Aatmanirbhar Farmers of Gujarat: Roadmap 2030

A transformative roadmap for developing an Aatmanirbhar Agriculture Sector of Gujarat by the year 2030

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Sr No	**Name of Department/Organisation**
1	Directorate of Agriculture
2	Directorate of Horticulture
3	Directorate of Animal Husbandry
4	Sardar Sarovar Project Command Area
5	Anand Agricultural University
6	Sardarkrushinagar Dantiwada Agricultural University
7	Junagadh Agricultural University
8	Gujarat Agricultural Organic University
9	Navsari Agricultural University
10	Kamdhenu University
11	Gujarat Organic Products Certification Agency (GOPCA)
12	Gujarat Green Revolution Company Ltd (GGRC)
13	Gujarat State Seed Certification Agency (GSSCA)
14	Gujarat State Seeds Corporation Ltd (GSSCL)
15	Gujarat Agricultural Produce Market Committees (APMCs)
16	NABARD
17	ATMA Directorate and SAMETI

I. Introduction

Atmanirbhar Krishi – Role of Stakeholders -
Road Map 2020-30 –Gujarat
Dr.Kirit N. Shelat

Indian Agriculture has had sustainable growth over the last seven decades. India had subsistence farming, would import food grains and had 'Ration Shops' for food distribution. The Green Revolution in the seventies changed all these. Country started getting steady growth of 2% to 4% per annum. It took up a massive water harvesting programme and diversified its agriculture including animal husbandry and fisheries.

Although India managed and almost came out from famine / drought every third year and started exporting – the arena of climate change has its own impacts. Covid-19 has further aggravated the uncertainties.

Prime Minister Shri Narendra Modi – took a series of measures to restructure the agriculture sector – particularly the marketing impediments. Huge resources have been allotted for infrastructure development with cheap credit facilities. Fisheries and Animal Husbandry have been given added support. Farmers now have financial support, extended markets and infrastructure facilities. The challenge lies with the State Govts and District Development Administration to support the farmer to become '*Atma Nirbhar*'. Involving all stakeholders. But first let us understand the current situation to develop a road-map for 2020-30.

The Indian farmers and farm income have often been under stress. The Indian farmers are resilient, willing to adapt, and face adversities. They have come out from

adversities of drought and famine of early years of development and face challenges and overcome them.

The food and agriculture face uncertainties that raise serious questions and concerns about its performance and sustainability. Uncertainties revolve around different factors, including population growth, dietary choices, technological progress, income distribution, the state of natural resources, climate change, the sustainability of peace, etc. Nobody knows with precision how these factors will evolve over time. However, they are sure to shape the future. Consequently, different nations, international organizations, civil societies, intellectuals, researchers are increasingly trying to find out alternative options and new pathways for food and agricultural systems.

Changing Cause

Population and income growth determine the demand for food and the changes in people's dietary preferences. Persistent poverty, inequality and unemployment constrain access to food and hamper the achievement of food security and nutrition goals. Agricultural production is limited by the increasing scarcity and diminishing quality of land and water resources, as well as by insufficient investment in sustainable agriculture. Climate change and Covid-19 are increasingly affecting rural livelihoods and further decrease in the working population on farms affecting productivity.

Changing course is critical - a more sustainable future both for short-term and long-term is attainable but getting there will not be easy. This will need to be more integrated – well planned out "micro level plans" and "business as usual" attitude will have to be changed. The rural families and communities will be required to refine the assets used for farm production and services, including livestock assets, accept new solutions and practices and implement innovative technologies and safety practices. Further we must commit to responsibility-sharing and accountability in implementing fundamental changes and schemes.

The transformative process requires bridging the gap between “average” and “progressive farmers”, villages, blocks, districts and states. The entire public administration will have to be involved in this process of “fundamental changes”.

New policies and programmes will have to be implemented with precision and old policies re-visited.

Gujarat Needs a New ROADMAP for Agriculture:

- Agriculture provides more than food – it provides essential commodities, environmental support and socio-economic support for its overall economic growth, industrialization, and diversification. It provides demand for non-farm goods and services and fulfils basic needs of every family.

- With rapid urbanization and infrastructure development – we need to produce “More” with “Less” land and scarce water resources. We need to feed the hungry millions and meet the challenge of malnutrition.

- We need to bridge the gap of income and its growth between its rural and urban population and within the rural sector – the gap of income between progressive farmer and average farmer – in the same village with similar land and water resources. That is why doubling the income of farmers is the future of rural areas and for that matter future agriculture.

- We need to fully utilize irrigation potential created by big dams like the Sardar Sarovar & Ukiah project to ensure that farmers of the command area take three crops. Together they cover more than fifty percent of farmlands.

- We need to ensure that the “Solar Scheme” reaches out to farmers who can use it for farm operations and sell surplus energy to Electricity Companies and earn income round the year.

Goals

The New Vision for Agriculture is to harness the power of agriculture to drive food security, environmental sustainability and economic opportunity. Its aspirations are high, not least of which are to increase production by 20% per annum while decreasing greenhouse emissions by 20% and reducing the prevalence of rural poverty by end of 2030 as for long term perspective – but immediately we need to revive the activities on-farm and off-farm in rural areas.

This is intended to build a powerful India. The *Atmanirbhar* India as Hon’ble Prime Minister calls it. In fact, food and food products will be in demand across the world and countries which can provide them will dominate the world. Food will be a more powerful weapon than atom bombs. India with the second largest arable land with adaptive and resilient farmers supported by progressive government and public governance system can provide world food and food products.

Indian Society is mostly dependent on agriculture. It is the foundation of the food chain and provides 60% of the jobs. From its inception, the purpose of agriculture has been to feed and fuel human activities. Driven by innovation and investment, agricultural productivity has increased substantially. Almost all our people have enough to eat today, up from old ration days and farmers in some parts have doubled or tripled their income. This unprecedented growth supported by development administration is now entering a new era marked by scarce resources, greater demand and potentially higher price and supply volatility – we have to learn to produce more with less.

In recent times, salinity ingress, droughts, floods, poor agricultural practices by small holders – particularly growing sharecroppers have led to depletion of soil erosion, soil fertility, and scarce water availability with poor quality. Meanwhile, broader environmental changes are affecting agriculture in ways yet to be fully understood. Alterations in climate mean that farmers must adapt to changing rainfall patterns and fluctuations in temperature; yields could be reduced by more than 20% in many areas, struck by drought, floods and / or heavy rainfall. The poor farmers are facing particularly severe outcomes and like to leave farming. On the other hand, overall demand for food, dairy products, vegetables, fruits, spices, meat, poultry and fish is growing at a rapid rate. The demand for processed – ready-to-eat food is increasing and so-called junk food is growing at a much higher rate.

An anticipated 70% of India's population is expected to live in cities by 2050, the need for effective food distribution – linking growers to retailers to consumers – would intensify. Urban populations demand more processed and ready-to-eat food, as well as more diverse options. This would increase the role of processing, packaging and logistics providers in food systems.

The multiple stakeholders are Public Sector, Cooperatives, Private Sector, Cooperatives and Civil Society who have interaction with farmers for their own interest and that of farmers.

The scale of challenge that we have, requires that everyone in each group to step up their efforts and play a well-defined role – we need an immediate critical path and a long term well laid out perspective.

The Government being in a leading position must set the direction to the transformation and create an appropriate environment for it. In India we have multiple layers of

Governance – in a decentralized Public Governance System multiple actions are needed at all levels.

The Public Governance

The public governance system includes elected and non-elected (Permanent) members of Public Administration.

The Public Governance

Central	]
State	]
District	] Farmers
Taluka	]
Village	]

The Public Governance includes elected and non-elected members of Public Administration.

Multiple Actions

Re-visit Policy Restructure Organizations	]
New Agro-advisory	]
Health Advisory	]
Good Agricultural Practices	]
Agri.Infrastructure	] Farmer
Tools & Knowledge	]
Finance	]
Market	]
Consumer Orientation	]
Skilling, Reskilling and Up-skilling Farmers	]

The Government supports and facilitates the changes and implements supportive schemes; the cooperatives – including self-help groups organize farmers' joint economic activity to achieve higher earnings through better marketing and bargaining strength.

The Business group drives implementation through innovation, investment, competition and value addition.

The Civil Society mobilizes and organizes community support and individual initiatives. It helps to build local capacity – skill, re-skill and up-skill farmers, acting as a bridge between farmers and all other stakeholders.

The aspirations of Rural Society – particularly youth are growing and higher income has to be generated. Agriculture, therefore, needs value addition to generate more wealth by local level processing – rural and agro industries. Need of the hour is that they act together in an integrated manner with convergence of efforts and understanding that farmers need support to grow economically and socially. Not only that he has to be convinced about that need – he has to be prepared to face challenges that volatile adverse climate change brings about threat to his livelihood asset – land and livestock and that he has to change and update his conventional farming methods.

The key player – farmer – needs to develop the desire to grow, adapt to changes, accept new ideas and remain alert as farming is increasingly becoming risky – but timely action provides rich dividends and increased income. Among them – there are poor farmers who need individual attention.

The Current Income Loss to Farmers

- **Transit Loss**: Post-harvest to market as per one estimate – 25% to 40% of produce is lost from farm to market due to bad transport, packaging and storage.
- **Distress Sale**: Sale to local intermediary – farmers sell their produce at village level to get cash and lose 15% to 25% in price at which they sell – compared to MSP or APMC.
- **Spurious Inputs:** As per one study of the Department of Consumer Affairs – more than 50% of seeds, fertilizer mix, bio-pesticides etc. are fake or spurious and farmers loss in productivity.
- **Non-use of Drip Irrigation**: Drip / Micro Irrigation increases yield by 15% and also saves water that is available for one more crop.
- **Most serious Challenge is** adverse weather conditions. In the year 2018-19 droughts affected 100 talukas of Gujarat, 279 talukas of Maharashtra and 156 talukas of Karnataka. Farmers reduced their income by low productivity crop loss. The recent locust attack in parts of Gujarat and Rajasthan – is a new emerging serious threat.

- **Salinity Ingress**: Increased sea-water level on farmland in ocean areas – coastal areas are affecting root zones due to over-ground and underground ingress. Very serious underground ingress which is affecting even hinterland and well/tube-well water is becoming contaminated. When such water is used for irrigation, productivity is affected.

- **Decreasing Working Force onFarmland**: Males are increasingly moving for non-farm jobs and farming is done increasingly with women farmers – women farmers who are otherwise occupied in multiple household tasks – find it less time. Further agriculture tools are men centric.

- **Protect from Animal Menace**: Stray cattle, nilgai, monkey and pigs are invading the ready to harvest crops – resulting in huge loss. In some areas (Gujarat & Rajasthan) locust attack is destroying – playing havoc with crops.

- **Sharecroppers**: Due to rapid urbanization – developers are buying lands all around existing cities and potential areas – such lands are handed over to sharecroppers in which richer cultivators or owners are interested in investing in land. As per one estimate sharecroppers are now about 30-40% of landholders.

- **Irrigation:**Inefficient Management of Canal Irrigation system – which has potential but limitation of connectivity to farms and transmission losses (about 40 per cent).

- **Covid-19 Impacts:**Covid has no adverse impact on farmland. Farmer and his family – the way of lifestyle needs to change with a healthy safety net.

  - During lock down there were problems related to – delivery of certified seeds, fertilizers, pesticides and farm tools and sale of perishable – like vegetables, fruits, eggs etc. Again, APMCs were partially open but had limited traders – who did not accept all that was brought for sale.
  - MSP – This has not started – farmers have stored produce – like wheat, chana etc.

The list can go on and may vary from district to district or even village to village. But since opening of areas – the farming and farm operations have become normal with incredibly good rained Kharif sowing operations. The Govt. has provided free food and that has relieved farmers from stress.

There are opportunities to increase income but there are threats -challenges that can reduce income.We need to address all these.

The Stakeholders are already engaging in many interventions.
But we need further specific interventions in the value chain

Research & Development	• High yield, stress-tolerant input • Bottom of the pyramid designs • Local varieties/adaptations	• Proper incentives for R&D • High-caliber institutions • Grants for nutritious orphan crops
Input distribution and adoption	• Agri-dealer networks • Product bundling • Risk mitigation purchasing	• Farmer producers / organizations – FPC/ Cooperatives/ SHG • Model farms • Direct credit of subsidy • Action against Spurious Input Distributors
	• Contract/joint farms • Crop selection based on soil	• Train off-farm skills, diversification ⇩

Farming	health and water analysis • Water efficiency • Soil • Livestock management • Zero post harvest losses • Crop Insurance • Good Agricultural Practices	• Extension services, capability building • Monitor land use change • Husbandry animal safety & nutritious feed • Registering Sharecroppers for Subsidy and Insurance
Trading and processing	• Inform farmers about prevalent prices • Trading businesses • Local storage facilities • Local Processing • Prudent procurement at villages under MSP & by APMC or cooperative.	• Investments in "value-add" industries (e.g. oil refining) • Cooperatives • Grain exchanges • MSP and APMC – collection at village level
Manufacturing and retailing	• Fair trade pricing • Local distribution channels	• Access to export markets • Build Agri. Airports & ports – Civil storage facility. • Quality/safety standards

Climate Related Services	• Information exists but limitation of communication to farm level	• Improve communication • Comprehensive weather advisory followed by agro-advisory • Use of local TV network
The Public Governance	• Centre State District Taluka Village	• Clarify role • Timely action • Reporting • Monitoring • Accountability

GUJARAT OVERVIEW

Gujarat is one of India's leading states as far as development is concerned. Its growth rate has gone up from 9% in the '90s, to about 10-12% in the first five years of the new millennium.

