has shown a trend break; performance, however, has varied. Foodgrains area has plateaued but its output in terms of value has increased considerably on account of spurt in growth of wheat. Rice production has also consolidated, both in terms of physical output and gross value. Amongst non-foodgrains, noteworthy contributions to gross value and output have been made by cotton, spices and fruits & vegetables. Technological advancements in terms of adoption of higher-yielding varieties of food crops and Bt cotton have caused high yield enhancement. Moreover, during this period contribution of yield to total output has been quite remarkable. Yet, factors responsible for fluctuations in output of these crops need a careful attention.

Technological advancement needs to encompass a wider range of crops as it is crucial for output growth. Growth of real income in the agricultural sector appears to have caused buoyancy in the farm sector and prosperity amongst rural households is providing wider markets for industry and service sectors, leading to high overall income acceleration. The production technology seems to be the major key to improve the prospects of agriculture in the state. Research should be encouraged for evolving suitable production technologies to push up the prevailing technological frontiers. Investments in this direction may be envisaged, particularly for the rainfed regions with scarce water resources, and for regions where there is possibility of water harvesting. Also, the problem of agricultural development in Gujarat has to be considered in the wider perspective of integrated rural development. Agricultural development has to be integrated with the overall economic growth and generation of livelihood opportunities in the rural sector. Diversified and high value agriculture is the pre-requisite for high growth of non-farm sector as it opens possibilities for value addition and strengthens backward and forward linkages with non-agricultural sectors, leading to livelihood opportunities for the indigent.

Specific recommendations for doubling farmers' income in Gujarat state:

Agriculture sector

- District and Taluka wise crop planning & cluster approach should be practiced to enhance yields.
- The technologies available today in Gujarat can increase yield levels up to 75%, improve farm profitability up to 100%, besides reducing per unit production cost. **Strategy:** Follow-ups of *krushi mahotsava* by the line departments in a phased manner need to be carried out to improve the adoption of technologies / GAPs.
- Though Soil Health Cards (SHCs) can bring down cultivation costs by 10-25%, it is still found to be supply driven as farmers fail to realize nutrient management. **Strategy:** Demonstrate & train the usefulness of the recommendations of SHCs by applying recommended doses of fertilizer on experimental plots at every GP.
- Focus on production of pulses by utilization of rice fallows and intercropping with coarse cereals, oilseeds and commercial crops (sugarcane, cotton).
- Incentivizing the use of improved varieties such as: GAR 13, GAR-1,2,3, GNR-3 and 4 and Mahisagar in rice; Vaishali, GT-103 and GJP- 1 in tur; Meha, Gujarat 4, GM-5, GNM – 6 in moong; Guj 2, Guj Gram 3, Guj Gram 3, Guj Gram 5 in gram; and GW 366, GW 11, GJW 463, GW 451, GAD- 3 (rainfed) in wheat.
- Low SRR in wheat, desi cotton, pulses, groundnut and soybean. Quality seed production need to be scaled up on war footing which will improve productivity by 20-30%.
- Tribal areas have relative advantage in organic farming due to: i) low level of input use, ii) shorter conversion period and iii) smaller yield reductions. These areas should be identified as organic zones and training support need to be provided

- *In situ* moisture conservation practices (ISMCP) to reduce irrigation cost by 50% and improve yield levels and popularizing of ride and furrow makers improves the adoption of ISMCP by 75%, thereby their access have to be ensured by CHCs & localized subsidies.
- Promoting INM modules with biofertilizers: E.g. *Rhizobia* for legumes and *Azotobacter* and *Azospirillum* for non-legumes and PSB / ZSB / KSB can reduce cost up to Rs. 5400 / ha.
- Special Agricultural Zones (SAZs) need to be established in the peri-urban and semi-urban areas for fruits, vegetables, milk and egg production focusing on exports and urban areas.

Horticulture sector

- Reclaiming 5 lakh ha of barren lands within the next two years by encouraging contract farming for horticultural crops (which will improve income levels up to 25% to 40%) and buyback arrangement by the institutional agencies can attract and retain next generation farmers.
- Area expansion in date palm, pomegranate, papaya and coconut (hybrid) is possible. But the constraint lies in the growing incidences of drying roots and wilting shoots. The effective strategy could be tissue culture units for date palm and pomegranate plantlets and by establishing plug nurseries for F & Vs & flowers.
- South Gujarat has high rainfall & humidity which can be exploited by promoting the cultivation of black pepper, turmeric, ginger, cashewnut and banana.

Livestock sector

- By Fertility Improvement Programme (FIP) conducted between 2011-12 and 2015-16: 6.95 lakh animals have become fertile. If the average milk yield is 5 Lit./animal/day then total milk production is 34.74 LLPD & additional income is Rs.14 crore /day @Milk price of Rs. 40 / litre. Thereby, there is an urgent need that FIP programme be implemented across Gujarat through aggressive campaign to reduce NPA besides improving milk availability.
- Encourage artificial insemination with proven bulls.
- Establish indigenous milk co-operatives for production and marketing of *desi* (A2 milk).
- Improve fodder production by utilizing proven fodder varieties. E.g. CO (GG)-3 dry matter yield of 553.7q/ha/year which was up to 85% higher. Fodder banks need to be encouraged at village level.

Fisheries sector

- **Marine water fish production:** Promote cage, pen, seaweed, oyster, and mussel farming policies in marine waters (Except North and Middle Gujarat agro-climatic zones).
- **Fresh water fish production:** Promote cage & pen farming policies in reservoirs and lakes.
- **Improve fish processing and export infrastructure**

Processing and Value Addition sector

- Cluster based emphasis on HPS groundnut for exports & table purpose in Junagadh, Kutch, Jamnagar, Porbandar and Bhavnagar will enhance farmers' income up to 25% in 3 years.
- Mechanization in production and post-production will reduce per unit cost of production up to 50%.
- Roughly, 30% of fruits and vegetable are lost in Gujarat accounting for Rs. 9,000 crores in the state. Processing at least 10% at farm gate level will increase farmers' income by 15 to 20%.
- Cluster based Agro Processing Centre for all crops: Primary processing, grading and milling of produce may increase the market rate by about 10 to 30%.

- Not less than 81% cold storages suitable only for Potato. There is a need to upgrade the facilities for multi commodities.
- High potential for improving fish processing facilities, especially in Saurashtra zone.

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