Gujaratis have historically been entrepreneurs who have traveled all over the world, whether to the Middle East and Africa as they did earlier, or Europe, America, Australia, New Zealand, and Russia, as they do now to explore new avenues.

Gujarat is also considered a land of opportunities – anyone who has come to Gujarat and has set up an enterprise has largely been successful. Gujarat has major industrial houses as well as multinationals.

Gujarat's farmers are no different from anyone else in the state - progressive, ready to learn and adapt, they are also enterprising, alert, willing to try new crops, adopt latest technologies and take bold decisions.

Gujarat is considered a place where new initiatives are taken for rapid economic growth. After it became a State in 1960, development gathered momentum. In fact, it had all possible constraints against rapid development – large arid and semi arid areas with recurrent droughts, rain-fed agriculture, poor industrialization, large under-developed tribal areas and more than 60% of its rural population below poverty line.

In the sixties and seventies, the Green Revolution followed by the white revolution triggered growth. In fact, dairy cooperative societies at village level in the pattern of *Amul* provided a cash inflow in rural areas and generated the demand for non-farm products. The Government came out with an aggressive industrial promotion policy. These, I have discussed in greater detail in my earlier book, *Mapping Development*. Even as the eighties and nineties saw a rapid

economic development in the industrial and service sectors accelerating growth both in urban and rural areas, agriculture continued to lag behind. Its growth was tardy, erratic and slow. But this sector gained momentum with the turn of the century. Now, all sectors are driving the growth together. Some of the salient features of Gujarat's economy are described below.

All data mentioned and the next chapter are based on the Annual Socio-Economic Report of the Director of Economic & Statistics, Government of Gujarat.

Industrial Sector: As per Commissioner of Industries, Government of Gujarat Annual Survey of Industries – 2003-04, the value of output at current prices of all registered factories covered in the survey increased from Rs.1,82,700 crore in 2002-03 to Rs.2,07,316 crore in 2003-04, showing an increase of 13.47%. The net value added by manufacturing under the factory sector has increased from Rs.22,889 crore in 2002-03 to Rs.43,366 crore in 2003-04. It is worth mentioning that Gujarat ranks second next to Maharashtra in respect of state-wise percentage share in net value added by manufacture generated by the factory sector of the country.

Mining: The major produce includes agate, steatite and gypsum. marble, limestone, lignite, bauxite, laterite, dolomite, fire clay, bentonite, quartz, silica sand, chalk, etc. The production of petroleum oil (crude) and natural gas is one of the key factors for triggering a massive expansion of petrochemicals and chemical industries.

Banking: The number of scheduled commercial bank offices in the State is 3,689 as of December 2004. The aggregate deposits amounted to Rs.93,152 crore. The total bank credit advance was Rs.41,344 crore. The Credit Deposit Ratio (CDR) of the State was 44.38%.

Education: The estimated number of educational institutions for primary education in the State was 37,671 and 82.66 lakh pupils were enrolled. Number of secondary and higher secondary institutions was 7,718 and the number of students enrolled therein

was 24.64 lakh. With regard to technical education facilities the state has a total intake capacity of 13,011 and 2,205 seats in degree engineering and degree pharmacy courses, respectively. The capacities in MBA and MCA courses were 2,911 and 1,732 respectively.

Health: The health infrastructure has significantly improved the health of the people in the State. The birth rate has declined from 34.5 (1981) to 24.6 (2003). The death rate has decreased from 12 (1981) to 7.6 (2003), and the infant mortality rate has also come down from 116 (1981) to 57 (2003). The number of Community Health Centers, Primary Health Centers and Sub Centers functioning in the State has increased to 272, 1,070, and 7,274 respectively at the end of March 2005, from 17, 251, and 2,951 respectively in 1 981-82. With regard to medical institutions, the State has 53 district and taluka hospitals, four mental hospitals, two specialized hospitals, and 60 dispensaries with a total capacity of 6,648 beds.

Rural Development: Under 'Swarna Jayanti Gram Swarojgar Yojana', 27,457 *swarojgar* were covered. Under 'Sampoorna Grameen Rojgar Yojana', 269.27 lakh mandalays were generated, 22,415 new houses were constructed, and 11,239 houses were upgraded under 'Indira Awas Yojana'.

Location

Situated between 21.1° N and 24.70 N latitude and 68.40 E and 74.5° E longitude, the state has Pakistan to the northwest, Rajasthan to the north, Madhya Pradesh to the east, and Maharashtra to the south and south-east. The plains of Gujarat are watered by perennial rivers like Sabarmati, Mahi, Narmada and Tapti and by smaller rivers like Banas, Saraswati and Damanganga.

Area and Population

The State has 25 districts and 225 talukas, spread over an area of 1.96 lakh sq km, accounting for about 6% of the country's geographical area. According to the Population

Census 2001, the population of Gujarat was at 4.84 crore, accounting for 4.93% of the national population.

Density

The population density is 258 persons per sq km. The highest density of 718 persons per sq km is found in the district of Ahmedabad, while the least density of 35 persons per sq km is in the Kutch district.

Electricity

Total installed power generating capacity of Gujarat was 8,713 MW in 2003-04 provided by Gujarat Electricity Board – State Board (4,333 MW), private sector (2,816 MW) and central sector (1,562 MW).

Roads

The total length of roads in the State is 74,019 km. The length of national highways, State highways, major district roads (MDRs), other district roads (ODRs) and village roads (VRs) was 2,382 km, 19,163 km, 20,953 km, 10,422 km and 21,098 km respectively.

Railways

The total length of the railway lines is 5,310 km comprising 2,089 km of broad gauge 2,345 km of metre-gauge and 876 km of narrow-gauge lines.

Airports

The state has seven operational commercial airports at Ahmedabad, Bhavnagar, Vadodara, Jamnagar, Surat, Rajkot and Bhuj and an international airport at Ahmedabad.

Ports

Gujarat has 1,600 km of coastline. It has 11 intermediate, 29 minor and three major ports. The major port at Kandla, managed by Govt. of India, handles about 40 million tonnes of cargo. The other two ports are private – Mundra in Kutch and Pipavav in Amreli. The 40 minor and intermediate ports are located across South Gujarat (13) Saurashtra (23) and Kutch (4). There are two LNG ports, one at Hazira-Surat and the other at Dahej-Bharuch. Gujarat's ports serve
about 30 per cent of India's landlocked states, especially northern States like Rajasthan, UP, Punjab, Haryana, MP, J&K, Chandigarh, Delhi, and Himachal Pradesh.

Post & Telecommunication

There are 8,992 post offices/branches. All talukas and villages have telecommunication facilities while all taluka headquarters have mobile phone connectivity.

Forest Cover

Approximately 18,000 sq km constituting 9.92% of area of the State is under forest cover. The dense forests are spread over less than 2,000 sq km in the districts of Valsad, Navsari and Dangs. The dry forests are spread over 10,700 sq km in Narmada, Vadodara, Panchmahals, Dahod, Sabarkantha, Banaskantha, Junagadh and Amreli districts. The thorn forests are widely distributed towards West and Northwest parts of the State covering 5,000 sq km in Mehsana, Ahmedabad, Western Banaskantha, Western Sabarkantha, Surendranagar, Bhavnagar, Amreli, Jamnagar, Rajkot and Kutch districts.

Population Below Poverty Line

13.17% of the rural population and 16% of the urban population are below the poverty line (BPL). In the early fifties almost 80% of the rural population was below the poverty line. This shows a significant decline in the poverty level due to the impact of rapid economic growth.

Classification of Working Population

Classification of population by economic activity as per 2001 Census reveals that:

- Of the total population, 170.25 lakh (33.60%) are main workers, 42.31 lakh (8.35%) are marginal workers, and 294.15 lakh (58.05%) are non-workers.

- Of the main workers, 27.67% are cultivators, 17.91% are agricultural labourers, 1.9% are engaged in household industries, and 52.62% are engaged in other economic activities like manufacturing and the service sector. Thus, about 45.58% of the working population is actively engaged in agriculture (i.e., cultivators and agricultural labourers).

Structural Changes in the Economy

With rapid economic growth, the share of agriculture in GDP has reduced to 25% at National level. However its contribution to the GDP remains between 30 and 40 percent in states like Punjab, Orissa, Uttar Pradesh, Bihar, Haryana and Madhya Pradesh, while in states like Gujarat, Maharashtra, and Tamil Nadu, its share is less than 20 percent. Agriculture growth at national level has remained below 3% per annum.

The rate of growth of GSDP in various sectors of the economy during different decades is as follows:

Rate pf GSDP at constant 1993-94 Prices (Percent)				
Sector	1960-61to 1970-71	1970-71 to 1980-81	1980-81 to 1990-91	19900-91 to 2000-01
Agriculture	2.67	3.15	-0.53	2.53
Manufacturing	2.58	6.62	8.41	9.13
Primary	3.19	3.40	0.03	3.42
Secondary	3.15	6.57	7.87	8.63
Tertiary	3.41	5.31	7.26	8.29
Total GSDP	**3.32**	**4.69**	**5.08**	**7.35**

Gujarat's economy has accelerated its growth during each of the last four decades. The manufacturing sector has grown at faster rates than agriculture.

Sector-wise Composition of Gross State Domestic Product GSDP) at Constant (1993-94) prices

Sector	Percentage share to total GSDP for the five years ending					
	1964-65	1974-75	1984-85	1989-90	1994-95	2000-01
Agriculture	42.30	29.60	33.81	25.30	24.35	11.93
Manufacturing	19.90	23.20	23.89	26.70	28.53	34.27
Primary	43.70	31.80	37.24	28.58	29.36	15.86
Secondary	25.20	30.20	29.62	33.13	34.82	41.49
Tertiary	31.10	38.00	33.14	38.29	35.81	42.66

The share of agriculture is continuously on the decline.

Gross State Domestic Product (GSDP) at factor cost at constant (1993-94) prices in 2003-04 has been estimated at Rs. 1,03,951 crore against Rs.75,945 crore in 2000-01. At current prices, GSDP in 2003-04 has been estimated at Rs. 1,67,356 crore, against Rs.1,08,484 crore in 2000- 01. The growth in GSDP (at constant prices) at 15.4% was observed to be mainly on account of exceptionally high agriculture production as well as better performance of the industry sector.

The share of primary, secondary and tertiary sectors has been reported to be at Rs.2,2676 crore which is 21.8%, 38.1% and 40.1% respectively of the total GSDP during 2003-04 at constant prices. The share of these sectors in the base year 1993-94 has been reported to be as 25.4%, 35.8% and 38.8% respectively. The per capita income (i.e., per capita NSDP at factor cost) at constant prices (1993-94) has been estimated at Rs. 16,779 in 2003-04.

Gujarat has shown rapid growth, with a growth rate higher than the national average. It is even higher than some of the so-called Asian Tiger Nations. Its rapid expansion and momentum has been rightly attributed to unprecedented growth of the manufacturing

sector and service sector. Agriculture also had growth although it was slow. But in the new millennium changes have taken place and this sector has also picked up speedy growth. This is outlined in the following pages.

AGRICULTURE

Gujarat is divided into North, South, Central and Saurashtra-Kutch regions. Large parts of the State are plains. Agriculture provides a major source of income for about 60% of the state's rural population. A population of more than two crore, including farmers and agriculture labourers depend on agriculture. It also provides demands that support a major segment of industries like fertilizers, pesticides, seeds, pipes, pumps and other implements. It also provides raw material for the textile industry, oil processing units and a large number of agro processing units including the dairy industry. It has created opportunities for self-employment and wage employment. Although the share of agriculture in the GSDP has declined over a period of time, its impact on the State economy has been quite high. In years of recurring droughts, when agriculture is affected, the overall economy gets slack and at times results in the negative growth of the economy.

Agriculture holds the key to reduction in rural poverty. Poverty in rural areas came down to 13% from 60% in the early sixties. Poverty reduction was driven by high yield and growth in important crops along with a strong support by the dairy sector, which provided cash income on a weekly basis to rural families. Even today, agriculture and dairy activities hold the key to removal of poverty of the approximately 12 to 16 lakh families who are still poor.

Some of the important characteristics are:

- Gujarat's agriculture is one of most diverse with a mix of food and non-food grain crops with and a domination of cash crops.

- It has adverse agro climatic conditions with 70% of its area under crops being rain-fed and subject to uncertain monsoons.
- The agriculture sector had a negative growth rate in the early sixties and seventies. These decades had recurrent droughts that continued into the eighties. But the situation changed in the nineties. The agricultural sector grew by 3.9% per annum surpassing the all-India average of 3.2%. In the new millennium, it has had a rapid growth of 11% per annum between 2001-03, becoming the country's number one state in growth of the agriculture sector. This has pushed growth in the non-farm sectors as well, resulting in an overall economic growth of 10%, again surpassing the national average. This also increased per capita income from Rs.9,796 in 1993-94 at current price to Rs.26,929 in 2003-04. Agriculture and livestock sector grew from Rs.9,793 crore in 1993-94 to Rs.30,244 crore in 2003-04 at current prices.

THE AGRO CLIMATIC REGIONS

There is diversity in the agro climate of different regions of Gujarat. The agro climate divides Gujarat into seven zones, based on geography, climate, average rainfall, and soils. These are as under:

1. **Southern Hills –** This comprises Dangs and Bulsar with average rainfall of 1,800 mm per annum. It has humid to sub-humid climate. The soil is deep black, alluvium coastal. The major crops are rice, sugarcane and fruits like mango and chikoo. Parts of this region, particularly Dangs and Vansda, Darampur and Kaparak of Bulsar district, have dense forest with predominantly tribal population. The agricultural practices in this zone are not modern, with low volume and low-value crops. Efforts are being made to change this. Dharampur farmers are now growing cashew nuts. These areas have great potential and need attention since a majority of tribal families still live below the poverty line. The undulating terrain is mountainous and subject to heavy soil erosion that washes away crops during seasons of heavy rainfall.

2. **Southern Gujarat** – This consists of Surat, Bharuch and Narmada districts. The average rainfall per annum is 970 mm. It has a semi arid and dry sub humid climate. The soil is deep back, coastal alluvium. The major crops are vegetables, rice, tuver, cotton, and sugarcane. Narmada and parts of Surat and Bharuch districts have forests and are dominated by tribal populations. Some of the areas like Sagbara and Devgadh Baria have very limited use of certified seeds and fertilizers. The crop yields are poor. Majority of farming families are below the poverty line. There are, however, successful efforts to grow herbal crops, cotton, and flowers in these areas. The terrain has hills, mountains and is undulating. Majority of farmers are progressive and are adopting modern agriculture.
3. **Central Gujarat -** This consists of Vadodara, Anand, Kheda, Dahod and Panchmahals districts. It has an average rainfall of 900 mm. The soil is black to medium black. The major crops are cotton, tobacco, maize, bananas, sugarcane, rice, and vegetables. Parts of Anand, Kheda and Vadodara districts have the richest agriculturists of the State. Regions such as Dahod, parts of Panchmahals and Vadodara have tribal populations with forests around. Dahod and Chota Udepur are considered as the most backward areas. A quiet revolution is going on supported by minor irrigation networks through horticulture crops. This is described elsewhere in greater details.

   The majority of areas of above three regions have the benefit of being irrigated by canals from the Mahi, Kadana, Ukai and, now, Sardar Sarovar reservoirs. These regions grow surplus fodder, with the exception of Panchmahals and Dahod. In years of droughts, these regions supply green and dry fodder to other affected areas of the State. These regions have maximum water resources. Majority of farmers are progressive and are adopting modern agriculture.

4. **North Gujarat -** This comprises Ahmedabad, Gandhinagar, Mehsana, Patan, Banaskantha and Sabarkantha. It has an average rainfall of 735 mm. The climate is semi arid and the entire region is drought prone. The soils are grey brown, coastal alluvium. The major crops are wheat, bajra, jowar, mustard, castor,

cotton, vegetables, and spices. It has the biggest spice market, located in Unjha, and cotton market centres at Kadi of Mehsana district. The monopoly crops like castor seeds, fennel and isabgol are grown here. Almost all farmers are progressive and adopt the latest technologies. It will benefit from irrigation from Sardar Sarovar and under the Sujalam Sanlam Scheme. The region has the highest discharge of underground water resources, resulting in a continuous salinity ingress.

5. **North Saurashtra -** This region consists of Amreli, Jamnagar, Bhavnagar, Rajkot and Surendranagar. The average rainfall is about 500 mm. The entire region is drought prone and frequently affected by scarcity of water. The soil is medium, black and shallow calcareous. Major crops include groundnut, cotton, gram, tuver, udad, bajra, and jowar. Farmers are progressive and achieve a high yield in cotton and groundnut. The new check-dam scheme and watershed programs have brought about some stability in agriculture in the last four years. It has paid rich dividends by preventing crop failure situations due to lack of rains. The region is known for its Kesar mangoes.
6. **South Saurashtra -** Junagadh and Porbandar are part of this region. The average rainfall is 850 mm. Soil is medium, black and coastal alluvium. The major crops are groundnut, gram, cotton and bajra, and mangoes. Coconut plantations are also found here. There is continuous increase of salinity due to intrusion of seawater. Farmers are progressive.
7. **North West Area –** This includes the Kutch district, the largest district situated between coasts and Great and Little Rann of Kutch. The region experiences recurrent droughts. Even in normal rainfall years, talukas like Lakhpat, Abdasa and Nakhatrana are affected by scarcity. There is always water and fodder shortage during summers. The soil is gray brown, deltaic alluvium sand and saline. Salinity ingress is taking place due to heavy winds, which bring salty particles and also due to seawater intrusion. The major crops are bajra, jowar, cotton, and groundnut. Date palm cultivation is also practised in the region. Cultivation of mangoes and grapes are being taken up in Bhuj and Rapar talukas in recent times. Average rainfall is 300 mm. The farmers are progressive. Earlier

there used to be planned migration of cattle. Now Narmada pipeline provides drinking water to villages. Fodder depots are opened every year.

RAINFALL

The physiological features divide Gujarat into three regions, viz. (1) The main land plains extending from Rann of Kutch and Aravali Hills in the North to the rivers Damanganga in the South; (2) The hilly peninsular region of Saurashtra and Sandy area of Kutch; and (3) the north-eastern hill tract.

The standard climate types are arid, semi arid and sub humid climates spread over different regions of the State. The region in north, comprising the districts of Kutch, Patan, Banaskantha and parts of Saurashtra have arid climate. The rest of the State is semi-arid.

All parts of Gujarat receive rainfall from the South West monsoon, being located at the peripheral boundary of its main current. The distribution has been extremely uneven and irregular. Low-pressure depressions over Bay of Bengal during monsoon months also bring rain to parts of the State and the cyclones that develop over the Arabian Sea produce heavy rains in the post-monsoon season.

The State receives an average annual rainfall of 807 mm in 34 rainy days. This annual rainfall varies spatially and temporally. It varies widely from 350 mm in western half of Kutch to more than 1,700 mm in the southern part of Valsad and Dang districts. Monsoon usually commences by the middle of June. It withdraws by the end of September. About 95% of total annual rainfall is received in these four months. About 10-15% of annual rainfall is received in June, nearly 40% in July, 25% in August, and 15%-20% in September.

The number of the rainy days (days with rainfall more than 2.5 mm rainfall) varies between 15 days in Kutch district, to 75 days in Dang district. In most parts of the State, rainfall is received in 20-40 rainy days. The annual rainfall variation in terms of coefficient of variation (CV%) indicates high (60%) in low-rainfall district of Kutch, and low (30%) in Dang district.

Different parts of North Gujarat and Saurashtra are identified as drought-prone regions. The high atmospheric demand for water in these regions makes agriculture more vulnerable to moisture stress conditions resulting in high variability in crop production.

LAND USE PATTERN

S. No	Particulars	Area in Ha.
1	Geographical area	1,96,117
2	Forest Area	18,653
3	Area under non agriculture use	25,997
4	Barren and uncultivable land	11,419
5	Permanent pasture and other grazing	8,507
6	Land under misc. trees and crops	40
7	Cultivable waste land	19,849
8	Other fallow	131
9	Current fallow	9,189
10	Net area sown	94,896
11	Area sown more than once	10,074
12	Total cropped area	1,04,970

Crops – Seasons

Crop group	Kharif rops	Rabi crops	Summer crops
Cereals	Bajra, rice, jowar, maize	Wheat	Bajra
Pulses	Tur, moong, urad, math	Gram	Moong
Oilseeds	Groundnut, sesame, castor	Rapeseed and mustard	Groundnut
Commercial crop	Cotton, sugarcane, tobacco	Potato	-

LAND HOLDING PATTERN

The average size of the land holding as per agricultural census 1995-96 is 2.62 ha. This is higher than the national average of 1.41 ha. The number of small and marginal farm holdings account for 55.33%. Area held by such small and marginal farmers is 21.35%. Semi medium and medium farmland holdings were 42.20%. They owned 65.06% of the area. Balance land is owned by large farm holders, constituting 2.41% who held 13.60% of total land holdings.

Current Situation:

Agricultural Growth- Gujarat

Gross Cultivated Area vs Number of Farmers:

Gujarat practices agriculture on half of the total geographical area (19.6 m ha). About 57.4 percent of the population lives in rural areas. Agriculture is an overarching occupation of the rural people with 51.8 percent of total workers dabbling as either cultivators or agricultural labourers. Predominant farmers i.e. 34.0% are marginal having less than one-hectare land holding. This is closely followed (28.9%) by small farmers (1-2 ha), 23.2% semi-medium farmers (2-4 ha), 12.5% medium farmers (4-10ha) and 1.5% large farmers (>10ha).

It is important to note that gross cultivated area (GCA) that hovered around 108±2 lakh ha during triennial average from 1980-83 to 2010-13 has drastically reduced at a rate of 15% to 92.89 lakh ha during 2015-18.;though it showed recovery of 1.54 and 7.21 % during 2018-19 and 2019-20 touching 94.32 and 101.12 lakh ha, respectively. This drastic reduction in GCA (around 10 lakh ha) has been recorded despite an increase in irrigation facilities (25% in 1980s to 46% in 2018) and exquisite programmes like Jyoti Gram Scheme that provided assured electric power supply for supplemental irrigation. The reduction in GCA was predominantly attributed to putting agricultural land to other uses like infrastructure development. The number of operational landholders during 2010-11 (48.86 lakh) increased by 8.8% (4.34 lakh) to 53.20 Lakh during 2015-16. The predominant increase (90%) was in the number of small and marginal farmers. This recipe of reduced GCA and increased number of operational landholders is a big barrier for enhancing income of the farmers.

Trends in Area

The crop production in Gujarat primarily hovers around non-food value amenable crops like cotton, castor, groundnut and seed spices. The area under cotton as percent of GCA decreased from 14.04% during 1980-83 to 10.70% during 1990-93. The reduction in area was predominantly imputed to obvious increase in biotic stresses like white fly

and American bollworm. The advent of Bt-technology spurred the sustained increase in area under cotton that stood at 28.49% of GCA during 2015-19. Similarly, area under castor too showed huge increase from 1.78% of GCA during 1980-83 to 6.92% of GCA during 2015-19. The area under groundnut reduced from 19.76% of GCA to 17.18% of GCA during 2015-19.

The area under groundnut showed a drastic reduction of 19% from 19.07 lakh ha during 2009-10 to 15.51 lakh ha during 2018-19.All the districts, except Porbandar showed reduction in area. The reduction area was acute in two major groundnut growing districts viz, Banaskantha and Sabarkantha. Amreli and Bhavnagar have been exhibiting recovery of area during recent years.

The area under castor has shown drastic reduction in area, during 2017-18 particularly in major castor growing districts viz, Kachchh and Sabarkantha. The area in the districts of Kachchh, Sabarkantha, Vadodara, Kheda, Jamnagar and Rajkot have shown reduction in acreage under castor. However it showed a recovery of 42% during 2018-19.

Trends in Productivity

The productivity of cotton has been showing increasing trends with an exception of 2015-16 and 2016-17. The productivity was dismal (360 kg/ha) during 2016-17. However, gains in productivity were momentous (127%) during 2017-18 (819 kg/ha). Erratic weather conditions reduced the productivity by 33% to 552kg/ha during 2018-19. The productivity of groundnut has been increasing and was at its peak during 2005-10 (1477 kg/ha). Thereafter, it has shown decreasing trends. The productivity during 2018-19 (554 kg/ha) was 62% lesser than 2005-10. It was just 19% of the productivity during 2013-14 (2970 kg/ha). The productivity in the districts of Junagadh and Porbandar have shown drastic reduction in productivity.

The productivity of castor has by and large shown increasing trends with few exceptions. However, the productivity has reduced by 4 and 14% during 2017-18 and

2018-19, respectively, than 2016-17 (2040 kg/ha). Only three districts viz, Jamnagar, Mehsana and Kachchh exhibited higher yield than average yield. The productivity has shown increasing trends in the districts of Jamnagar, Mehsana, Kachchh, Sabarkantha, Aravalli and Patan. The reduction in productivity was both due to abiotic (extreme weather conditions) and resurgence of biotic stresses like white grub in groundnut, pink bollworm in cotton, etc.

Trends in Production

The production of food grains and oilseeds reduced by 13.83% (94 lakh tons to 81 lakh tons) and 28% (75 lakh tons to 54 lakh tons) during 2013-14 to 2018-19, respectively. The crop production primarily hovers around non-food value amenable crops. Cotton production was 100.88 lakh bales during 2013-14 but reduced to 50 lakh bales during 2016-17 at an annual rate of 5, 22 and 34 per cent during 2014-15, 2015-16 and 2016-17, respectively. However, its production increased by 153 per cent during 2017-18 (127.46 lakh bales).Consequent upon bad monsoon, the production again plummeted by 31% to 88 lakh bales during 2018-19.

Production of groundnut reduced by 63 per cent from 54.46 lakh tons during 2013-14 to 20.32 lakh tons during 2015-16. However, the production has increased during the subsequent years and reached 32.06 and 32.61 lakh tons during 2017-18 and 2018-19, respectively.

Castor production has hovered around 11.5±1 lakh during 2013-14 to 2017-18. However, the reduction in production was acute (19%) bottoming up at 9.5 lakh tons during 2018-19 from 11.72 lakh tons during 2017-18. However, the production increased by 72% during 2018-19 mainly due to 42% increase in acreage from 5.21 lakh ha during 2017-18 to 7.40 lakh ha during 2018-19.

The production of total horticulture exhibited a stupendous increase of 125% during the decade 2005-15 (9.46 lakh tons to 21.32 lakh tons). The increase was attributed to 102, 147 and 350% growth in all the three segments of horticulture viz; fruits (4.13 lakh tons to 8.33 lakh tons), vegetables (4.87 lakh tons to 12.05 lakh tons) and flowers (0.04 lakh

tons to 0.18 lakh tons). However, the impressive growth of total horticulture evinced during the decade ending 2015 got gagged to around 5% during 2015-17 and less than 1% during 2017-19. This was attributed to static or less than 1% growth in fruits and flowers: and 5.5% reduction in vegetables during 2018-19.

The production of seed spices exhibited a growth of 83% during the decade ending 2015 (0.42 lakh tons to 0.77 lakh tons). The production of seed spices has been growing at a steady annual rate of around 9±1% to have touched 0.82 lakh tons during 2018-19. The data indicated that the growth of horticulture has slowed down during the last few years.

Both milk (111 lakh tons to 128 lakh tons) and egg production (15550 lakh to 17940 lakh) has increased by about 4 per cent during 2013-14 to 2016-17. Production of wool hovered around 24.26 ± 1.50 lakh kg/annum during 2013-14 to 2016-17. Annual production of fish remained static around 8.08 ±0.08 lakh tons/annum. Therefore, it seems that the increase in income was mainly attributed to the increase in production of fruits, vegetables, milk and eggs.

Farmers' Income:

Entrepreneurial mind set of Gujarati populace coupled with well-developed infrastructure including roads and versatile cooperative sector are the two handy strengths of agriculture in Gujarat. The situation stands supplemented with exemplary backward and forward linking of agriculture. The robust cooperative dairy sector in Gujarat is bellwether for economically empowering women and poorest of the poor farmers at the last post.

The upturn in agricultural development in Gujarat is evident in sustained double digits growth rate of agriculture during the last decade. The growth in farmers' income in Gujarat has increased at an annual compound rate of 11±1% during 2013-14 to 2016-17 has been exemplary at the national level. This is evident in the comparative increase in the gross annual income per farm household in Gujarat (1.13 lakh to 1.57lakh) than 0.96 lakh to 1.30 lakh at the national level (Figure 1). This has happened due to

infrastructural development, improvement in communication network including roads; assured electricity with dedicated separate lines for farming sector; increase in irrigation facilities owing to incredible aquifer recharging, Sujalam-Suflam and Narmada canal network; MIS; timely availability of inputs including fertilizer; good linkages and marketing network; processing and cold chain; and above all better bracing of horticulture and animal husbandry with crop husbandry. It is not out of place to mention that the government has the precise endeavours to develop expansion of post-harvest technologies, gamma-ray irradiation facilities, storage facilities, marketing inclusive special export-oriented zones and processing facilities to enhance income from the agriculture sector, etc.

The Role of different stakeholders is as follows:

Stakeholder:	Role – Responsibility
State Agricultural University Vice Chancellor and Director-Extension through KVK	• Transfer new variety of seeds and climate resilient practices – promote "orphan crops" • Provide Weather Advisory followed by Agro-advisory every month – during season on day to day basis through local TV cable network – district-wise • Provide Agro-advisory to select crops which can be sustained by soil – based on soil health and water analysis – village-wise Soil data each village of all farmers is available
District Administration: Dy. Directors of Agriculture, Horticulture, Animal Husbandry, ATMA & Fisheries cooperation along with their field staff Extension Officers and VLW (Village Level Workers)	• Ensure that all existing and new schemes reach to village level and poorest farmers benefit first. • Ensure that farmers get quality – certified inputs and action against fraudulent sales of input is taken. • Follow Krishi Mahotsav approach – visit each village – interact with farmers and guide them –

	about Climate Smart and Good Agricultural Practices. • Provide Soil Health Card with guidance of crops – alternative crops that can be sustained by his soil. Provide data about price available under MSP, APMC and open market operation of the last five years to enable farmers to take informed decisions.
	• Promote of Farmers' Producer Organization – at least one for each block. Organize through FPO Toolbank, Farm services, storage, grading & packaging and marketing.
The District Development Officer and Jilla Panchayat	• Monitor progress of all schemes related to agriculture and rural development and provide employment under MNREGA wherever needed – promote water harvesting schemes. He must ensure that farmers' benefit from new changes under APMC Act and get maximum price. He must lead the Krishi team to villages during Krishi Mahotsav. Monitoring market operation and promote direct market operation by traders, FPO, Agro-industries retailers.
Collector	• Overall coordination of development and its implementation at village level and directly

	monitor implementation of MSP (Minimum Support Price) Scheme. Develop Micro – Level Block Plan by District PL Board. Implement link – project to provide rural employment. • Promote use of Solar Energy Pump Scheme
Gram Panchayat – Sarpanch & Committee Members	• Make aware and implement Covid-19 Health Safety Guidelines. • Keep village clean • Provide employment under MNREGA. • Regularly call Gram Sabha • Ensure that poor families get the benefit of Govt. Schemes first. • Make all farmers to avail of insurance cover. • Provide weather and agro-advisory to farmers. • Organize farmers to fight locust menace

	• Organize water harvesting works. • Promote efficient use of water – drip irrigation.
NGOs	Act as link between govt. agencies and farmers. Organize community works. Provide farmers' details of schemes and assist in applying and to get benefit. Promote Climate Smart and Good Agriculture Practices and water harvesting and efficient use of water by drip irrigation. Make farmers aware about fraudulent inputs.
Industry	Agro-industry and big retailers may directly buy from farmers – without middlemen. Input dealers – need to provide quality certified inputs and make aware farmers about not buying cheaper fraudulent inputs. Promote local cleaning, sorting and grading.
Banks – Cooperative commercial NDFC NABARD	NABARD needs to take lead to ensure that KISAN CARDS are availed by all farmers, animal holders, and fishermen. It needs to promote and assist credit to self-employment, micro-processing units and service units.
Irrigation Deptt. and SSNNL	• Connect all villages under the command area. Organize a village link. • Make Gram Panchayat responsible for this

	• Promote drip irrigation • Reduce and monitor transmission losses
Gujarat Vidhyut Nigam	• Promote Solar energy – to provide farmers zero cost energy and source of additional income.

The Atmanirbhar Farmer

In order to achieve the goal of '*Atmanirbharta'* – it is the farmer who is key to its success. He must realize his own role:

- Alert – he must keep himself up-dated climate change, and the danger of the spread of Corona. About benefits available under existing and new schemes of Govt.

- Adaptation of new technology: Climate Smart Farming, Good Agricultural Practices, Drip and Sprinkler Irrigation and Solar appliances.

- Knowledgeable – Keep track of market price of inputs and agri-produce including that of MSP and select his crop based on its Soil Health analysis – selection high value and low volume crop. Take benefit from all Govt. Schemes. Sell crops – directly to APMC, MSP or trader / industry whoever offers the maximum price.

- Resort to multiple sources of income – livestock, solar – sale of excess energy generated, bee keeping, handicraft etc. and take employment under MGNREGA.

- Safety – safety advice given by the Health Deptt. for himself, family, workers. For safety of crops follow weather and agro-advisory and insure the crop.

- Add – value and get a better price by cleaning, grading, sorting, properly packing and selling where the highest price is available.

- We have some case studies which illustrate the above on the following pages.

Way Forward

Rural economy provides the sound base required for a rapid self-reliant and sustainable long-term growth of any big state in terms of geography and population. Country has always recognized this fact, but more so after the beginning of formal economic policy reforms in 1991. The strategy of providing quality electricity, water and road connectivity in rural areas has significantly lifted agricultural growth and hence the living standards of the rural population. The consequent increase in the purchasing power of the people resulted in the demand for hitherto considered urban amenity goods and mass mobility within the state. Industry, trade, transport and informal service sectors started growing rapidly and soon made urban centres across the country an irresistibly attractive destination for pulling the migrant labour from all over the country. The labour and skill got mobilized.

However, global adverse shocks due to oil prices, tariff war, Covid-19 and climatic change seriously affected the productivity in agriculture and increased rural-urban imbalance. It calls forth some urgent steps to regain the lost balance and rhythm. This needs to be immediately addressed within the next one to two years so that the rural areas can again become the growth engine of the economy in the background of a series of initiatives taken by central and state govt. to restructure agriculture and support rural families and youth.

Micro Level Plans

The various schemes of the Government are implemented at village level through different departments from Centre to State – District, Taluka and finally at Village Level to reach out farmers. There are overlapping schemes and responsibilities.

The Planning Commission did introduce Micro Level Plan in the year 2012, known as District and Taluka Agriculture Production Plan. But that did not cover all related departments. Further over a period of time – this has perhaps been abandoned. But Micro Level Plans – Block and Village Level Plans are key to re-structuring. In that we need to know Block Level GCDP and target the growth. The Block Agriculture

Development Plan needs to integrate all activities related to Agriculture, Water, Solar, Fodder, Livestock Development and Finance – with an aim to increase income of individual farmer families and GDP of villages. The challenge is to reduce the gap of income between Progressive Farmer and Average Farmer in the same village with similar land and water resources. There already exists a District Planning Board. District Planning consists of all District Level Heads of Deptt., MLAs, MPs, District and Taluka Panchayat Presidents. It involves all elected and non-elected District Level public governance. This mechanism exists for preparation of Micro Level Plan and is made accountable to prepare plan and monitor its implementation.

Centre	State	Dist. Collector & DDO – Dist. Devp. Officer	Block / Taluka	Village
-Agriculture -Rural Development -Water Resource -Agro Processing Power Science & Technology; CSIR Vigyan Prasar Commerce; -Spice Board -APEDA TEA & Coffee Board STC. -Fertilizer Chemical -Skill Development -External Affairs Civil Supply	-Agriculture -Rural Development -Water Resource -Agro Processing Power Science & Technology; -Fertilizer Chemical -Skill Development -Civil Supply Labour -Entrepreneur-ship Development	-Dist. Planning Board -Irrigation -State Irrigation Panchayat -DRDA Watershed Elec. Company Dist. Supply Employment Exchange ITI -Dy. Director; Agriculture, Horticulture -ATMA. -KVK -DRDA -Rural Development -Dept.Watershed -Livelihood Agency	-Mamlatdar -Taluka Development Officer -Taluka Panchayat -Agriculture Cooperation - Rural Development	-Gram Panchayat VLW (shared) -Gram Sabha -Milk Cooperative

Knowledge Economy

- Digitize all land ownership records with details of Cultivators and Owners.
- Satellite mapping of crops for Market Forecast – including information competitive areas and crop failures
- Satellite tracking of fish catch
- Satellite mapping of individual farmland insured under Crop Insurance for settlement of insurance claim.
- Use of Artificial Intelligence in Agriculture like diagnosis of diseases in plants and animals, sensors for monitoring storage condition of products stored, climate related advisory based on simulation models.
- Our immediate objective is that farmers – or for that matter any villager need not visit office at village level – block level and District level. The village panchayat needs to operate an online system and all can apply /get benefits through that.

Restructure – State Agricultural University

- SAUs Agriculture Universities have done outstanding work – both in research and development and technology transfer. Now emerging areas which need focus on –
- Water Management: Efficient use of water resources, undertaking tests of quality of water and developing agro-advisory for its treatment before using it for irrigation. Water analysis like soil health analyses key for sustainable agriculture.
- Agro-Processing: India is leader in horticulture production but processes only 6-7% of its total production. In contrast Europe processes 70% of its production. This has huge potential. Currently some of R&D labs on related subjects and like are under CSIR – eg: CIFRI. This needs to be integrated with SAU. In fact entire Agro – waste which is being burnt can be used for industrial use – as fiber, fuel or as compost. This can save a continuing environmental problem.
- Market Intelligence: Consumer – local – urban – Exports.
- Research – Crops – Processing – Market – line – State Level.
- This will need restructuring current SAU labs and research centres – in short each research centre needs to have a processing research unit for related crops and plants or along with market intelligence.

Rural Distress and Employment Opportunities:

Currently several policy initiatives exist –but they are not integrated for creating rural jobs. There is a need for a scientific socio-economic survey carried out at regular intervals along the lines of the BPL survey for each block and each village to identify demand and supply of specific jobs. It will involve the survey of urban and semi-urban localities and colonies for their demand for services or employment opportunities. There are more than 400 clusters: semi-urban and urban – industrial – including ports. They have a variety of service needs and small retail outlets for tea, ironing, repairs,

vegetables and fruits, pan shops etc. that need to be systematically identified. There are job opportunities for rural youth. These will generate massive employment and relax rural distress and discontent. The Rural Development Department should take up this on an immediate basis with the help of local colleges and universities in the state.

Corporate and Cooperative Farming:

New changes by statutory provisions have made this possible while protecting the interest of farmers. Rural distress is growing because agriculture for small and marginal farmers is becoming non-viable due to small operational holding, prohibiting costs of applications of new technology, improved implements, HYV seeds and lack of capacity to adopt efficient farming practices resulting in low productivity. On the other hand, employment opportunities in urban centres, industrial areas and construction projects lure the adult workforce. As a result, the majority of rural youth do not have interest in continuing with farming but have to cling to the small plot due to our land legislations. Sale or leasing of agricultural land should be freely allowed for better allocation and increasing productivity of the scarce land resource. Land market imperfections arising out of restrictive legislation should be removed at the earliest.

Moreover, corporate farming needs to be encouraged by easing of land ownership and land use regulations such that the farmers can retain ownership but lease out their land with or without labour for a longer term to receive either a share in the profits and/or a fixed income. This will not only help improve the land productivity by allowing improved scale operations, access to funds, improved seeds, implements, HYV seeds and better agricultural management practices, but also create the possibility of taxing agricultural income for augmenting the state revenues.

Sharecroppers and Agricultural Labour:

One reason for low investment in agriculture is the growing number of sharecroppers. Since the land they still have is not on their name in the village record, they are invariably bypassed in all benefits of government schemes and projects. Legal status of sharecroppers needs to be recognized to make them eligible for the government schemes on loan- subsidy without contradicting the existing Tenancy Act that makes the tiller the owner. Otherwise, it will result in owners keeping their lands

un-cultivated with resultant loss in cropped areas. NABARD has a scheme of providing credit to such farmers without collaterals if they can form Joint Liability Group. The RRBs and DCBs and PSBs routes have not worked efficiently. The by-laws of the DCBs need to be amended to relax the upper limit of 20% to 40% on the nominal membership, so that the credit can be extended to the sharecroppers and agricultural labour. Moreover, the FPOs including sharecroppers need to be promoted. The organized credit sector should provide credit against the farm produce or output rather than land or inputs. The Rural Development Department should implement the sere commendations.

Capacity Building of All Stakeholders:

Stakeholders include crop and horticulture farmers, *pashu-palaks*, animal holders, poultry farmers and fishermen. They need to be skilled, re-skilled and up-skilled in the arena of climate change. Govt. has now made available cheap credit – animal holders and fishermen are covered. Capacity building should be carried out by the Agri. Development Department regularly covering a large proportion of stakeholders on the following aspects:

1. Understanding adverse impact of climate change and learning “Resilient Agriculture”.
2. Understanding weather forecast to protect crops - horticulture – livestock – poultry and fisheries
3. Use of equipment -tools
4. Purchasing quality inputs for high productivity and value
5. Understanding the need for change and accepting challenges.
6. Good Agricultural Practices
7. Sell where you get best price – market forces

Solar Energy to Farmers:

Country has one of the best policies to promote solar plants at villages to

improve farmers' income. The farmers are entitled to sell solar power to the grid for which the Discoms would pay them a predetermined tariff per unit. Though the programme is good, there has not been much progress and there is reluctance on the part of Discoms to buy solar power from small plants located at villages at a fixed price.

Government needs to find a way to resolve this because there are several solar systems installed but not activated in rural areas. There is a need to search and develop innovative usage of solar energy such as for distillation to promote its demand. In fact, the Energy Department needs to give free hand to industries in the rural and arid areas to use as much solar energy as possible.

Blue Economy:

There is a need for creating a Seawater based ecosystem sustaining on natural resources through developing seaweed cultivation centres across Gujarat Coastal Line and providing a boost to the socio-economic development in coastal areas. More specifically this involves the following activities by the State Fisheries Department: 1. Identify the sites for developing the cultivation centres by working along with private ports and local villages; 2. Encourage coastal communities to participate in the cultivation of the material; 3. Develop seed banks for selected varieties of seaweed; 4. Provide a boost to private entrepreneurs to manufacture basic and supplemental products to ensure supply of industrial raw material;and 5.Mass-cultivate the selected varieties of seaweed in the open sea to create an industry for the same. This can be done along with the development of Aquaculture. The new Fisheries policy provides extensive incentives and support.

Promote Urban Vegetation Cover:

Vegetation gets removed in the process of expansion of urban limits and on the periphery of urban centres by developers. This reduces croppedareaandCO_2 absorption attributable to vegetation. A clear Urban Vegetation Policy is required that mandates developers and new construction of houses, colonies and townships to: a)

Recharge rain-water; b) Recycle wastewater; and c) Create vegetative cover in 40% areas which they are required to keep open.

Tackling Salinity Ingress

Agriculture is under major threat of salinity ingress as the country has huge coastal areas. This is both overground and under- ground. For example, in Gujarat, as per BAISAG, 25 districts, 123 talukas and more than 8000 villages are affected by salinity ingress. This is affecting – contaminating water. It affects irrigation and the root zone of crops and trees resulting in low productivity. This is a major problem which needs to be addressed by the Rural Development and Irrigation Department.

Inclusive Development:

A. Gender Equity

Govt. has recognized the role of establishing gender equity in farming and related occupations and has several schemes to empower women. However, the progress on this front has not been satisfactory. The priority is desired in making women and particularly rural women aware about such schemes and about their equal status in the family through specifically targeted training programmes informing them about climate change related risks and uncertainties, innovations for value additions, nutrition and health for family and their legal rights. Women need to be made aware not to let go of their right of inheritance. Further women friendly agriculture tools need to be made available.

B. Accountability – Monitoring and Evaluation:

With expansion of existing and new welfare schemes – the farmers have multiple opportunities. But despite this in the same village – with the same land and

water resources – one farmer makes profit – while other lags behind – migrates, commits suicide or lives subsistence life. Same is true about villages, blocks and districts. This requires a strong administrative effort by the Development Administration to reach out to all. But what it needs further is that tasks are assigned to each functionary – from village to state level is monitored – and communicated lapses and complemented achievements on a weekly basis and realization made available to them that their accountability is measured from time to time – and related to their career progress and posting.

There was a system of Programme Evaluation by the Director Bureau of Economics. This should be revived. A start could be made to evaluate 'online' applications in different schemes to identify gaps and plug loopholes.

c. Smart Villages:

There is a scheme called Shyama Prasad Mukherjee RURBAN Mission launched by GoI in 2016. The Covid-19 phenomenon awakens urbanities to take maximum advantage of the scheme since by now all villages are well connected by rail & rural roads, electricity & LPG, mobiles &WiFi, and TV channels. Now the question is how to use all these effectively to create production bases in rural areas and small towns and meet aspirations of local youth for employment and prevent migration. There is a need for stepping up smart connections in the rural and small town areas by tailoring several elements modularly depending on local conditions and desires of local people. The Urban Development Department in collaboration with the IT Department should aggressively implement this recommendation by targeting at least 20% of the potential villages and towns in the next two years. Funds and available New Smart Cities could be diverted here.

Such smart villages can come around existing Industrial Township and big cities. Infact, the Urban Development Department should promote them looking Covid-19 adverse effects. There is already an Urban Infrastructure Development Board. It may be given targets of smart villages. This will also simultaneously provide livelihood to a large number of rural poor families.

Revive Krishi Mahotsav

Reinforce Krishi Mahotsav Approach which should include various activities such as:

- Village level guidance – by agri. Team – once in each season – prior to sowing operations.
- Quality inputs to small and marginal farmers
- Activate MGNREGA–
- Cover all Animal Holders and Fishermen under Kisan Credit Card
- Promote FPOs for Horticulture crops, poultry, dairy products, fisheries & honey etc. one in each block.
- Promote Drip Irrigation, bring flood irrigation to minimum.
- Cleaning of canals, old community ponds, silted check dams etc.
- Village level purchase by MSP and APMC and direct purchase by trade / industry from farmers at farm gate.

Crop guidance based on soil health and moisture analyses.

The Critical Path

- Both Central and State Governments have initiated a series of initiatives – which has restructured the Agricultural Sector.

- Now the role is of the State – District – Village level public administration to implement this. In the arena of Digital Economy, all applications, mutations in land ownership, Extension message – need to be done by digital platform. Farmers need not come to visit offices - Mamlatdar, Taluka Development Officer or Dist. Agri. Office. The Village Panchayat can set up an online system – for all villagers.

- The other stakeholders – private sector – Civil Society – cooperative sectors need to act for opening of the market – provide farmers access to the highest available price and provide information of Demand – where they can sell. Similarly they need to provide advisory for adverse weather events.

- Maximum use of solar based agriculture tools – water pumps – driers and use of solar energy for rural electrification.

- Finally the farmer himself has come to realize available support and opportunities. He and his family need to realize that they have to increase income and for that they will have to adapt to modern technology, implement good and climate resilient practices and produce what the market needs and sell where they get the best price.

- Some critical steps involve – re-introduce Krishi Mahotsav approach to have direct contact with farmers at his door-step. Round the year he may be contacted and communicated through TV networks, radio – social media. But three times in a year the agriculture team needs to visit the village and solve – problems at village level.

- Communications of benefits and opportunities – farmers – but particularly poor farmers who are left out of the development process. District Administration must check that they get first of all available subsidies under different schemes and are re-skilled and up-skilled.

- Strengthen climate related services – use actively local cable TV networks – to provide weather and agro-advisory on a day to day basis.

- Support market operation. Bring private players to directly deal with farmers without middle agents which ensure that there is no glut or excess supply brings down prices. This is very important. Legally this has been done.

We can look forward to 10 per cent growth per annum in the Agriculture Sector and all-round improvement in quality of life at village level. Reduction in Poverty – employment to youth in the non-farm sector.

India emerging as a major supplier in Dairy products, poultry, meat and fisheries – apart from vegetables, fruits and flowers and cereals, spices, edible and non-edible oils, ready to eat food, processed food and beverages, healthy food, organic food, tea, coffee, vanilla so and so forth as major agricultural nation.

India is a major provider of technology related to climate smart and good agriculture.

India's rural society and economy will thrive with smart villages, Atmanirbhar Farmers and with reverse movement by urbanites to stay in villages to enjoy the environment. Rural India will emerge as sustainable – economically, socially and environmentally will be in true sense 'ATMA NIRBHAR'.

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Seven Strategies outlined by the Hon'ble Prime Minister of India, Shri Narendra Modi for Doubling the income of farmers in the country

Strategy	Particulars
Per Drop, More Crop	Big focus on irrigation with adequate budgetary support for achieving the aim of "per drop, more crop"
Soil Health based farming	Provision of quality seeds and nutrients based on soil health of each field
Effective system of Cold-Chain and Warehousing	Large investments in warehousing and cold chains to prevent post-harvest crop losses
Enhancing Value-Add in Farmers' Produce	Promotion of value addition through food processing
National Farm Market	Creation of a national farm market, removing distortions and e-platform across 585 stations
Crop Insurance	Introduction of a new crop insurance scheme to mitigate risks at affordable cost
Ancillary Activities to raise farmer income	Promotion of ancillary activities like poultry, beekeeping and fisheries.

Strategies for Development of Aatmanirbhar Farm Sector of Gujarat

It is imperative to ensure that a 'comprehensive strategy' is in place for development of an 'Aatmanirbhar Farm Sector' in Gujarat. These strategies have been divided into four main sections namely- Agriculture & Horticulture, Animal Husbandry, Fisheries, Agriculture Finance & Marketing. The following are the set of various strategies which are outlined in order to attain the said objective.

A. Agriculture and Horticulture

1. Development of a **'Knowledge Economy'** for the Farm Sector of Gujarat must be undertaken
2. Ensuring **appropriate financial allocation for farm sector** with a balanced approach towards creation of necessary farming infrastructure and adequate support prices for the farmers
3. Ensuring the presence of a **'Residential Gram Sevaks'** in every village in Gujarat
4. Enabling **'Ease of Farming'** through single-window availability of farming related services
5. **Maximising the reach of Sardar Sarovar Canal Network** and ensuring its optimal use for farmers' prosperity
6. Ensuring **effective seed management**
    a. Establishment of **Hi-tech nursery, Plug Nursery, Tissue Culture Laboratory** etc. throughout the state
    b. Developing **adequate storage facilities** for storing quality seeds throughout the year
    c. **Training will be given for seed production** and post harvest handling of quality seeds in different crops
    d. **Exploration of germplasm collection** for **seeds of desi and indigenous varieties / crops**
    e. Intervention of government to be made for **smooth registration and licensing for selling of certified seeds**

7. Creation of an **eco-friendly and cost-effective fertilizers and pesticides ecosystem** for state farmers
    a. **Application of nanotechnology** for improving fertilizer and pesticide use efficiency
    b. Encouraging the **use of Biofertilizers** among the farmers
    c. Developing a more efficient **fertiliser subsidy mechanism** to ensure minimum leakage and maximum benefit for the farming community of Gujarat
    d. Integration of the whole **mechanism of pesticides regulation**
    e. Incentive to **start ups** for **mass productions of bio-rationals**
8. Developing an efficient structure for **certification of seeds for enhanced agricultural productivity**
9. Promotion of **scientific water conservation techniques** with focus on local factors must be carried out
10. **Genetic Resource Management** must be undertaken for varied species of seeds, plants, soil elements etc. across different agro-climatic regions of Gujarat
11. **Promotion to medicinal and aromatic plants:** Intensified research on the development of improved varieties of medicinal and aromatic plants must take place
12. Thrust on **Crop Diversification** must be placed for providing varied avenues of incomes to the farmers
13. **Climate friendly agriculture**: Adoption of climate conducive farming methods must be undertaken and the same must be widely popularised
14. Incentivising the **adoption of global best practices** in agriculture
15. **Promotion of horticulture crops** among farmers:
16. **Real-time weather forecasting data** must be made available to the farmers in a timely and easy-to-access manner
17. **Establishment of laboratories** for mass rearing of identified biotypes
18. **Optimising use of technology** for dissemination of farming related information

19. Developing a **holistic ecosystem for allied services** related to agriculture
20. Developing a **thriving agricultural education system** to farmers of the 21st generation
    a. Developing **world-class agricultural education curriculum** for the youth of Gujarat
    b. **Restructuring of State Agricultural Universities (SAUs)** must be done to ensure that their network is best placed to promote agricultural education in the country
    c. Providing **vocational educational courses** to the farming community which are **need-based and region-specific** for different parts of Gujarat
    d. **Utilising technology to reach maximum number of farmers** through newer means of internet communication
21. **Judicious use of saline water** must be ensured in agriculture and salt affected soils
22. Creating a **vibrant ecosystem for value-addition** to the agricultural crops: Value addition will open up a major avenue for farmers to boost their incomes and also develop employment opportunities for other members of the family, villagers etc. Initiatives to promote the same must be undertaken at grassroots level.
23. Controlled environment farming (**Hi-tech Horticulture**) must be promoted among the farming communities in Gujarat
24. Boosting incomes through **horizontal and vertical integration in the farm value chain**
25. Ensuring **effective management of land fertility (soil health)** through newer innovations in the line of Soil Health Card etc. must be undertaken
26. **Water-efficient cropping patterns** must be incentivised across different regions of the state
27. Promotion of **renewable energy** in farming: Major thrust on solar power, wind power based farming must be placed by creating conducive policies

for the same. Also development of additional sources of income for farmers can take place in this manner.

28. **Empowerment of Nari Shakti:** Training to women for horticulture produce through augmentation of Self-Help Groups (SHGs) networks must be undertaken
29. Development of **adequate and affordable cold storage** infrastructure to ensure safe storage and higher prices for the farmer produce of the state
30. Major thrust on **Skill Development for Horticulture Professionals:** Horticulture requires a set of various skills which must be developed to attract youth to horticulture farming. Developing Skill Development programs must be undertaken for the next generation of Horticulture Professionals in Gujarat
31. Adoption of **'Vocal for Local'** theme in agriculture sector: Major thrust must be laid on promoting the use of desi/indigenous varieties of inputs for farming
32. **Promotion of natural & organic farming:** Organic farming provides a very large market for farmers as the consumers get more aware about the health benefits of such crops and food items. Proper infrastructure in this regard must be created and encouragement to farmers must be given.
33. **Recognising and honouring best farming practices**: Best practices of farming adopted by farmers must be widely popularised (as being undertaken through programs such as Mann Ki Baat).
34. Providing **platforms for scientist-farmer interactions** for cross-dissemination of knowledge: Regular and effective platforms for interactions among the research and the practicing community of agriculture sector in Gujarat must be undertaken

B. Animal Husbandry

35. **Creating a Robust Disease Diagnosis & Animal Health Facilities:** A strong and efficient disease diagnosis system with the presence of health

facilities for different forms of cattle must be developed in every district of Gujarat

36. **Development of Veterinary Dispensaries:** Veterinary Dispensaries Network must be strengthened in the state to ensure better and longer lives of the cattle in the state
37. **Boost to establishment of ICDP & Artificial Insemination Centres**
38. Infusion of **High Genetic Merit Animals** in Cattle Populace: High quality animals must be infused in the cattle population of Gujarat
39. **Promotion of Animal Husbandry among Divyangjan**: Divyangjan community in Gujarat must be made participants in the agricultural community through their participation in the animal husbandry sector.
40. **Self Employment through Dairy Farming**: Large scale creation of self-employment opportunities must be undertaken in the dairy sector.
41. **Boosting Dairy related Infrastructure (Doodh ghars)** through effective allocation of funds for these initiatives
42. **Promotion of Value-Addition in Animal Husbandry:** Further addition of value to dairy products can greatly enhance the incomes of the farming community in Gujarat.
43. **Scientific management practices** for housing, feeding and management of livestock species must be created
44. Promoting **initiatives for conservation and genetic upgradation of indigenous breeds of livestock** and fisheries in collaboration with farmers / farmers‟ groups / cooperatives, etc. must be done

C. Fisheries

45. **Development of suitable varieties of inland fish** in Narmada command areas of North Gujarat must be undertaken
46. **Establishment of inland (fresh and brackish water) fisheries/ aquaculture research station** and training centre
47. **Expansion of Fisheries Information Network** to provide timely and effective information to the stakeholders engaged in fisheries

48. Provide a **boost to private entrepreneurs to manufacture basic and supplemental products** to ensure supply of industrial raw material related to fisheries sector
49. **Mass-cultivate the selected varieties of seaweed** in the open sea to create an industry for the same.
50. Promotion of **Nutri-sensitive Fishing Practices** in Gujarat must be undertaken
51. **Robust educational structure** to create world-class professionals for 'promotion of fishing ecosystem' in Gujarat
52. Using of **Public-Private Partnership (PPP) Model** for promotion of fisheries must be done
53. Promoting skill based training and **dissemination of technologies for improving production in fisheries sector** must be undertake
54. **Attracting rural youth in fisheries sector** through incentives and promotional schemes

D. Agricultural Finance and Marketing

55. Promotion of **Agri-Startup Ecosystem among the Yuva Shakti** through financial assistance, provision of a platform for marketing farm produce, requisite vocational training among others.
56. **Enabling legal status of sharecroppers:** Legal status of sharecroppers needs to be recognized to make them eligible for the government schemes on loan- subsidy without contradicting the existing Tenancy Act
57. **Providing quality training of Extension Functionaries** engaged in agri-financing domain to ensure that the farmers can get latest information about farming practices across the world
58. **Providing credit against farm produce:** The credit sector should provide credit against the farm produce or output rather than land or inputs.
59. **Leveraging the network of Farmers Producer Organisations (FPOs)** for enhancing the reach of agri-credit among the farmers

60. **Effective and timely monitoring of dissemination of agri-credit** to the committed farmers of Gujarat
61. Boosting the **'Ease of Access'- an easy-to-use one-stop agri-financing portal** on the lines of the portal created for MSMEs
62. Developing conducive financing schemes for 'agri-preneurs' of Gujarat: Through value-addition initiatives, agri-preneurs of Gujarat can greatly boost their incomes. Efforts must be made to provide low-cost finance to these farmers who can greatly contribute to enhancing rural incomes and employment.
63. **Demand supply analysis and consumer study** on food products must be undertaken on regular intervals
64. **Interest Subvention for Milch Animals:** To boost the dairy production, interest subvention for milch animals must be provided especially for disadvantaged communities in the state.
65. **Expanding the reach of crop insurance products:** Crop Insurance must be provided to the maximum number of farming community members for income protection of the farming community.
66. Ensuring **timely and adequate payments for Crop Damage** to ensure that crop loss does not push the farmers into the poverty cycle and they can continue to undertake farming in the coming cropping cycle.
67. **Expanding reach for local farm produce in global markets** must be given high priority
68. Development of **world-class agri-marketing courses** through a network of Agricultural Universities in Gujarat must be emphasised upon.
69. **Economic analysis of agriculture diversification**, natural resource management, policy reform and food processing industry must be undertaken on a timely basis.
70. **Maximising the 'Digital Gujarat' mission** to directly connect the 'Farmer to Consumer'

Work Plan

- **Short Term: 2021-22 & 2022-23**

A. Agriculture and Horticulture

1. Effective financial allocation for development of the horticulture sector

For holistic development of the horticulture sector, the following measures can be undertaken in focus areas such as expansion of areas under cultivation, technology intervention, capacity building and infrastructure development.

FOCUS AREA	**UNIT**	**2020-21**	**2021-22**	**2022-23**
		(Planning)		
Financial allocation	Rs. Crore	406.4	440	485
Area expansion	Lakh Ha.	18.3	18.7	19.1
Planting material Infrastructures	No.	473	485	500
Post Harvest Management :-				
Cold Storage capacity	MT	23	23.5	24
Integrated Pack House	No	15	17	20
Skill Development for Horticulture Professional (Through CoEs)	Beneficiary	2000	2500	3000
Training to Women for Value addition in Horticulture produce	Beneficiary	5000	6000	7000

2. Ensuring the Presence of Well-trained and Qualified Manpower for SSNNL Network

Equal numbers of the present posts of Agriculture Wing shall be full-fledged filled-up by appropriate expertise as recommended by the high level experts' committee of SSNNL. This shall help to achieve the smooth functioning of the

secluded agriculture wing and significant progress of pilot development in each of the 13 Agro Climatic Regions by the year 2023.

3. Creating awareness and providing world-class training to the farmers

To create awareness among the farmers for the good quality higher crop production with use of low cost technologies, value addition, storage, grading, packing, marketing etc. under *Aatmanirbhar Bharat* mission through khedut sibirs / seminars / trainings / demonstrations such as with focus on Narmada & other river irrigation command area. Various areas that must be covered during these sessions are:

- Exploration for collection of local and indigenous varieties of important crops (Seed and planting material)
- Training on value addition
- Training on grading and packing
- Promoting natural and organic farming
- Training on preparation of bio-pesticides
- Training on identification of bio agents and mass multiplication
- Training on establishment of micro enterprises.

4. Optimise Use of Technology for Enhanced Agricultural Productivity

  - Sorting out of befitting agro-technologies to enhance socio-economic status of farmers
  - To create awareness among the farming community regarding benefits of judicious use of technologies for utilizing available natural resources.
  - Identification of constraints faced by the farmers in the adoption of available technologies and steps to overcome them.
  - Identification of ways for fine-tuning of existing un-penetrated technologies among farmers
  - Vocational training programmes to farmers in the area like agribusiness management, agro product processing and value addition in crops

- Demonstrating recent technologies for minimizing cost of production and realization of other benefits to the farmers.
- Providing training on preparation of natural inputs for maximizing quality produce.
- Instant solution for farmers' problems viz., crop production, protection, processing, value addition and marketing.
- Imparting hands-on-training for self-reliance in seed, energy and other inputs production for different crops and livestock as well as value addition of agricultural produce to increase farmers' income.

B. Animal Husbandry

5. Development of Veterinary Dispensaries

There is an inevitable additional requirement of Infrastructure and Human Resource for Health and Breeding of livestock in the State, where in particularly at least 100 new Veterinary Dispensaries and 50 new Mobile veterinary dispensaries are required to be established during the next two years.

6. Creating a Robust Disease Diagnosis & Animal Health Facilities

For prompt and accurate diagnosis well-equipped disease diagnosis facilities and other treatment facilities are required to be made available in every corner of the State. Modernization of 99 Veterinary Dispensaries, 10 Animal Disease Investigation Offices and 20 Veterinary Polyclinics has to be carried out in the next two years to expand and strengthen Animal Health Services of state.

7. Boost to establishment of ICDP & Artificial Insemination Centres

It is also envisaged to establish 2 new ICDP and 250 New AI Centres. Newly constructed FSS at Bhutvad and Mandvi are to be made operational during next two years which requires additional technical staff and supporting staff apart from existing sanctioned staff along with necessary infrastructure.

8. High Genetic Merit Animals

Production of 47 Lakh Frozen Semen Doses and 2.50 Lakhs Sexed Semen Doses is estimated during the next two years at Government Frozen Semen Stations.

9. Promotion of Individual and Institutional level Beneficiary Schemes

A wide range of individual and institutional beneficiary schemes are playing an instrumental role in overall development of the Animal Husbandry sector in the state. During next two financial years, target of various multifaceted scheme will be as follows;

A. **Interest Subvention for Milch Animals:** Interest subvention for approximately 13000 milch animals will be provided
B. **Construction of Cattle Sheds:** Assistance will be provided for construction of cattle sheds to 630 beneficiaries.
C. **Promoting Fodder Production of Livestock:** Approximately 1,03,000 fodder minikits of improved variety will be distributed to promote fodder production for livestock.
D. Assistance will be provided to 4000 beneficiaries for purchase of power driven chaff cutter
E. **Providing Cattle Feed for Pregnant Animals:** Approximately 1 Lakh beneficiaries will be covered in providing assistance for cattle feed for pregnant animal and 2.50 lakhs beneficiaries will be covered in providing assistance for cattle feed for each calving animal
F. **Promotion of Animal Husbandry among Divyangjan:** Assistance will be provided for 2260 units of 10 +1 Goat, 10,000 units of 25 RIR/Kadaknath, 400 units of 40 RIR birds to Divyangjan and 1000 units of 50 RIR/Kadaknath along with necessary training of poultry farming
G. **Self-Employment through Dairy Farming:** To promote self-employment through dairy farming, assistance will be provided for the establishment of 3000 units of 12 milch animal farms and 50 units of 50 milch animal farms.

H. **Boosting Dairy Infrastructure:** To strengthen dairy cooperative structure of state, assistance will be provided to village dairy cooperative societies for 1742 automatic milk collection system, 517 bulk milk cooler, 2763 milk adulteration detection machine with approval of Government of India under National Programme for Dairy Development

I. **Construction of Dudhghars:** Construction of 460 Dudhghar/Godowns for village dairy cooperative society will be assisted by the Government of Gujarat.

J. **Promotion of Value-Addition in Animal Husbandry:** Projects of assistance for establishment of new 3 paneer plants, 1 cold storage for butter will be taken up upon approval under Rashtriya Krishi Vikas Yojna. Approved projects of assistance for 02 Milk Processing Plant to milk unions of state are planned to be completed by 2023.

K. **Organising District Level Awareness Programs:** It is planned to organize 132 district shibirs with 400 participants in each shibir. Similarly, 496 taluka shibirs will also be planned with 300 participants in each shibir. Scientific animal husbandry and breeding practices will be taught and literature for the same will be provided to each participant free of cost to participants in these shibirs. Participants will also be guided for various beneficiary schemes.

L. **Recognition of Best Practices in Animal Husbandry:** Total 1130 best livestock owners of the state will be offered an award to recognize and appreciate best practices followed in various aspects of animal husbandry and dairying. “Prerna Pravas” will also be organized covering approximately 12,400 livestock owners.

10. Boosting the Agro-Educational Curriculum in Gujarat

In 2021-22 the university shall design new Short term and PG courses, the place shall be identified for the center of Incubations and training and webinars shall be conducted whereas in 2022-23 the courses which were designed shall be started

and global classroom concept shall be executed through international universities tie up.

11. Ensuring large-scale certified seed production

season	Year 2019-20 (Actual)		Year 2021-22 (Targeted)		Year 2022-23 (Targeted)	
	Area Registered in Hect.	Quantity certified in Qtls.	Area Registered in Hect.	Quantity certified in Qtls.	Area Registered in Hect.	Quantity certified in Qtls.
Kharif	32462	431393	41800	543400	44980	597740
Rabi	41605	892881	44110	990168	46521	1089184
Summer	6395	69271	2858	17480	3144	19228

12. Undertaking effective training and extension activities (by SAMETI and ATMA)

SAMETI Activity 10 year Road Map		(No of Trainees/Officers)	
Sr No	**Activity**	**2021-22**	**2022-23**
1	Training of Extension functionaries	800	900
2	Exposure Visit of Officers	110	100
3	E-Tech Packages (No.)	22	26
	Total	**932**	**1026**

ATMA Activity		(No of Beneficiaries)	
Sr No	**Activity**	**2021-22**	**2022-23**
1	Training of Farmers	800	900
2	Exposure Visit of Officers	110	100
3	E-Tech Packages (No.)	22	26
4	Exhibition/ Kisan Mela	56,700	59,500
5	Farmer-Scientist Interaction	3,000	6,300
6	Field Days/ Kisan Gosthi	65,800	69,000

7	Farm School	52,000	55,000
8	No of Farmers in FIG's	48,000	51,000
9	No of Farmers Awards	560	625
	Total	**5,31,110**	**5,61,925**

Infusion of Technology in Training and Extension		**(No's)**	
Sr No	**Activity**	**2021-22**	**2022-23**
1	Kisan Call Center (No of Calls)	1,45,000	1,65,000
2	BISAG Programme	40	42
3	No of Text Message (Portal)	9	10
4	Social Media (FB/Twitter/etc.) No of Post	25	35
5	No of Publications (Book, Leaflets, Handbills Folder)	5	7
	Total	**1,45,079**	**1,65,094**

Sr No	**Activity**	**2021-22**	**2022-23**
Natural Farming -10 year Road Map		**(No of Beneficiaries)**	
1	Rs.900/Monthly subsidy for the maintenance cost of one indigenous cow to a farming family doing Natural Farming	1,93,000	1,93,000

Part 2: Strategic Overview and Roadmap for Aatmanirbhar Farm Sector of Gujarat

1. Directorate of Agriculture

Gujarat is located on the western coast of India with an area of 196,024 km^2. Gujarat is known for its industrial growth in the country though Gujarat state creates an identity of agricultural prosperous state with adoption of latest technology and achieving highest production. Gujarat is classified in 8 (eight) agro climatic zones with an average rainfall of 831 mm albeit distribution of rainfall is not uniform as rainfall varies widely from 250 mm to 1500 mm across various zones. Gujarat has 50% of its total geographical area under cultivation. Gujarat is known as an arid and semi-arid region as its 58% area falls under this category. Net irrigated area in the state is 48.38 lakh ha. which are being efficiently utilized through micro irrigation technologies, water harvesting and water conservation programme resulted in increment in the Gross Irrigated Area.

Gujarat has a diversified crop basket balanced with high value crops as well as nutritional security. Cotton is an important crop of the state which contributed 25% of the net sown area. Oilseeds are also dominating in state cropping patterns with acreage of more than 28 lakh ha. Food grain area contributed 41 lakh ha. with a fast increasing pulse area. Horticulture emerged very well in the state cropping pattern. State's diversified cropping pattern is well aligned with agro climatic conditions as the state ranked top position in productivity of major crops in the country. State contributed 95% Castor, 76% Fennel, 56% Cumin, 44% Groundnut and 31% Cotton in the country's total production which are evidential of state agriculture performance.

The agriculture sector represents all the strata of society and agricultural development in the state prospers all the stakeholders without regard to their social and economic status. The Directorate of Agriculture is mandated for the same which is being tackled through their multi-dimensional activities including extension, pest surveillance, input supply management, enactment of agriculture inputs related acts, incentivizing agriculture and agriculture statistics.

Agriculture is dynamic in nature and diligently aligned with changing climatic and economic situations. To overcome the changing climatic conditions and match pace

with changing economic situations, there is a need for a long term vision with a line of action supported by well-articulated situation analysis.

Diversified agro-climatic zones, entrepreneurial farmers, well-developed infrastructure, co-operatives, electricity supply, ample solar and wind energy round the year are the key strength in the state agriculture which supported robust agriculture while 58% arid and semi-arid area, declining land holding, price crashing, inadequate extension machinery, poor extension infrastructure, inadequate processing facilities are the weakness in agriculture sector need to address properly to sustain agriculture business in long run. Agri. export zone, IT network, solar energy, consumer preference, organic inputs, warehousing chain, weather based advisories, summer cultivation, waste land/ problematic land development are the opportunities to catch for sustainable agriculture development. Inadequate rainfall, market fluctuation, depletion of water table, younger generation preferring urban employment and agriculture sector not getting due credit in spite of achieving food security are the some threats that need to be addressed timely and properly to retain interest and confidence of farmers community in agriculture.

Keeping in view of the scenario, the department envisaged the vision for ecological, economical and social sustainability. To achieve these goals, focus areas are derived which includes Sustainable Production System, Decrease in cost of Production, Input Supply Chain management, Database Management, Delivery Mechanism and Institutionalization of Farmers. Focus area for Roadmap of Agriculture 2030 framed with vision to support agriculture in range of INPUT to OUTPUT. It was drafted with ideological inclination which supports the decision system in achieving the goal.

Strategies identified for agriculture development are broadly classified in four categories viz; (i) extension (ii) delivery (iii) resources and (iv) profitability. Strategies under the umbrella of extension includes extending the reach to the farmers through residential Gram sevak concept in each and every village, Single window at block level which facilitate all agriculture facilities available at taluka level, Skill up gradation for farmers as well extension functionaries to keep pace with recent development and Input quality advisory with support of ICT to make farmers aware in wise selection inputs. Technological involvement for precision farming, UAV etc. supported by Startup

promotion, Input Supply & Quality Control backed by dedicated agriculture inspector per taluka, laboratories and IT based vigilance system, Ease of claiming Crop Insurance & Quick relief in crop damage through auto mechanism for crop loss assessment and payment are the key strategies to improve delivery mechanism in agriculture sector. Involvement of scientific assessment and management in Nourishing natural resources, Analysis based nutrient and crop recommendations, Climate resilient Agriculture, efficient and maximize use of Canal Command Area are the key strategies for resource management. Profitability will be achieved through creation of market intelligence, permanent structure for operation of PSS, storage chain and promotion of value addition, export and non-farm income.

Crop production is the ultimate output in the agriculture sector. More than 100% growth in pulse area and 200% growth in pulse production, more than 75% production growth in cereals and oilseed crops with approximate 30% growth in their area and sustaining the cotton production although 25% reduction in area are the quantifiable outcome to be achieved up to 2030 through following the path articulated in vision document.

2. Directorate of Horticulture

Background

Cropping system of the state is diversifying towards horticultural crops. Considerable growth in area coverage and production has been observed in the last fifteen years. Area and production of horticultural crops has increased by 66% and 103 % respectively. An average 4.5 % annual growth has been achieved in area expansion of Horticultural crops during this period. Considerable areas have been diversified towards horticulture in the Arid and Semi-arid region in recent years. Area under total horticulture crops in the state during the year of 2019-20 was 18.3 lakh ha. With the contribution of fruit crops (4.46 lakh ha.), vegetables (6.54 lakh ha.) and spices crops (7.09 lakh ha.) State contributes 9.24 % share in national fruit production. 6.65 % in national vegetable production and 12.07 % in production of spice crops.

Key Findings

Production of Horticultural crops is technology and skill driven. There is a good scope of area expansion of fruit crops as arid and dry land horticulture. Cultivation of fruits and vegetable crops have good potential for processing and export. Government supports area expansion, technology intervention, capacity building and infrastructure development for horticulture. Emphasis has been made on development for quality planting materials, Skill development and support to précised crop production systems and post-harvest management technologies.

Issues

Availability of quality planting material in required quantity, higher initial investment for cultivation, perishable nature of farm produce, lack of proper Know-how and crop production skill of farmers, shortage of skilled labours, inadequate specialized marketing infrastructure support.

Challenges

Development of horticulture plantations in Rain fed and problematic soils is the major challenge. Being a high investment sector risk management against natural calamities is another important aspect. Small scale cultivation and limited farmers institution, fragile Value chain, Unorganized retailing, increase in investment for processing and export infrastructures, ensure availability of Quality Nursery plants, development of export and processing clusters, promotion of Floriculture, residue free production and certifications are the major challenges. Lack of required horticulture extension machinery at department level are the major limitation for the development of the horticulture sector in the state.

Strategies and future line of action

The Department of Horticulture has adopted an End to End Approach for support to the sector right from planting material to marketing support for development of Crop Clusters. Introduction of New Crops and Varieties, Utilization of nonconventional area
and diversification of cropping pattern, Providing Infrastructural support for Good Planting Material along with support to Technologies like Micro-Irrigation, Mulching, Fertigation, use of Tissue culture plants, High density plantation, Rejuvenation of old orchards are the major strategies for development.

Major emphasis shall be made on Skill development of farmers and farm labourers, Support FPOs for Post-Harvest Management, Increasing area under high yielding and high value crops, Strengthening of Horticulture Extension system, PPP on creation of Farm advisory services, Development of Export and Processing clusters, Promotion of floriculture Industries

Road Map and Plan of work

- Area-Production and Productivity enhancement plan of horticulture crops. Baseline and tentative projections.(Area., Production. , Productivity in)

Sr	Year	Area (Lakh Ha.)	Production (Lakh MT.)	Productivity (Mt. /Ha.)
1	2019-20	18.30	237.83	13.00
2	2024-25	20.20	305.00	15.00
3	2030-31	22.75	410.00	18.00

- Transfer of technology (Horticulture Extension Plan)
  - Development of Horticulture centers of excellence at district level
  - Emphasis on demonstrations on Hi-tech Horticulture
  - Skill development of Horticulture entrepreneur trainings for youth farmers and horticultural labors
- Post-harvest handling and value chain
  - State produces 224.91 Lakh MT fruits and vegetables. 5-10% off farm losses in field crops and 25-30% in horticulture crops. It is targeted to reduce crop losses up to 7.5 % by year 2022 and by 5 % till year 2030.

Policy Suggestions

- Medium termed production loan for perennial Fruit crops as per interest rate of Crop loan
- Encourage cultivation of fruit crops at public institutions, Green zone and afforestation
- Support farmers for large scale cultivation of horticultural crops
- Lease Land can be provided to FPOs for PHM Infrastructure at production clusters
- "*KhedutGrahak Bazar*" in urban and semi urban areas
- Establishment of Fruit and Vegetable supply chain on AMUL model
- Dedicated space in Urban planning for retailing of Fruits & Vegetables
- Introduction of Nursery Act

Particular	UNIT	2020-21 (Planning)	Year 2021-22	Year 2022-23
Financial allocation	Rs. Crore	406.40	440.00	485.00
Area expansion	Lakh Ha.	18.30	18.70	19.10
Planting material Infrastructures	No.	473	485	500
Post-Harvest Management				
Cold Storage capacity	MT	23.00	23.50	24.00
Integrated Pack House	No	15	17	20
Skill Development for Horticulture Profession (Through CoEs)	Beneficiary	2000	2500	3000
Training to Women for Value addition in Horticulture produce	Beneficiary	5000	6000	7000

3. Directorate of Animal Husbandry

❖ Current Situation:

- Gujarat possesses 27 registered breeds of livestock out of total 197 registered breeds of India.
- As per recent livestock census data, Gujarat harbors 2.69 crores of livestock contributing 5.01 % of total livestock population of India.
- In 2018-19, Gujarat stood at 5th Position with 7.72 % contribution to the country's total milk production of India.
- In Gujarat, productivity of buffalo, indigenous cow, crossbred cow and goat has increased by 35%, 48%, 28% and 37% respectively during the last 19 years.
- Share of the livestock sector alone in Gross State Value Added (GSVA) is 3.31% and the livestock sector has a contribution of 29.6% to the collective share of GSVA of crops and livestock.

❖ Current Issues:

1. Need of expansion of livestock health and breeding services in the state in terms of infrastructure and human resources
2. Livestock owners give inadequate attention to the feed and fodder aspect (actually it is 65-70 % of expenditure of production) and many livestock owners are still following conventional breeding practices and have negligence to timely vaccination regimen.
3. Low milk productivity as compared to developed countries is also leading to high cost of production.
4. Less attention of livestock owners towards milch animal by-product utilization and less value addition also contribute to being less profitable.
5. Lack of ease of credit facility for livestock is still a major issue where livestock keepers are still out of reach to good credit support.
6. Animal Husbandry has been adopted as a supplementary income source and not as the primary source because still household rearing of animals with minimum input is preferred.

7. Due to lack of disease free zones, export potential for many livestock products primarily milk and milk products is hampered particularly to developed countries.
8. Higher cost of feed and fodder for animals is also an issue which needs to be addressed with policy intervention and by providing adequate assistance to individual livestock owners.
9. Lack of awareness among farmers for the concept of clean milk production should be overcome.
10. Non-dairy livestock such as goats, Sheep, camels, horses and donkeys need to be explored for their potential economic utility.

❖ **Suggested Strategy:**

1. Expansion of animal health and breeding coverage through establishment and mobilization of veterinary institutes and artificial insemination (AI) centres
2. Devising technologies for rapid diagnosis and accurate forecasting of diseases and nutrient deficiency will also play a critical role in increasing production/productivity of livestock.
3. Encouraging livestock owners towards scientific livestock keeping by providing appropriate assistance and extension will also aid in increased production and productivity of livestock
4. Preservation and Propagation of indigenous livestock with inclusion of sophisticated technologies like sex sorted semen, embryo transfer
5. Application of newer technologies and newer modes of communication need to be dovetailed with existing schemes in the field of extension activities to make it more effective and result oriented.
6. More lucrative incentives can be provided for Non Dairy activities – like goat rearing, poultry keeping, to especially small farmers and SC/ST people, as non-dairy activities not only diversify the livestock sector but also cater the needs of sections of society who cannot rear dairy cattle due to socio economic conditions.
7. Formulation of focussed breed specific programme especially for conservation and propagation of indigenous breeds of cattle and buffalo

8. Implementation of heifer rearing programme to encourage livestock owners for rearing heifers instead of procuring well grown livestock (especially cross bred cattle) from other states to prevent entry of disease with those livestock.
9. Incentivize rural fodder entrepreneurs and encourage farmers to produce fodder as cash crop to counteract fodder deficient status of state, so as to have availability of green and dry round the year. Utilization of wasteland for fodder
10. Coverage of AI in Gujarat is lesser as compared to Haryana, Punjab, Karnataka, Tamilnadu, Kerala: target should be to expand AI coverage in the coming 3 years/next decade.
11. Up-gradation and improvement of indigenous cattle of Gujarat as Large no of ND Cattle is available in the state. ND Cattle population should be upgraded by use of semen of pure Indigenous cattle.
12. Formulation and implementation of mastitis control programme; as economic losses due to mastitis in the livestock sector is as high as FMD and Brucellosis. Addressing reproductive diseases and reproductive disorders.
13. Educating farmers about the importance of cleaning/washing of hands before touching udder and not allowing animals to sit just after milking for 30 minutes.
14. Infertility among crossbred males: there is need to identify parameters for forecasting
15. 5.44% of buffalo, 4.42% of Exotic/Crossbred cattle and 5.35% of indigenous cattle have never calved in their life even though they are breedable: making them to calve once
16. There is a need to develop electronic doors to detect estrus/heat and cow side test to detect pregnancy; tools of early detection of sub clinical mastitis
17. Reducing the puberty age buffalo especially through nutritional intervention
18. Developing indigenous technology for sorting of semen to reduce cost of production of sexed semen doses.
19. Focussed work should be done for prediction of fertility of male/female calf at early age and extending shelf life off milk
20. Exploring therapeutic and nutritional potential of non-bovine milk in Gujarat having all species available in the state.

❖ **Work Plan 2021-22 & 2022-23**

- Establishment of 100 Veterinary Dispensaries and 50 Mobile Veterinary Dispensaries
- Modernization of 10 ADIOs and 20 Veterinary Polyclinics and creating facility of Ambulance Van for 10 Veterinary Polyclinics
- Establishment of 2 new ICDP and 240 private AI centres
- Making 2 newly established frozen semen stations operational.
- Production of 47 Lakhs Frozen Semen Doses and 2.50 Lakhs
- Providing interest subvention for approximately 13000 milch animals
- Assistance for construction of 630 cattle sheds
- Distribution of approximately 1,03,000 fodder minikits of improved variety
- Assistance for cattle feed for 1 lakh pregnant animals and 2.50 lakhs calving
- Assistance for purchase of 4000 power driven chaff cutter
- Assistance for 2260 units of 10 +1 Goat
- 10,000 units of 25 RIR/Kadaknath, 400 units of 40 RIR birds to persons with disabilities and 1000 units of 50 RIR/Kadaknath along with necessary training of poultry farming
- Assistance for 3000 units of 12 milch animal farm and 50 units of 50 milch animal farm
- Assistance to village dairy cooperative societies for 1742 automatic milk collection system, 517 bulk milk cooler, 2763 milk adulteration detection machine, 460 Dudhghar/Godowns
- Assistance for 3 paneer plants, 1 cold storage for butter and assistance for 02 Milk Processing Plant to milk unions
- Organization of 132 district shibirs with 400 participants in each shibir and 496 taluka shibirs with 300 participants in each shibir
- Offering award to 1130 best livestock owners and organization of Prerna Pravas" for 12400 livestock owner

❖ **Policy Suggestions:**

- Formulation of state livestock policy covering minimum requirement and standards of livestock health, breeding and extension.
- Formulation of comprehensive policy to encourage dairy activities in Saurashtra and Kutch regions
- Providing status of agriculture to poultry and livestock farms for land, electricity, taxes etc.

❖ **Outcome of strategy:**

Particular	**Current**	**2030**	**Remarks**
Coverage of per Veterinary Institute (No. of Livestock Unit)	17,550	10,000	By establishing 900 new Veterinary Institutes by 2030
Coverage of per AI Centre (No. of Breedable Population)	1,101	1,000	By establishing 926 new AI Centres by 2030
Annual Milk Production (Lakh MT.)	152.92	217.00	Increment of 6.45 MT Milk Production at every year
Productivity of Indigenous Cow (Kg/Day/Animal)	4.65	5.50	With increase of 18 %
Productivity of Buffalo (Kg/Day/Animal)	5.39	6.50	With increase of 21 %
Productivity of Crossbred Cow (Kg/Day/Animal)	9.32	11.00	With increase of 18 %
Milk procurement under Cooperative (LLPD)	200	320	With increase of 31 %

4. Sardar Sarovar Project Command Area

1. **Introduction :** The Ministry of Agriculture & Farmers' Welfare has taken several initiatives and key reforms in agriculture in the recent past. Also, the Government has committed 'Har Khet Ko Pani' and 'More Crop Per Drop' through PMKSY. Agriculture has been the common occupation of over half of the population of Gujarat and the availability of water has been the limiting factor for agriculture sector for years.The Sardar Sarovar Project is one of the largest multipurpose water resources project of India shared by four major states – Gujarat, Maharashtra, Madhya Pradesh and Rajasthan. Its command covers an area of 18.55 lakh ha covering 3177 villages in 77 talukas of 17 districts. The 'Narmada Planning Group' has worked for years and envisaged visionary plans for the enhancement of 'Irrigation Intensity' and the 'Water Use Efficiency'. The canal network up to sub-minor is developed in 14.92 lakh ha and the remaining area is planned to be completed by December, 2021. But very few WUAs are functioning. Hence, actual realization as against the envisaged is quite less.
2. **Potential strength for ATMA NIRBHAR KRUSHI:** Sardar Sarovar Project is a Lifeline of Gujarat as it provides multiple benefits like-Drinking and industrial water supply, Vast lined canal network, large catchment contributing runoff, wide scope of generating green energy and have excellent scope of growing variety of high value crops.
3. **Issues :** Water logging and soil salinity are two major issues. None of the 'Water Users' Association' has taken over canal management as envisaged, the farmers are practicing more water intensive crops and applying excessive chemical fertilizers which may cause soil degradation in future, in poorly drained flat lands limited water allowance has been planned which is absolutely not followed by the farmers nor could the system be provided, the estimated average delta at field level is about 330 mm which itself is a great challenge and difficult to achieve, non-realization among the farmers of water as a precious commodity, the cases of excessive seepages are observed randomly in entire command area, inherent soil salinity exists in the major area, there is acute

shortage of staff having concerned expertise for farm level development, and direct lifting from the canals becomes normal practice among the farmers in head reaches.

4. **The strategies for mitigation of the issues** -Reclamation of Problematic Lands; Construction of Field Drainage System; On-farm Development Practices to Enhance WUE; Water Resources Management at Farm Level; Adoption of Micro Irrigation System; Soil Health Management and Organic Farming; On-farm Use of Non-Conventional Energy; Economic Activities by FIGs/ WUAs and Development of Water Distribution Network are the strategic mitigation measures. Activity wise tasks and expected outcomes are derived. Enhancement of irrigation intensity and wue are the key tools to be achieved to empower the farmers and to educate them such as to create a sense of ownership among them. Creating augmented sources of water on farms and providing a foolproof system for controlled distribution are the key solutions. There is a strong need for development of Decision Support System (DSS) for scientific decision making and automation in water distribution up to possible extent for efficient management of irrigated agriculture.
5. **Work plan 2021-23**-To undertake proposed activities comprised of- the may be initial implementation by undertaking all the activities in each of the 13 Agro-climatic regions on pilot basis; to achieve smooth functioning of secluded set up and significant progress of pilot development in each of the 13 Agro Climatic Regions by the year 2023.
6. **Potential Outcomes**-The cropping pattern in the command has witnessed a major shift towards high value crops like cotton, castor, pulses, spices, fruit crops, vegetables. Increase in processing industries like ginning and pressing, seed crushing, flour and rice mill, sugar and groundnut oil milling generated employment and the mechanization in agriculture will boost the Agro-based industries, which ultimately provide opportunity to micro-entrepreneur under the Agro MSME scheme in the state.
7. **Policy suggestions-** There is a need to provide regular manpower at village level to guide and boost the beneficiaries to adopt participatory irrigation

management, and farmers have to accept their responsibility and become a member of WUA. There is a wide gap and spatial variations between the irrigation potential created and actual irrigation that takes place. Also, there is a need for a change of farmers' mind-set from 'more water more yield' to 'precise irrigation more yield'. Require a system to incentivize and shift the farmers' behaviour towards adaptation of new technologies. There should be a single authority to look after in dealing with the farmers in all aspects. The specific condition of the command area requires certain strategic actions for which the expertise of agricultural engineering should be utilized for holistic approach.

A high level experts' committee constituted by SSNNL has recommended Creation of a secluded set up and cadre posts to use the expertise of Agricultural Engineering. To fill-up equal numbers of the existing vacant posts first on contractual basis to start the recommended strategic activities. On achievement of smooth functioning by the set-up, it should be provided with an appropriate additional setup of 300 posts of Agricultural Engineers and 186 posts of 'Field Technicians'. Subsequently, all responsibility of minor and below be transferred.

8. **Conclusion**-The productivity enhancement in the irrigation project commands is becoming essential considering huge investment incurred so far. The situations of other command areas are also more or less similar to SSP commands. In the context of change in agriculture under the influence of climate change, the use and application of engineering is a need of time. The majority of the schemes of various departments for the benefits of farmers are pertaining to agricultural engineering. Merging these schemes will facilitate the farmers in ease of availing benefit. Large numbers of agricultural engineers are contributing in the services of the states namely Tamil Nadu, Odisha, Madhya Pradesh, Rajasthan etc. Hence, it is high time to create a secluded set up in Gujarat also specifically w.sp.r. to productivity enhancement in irrigation commands by undertaking the strategic activities as discussed on priority for farmers' welfare by creating resilience in agriculture.

5. Anand Agricultural University

Atma Nirbhar technological approach & policy suggestion from Anand Agricultural University for small / marginal farmers of middle Gujarat

Executive summary

The Anand Agricultural University has been making incessant efforts since its inception to achieve excellence in pursuit of its mission to provide teaching; research and extension education services related to agriculture and allied sciences to develop excellent human resources and innovative technologies for services to the farming community with the motto of making Gujarat and India agriculturally prosperous.

Considering the tribal area, *Bhal* area (rainfed) and area under *desi* cotton in the jurisdiction of Anand Agricultural University, 7 important crops have been identified viz. Maize, *Bhalia* wheat, Ginger, Turmeric, Soybean, Banana and *desi* cotton to envisage future challenges under *Atma Nirbhar* Bharat Mission

Current status

Currently maize, ginger and turmeric are grown in tribal areas, where small and marginal holdings are relatively more, therefore, need to develop indigenous technology based on local need. *Bhalia* wheat is a GI (peculiar) crop of the state, which has no special value added products. Soybean is a newly introduced crop in the state. Bananas need proper transportation and marketing. *Desi* cotton needs special attention to increase the area under cultivation.

Sr. No.	Crop	Average productivity	Potential
1	Maize	1780 kg/ha	7000 kg/ha
2	Bhalia wheat	1000 kg/ha	1600 kg/ha
3	Ginger	15 t/ha	25 t/ha
4	Turmeric	20 t/ha	22 t/ha
5	Soybean	675 kg/ha	2200 kg/ha
6	Banana	60 t/ha	100 t/ha

7	*Desi* Cotton	325 kg/ha	925 kg/ha

Current issues

1. Poor adoption of good agricultural practices
2. Unavailability of quality / pure seeds and dominance of private varieties
3. Inadequate storage facilities and reuse of own seeds
4. In adequate value addition
5. Lack of organized Agricultural Marketing
6. Inefficient use of local resources and indigenous technologies like BPKP
7. Lack of multiple technologies usage package for small and marginal holding farmers to support livelihood

- **Suggested strategies**

Following strategies will be adopted for above mention 7 crops for increasing productivity and following of GAP

1. Up scaling seed enhancement into designer seed treatment technologies with improved local seed varieties and botanical pesticides prepared by farmers
2. Management of various insect-pests by using bio-control agents
3. Population dynamics of major insect pests and Integrated Pest Management (INM) efforts
4. Bio control of diseases of crops and Integrated disease management (IDM) strategies
5. Increasing water use efficiency through adaptation of micro irrigation system and developing low cost technologies for in situ moisture conservation
6. Integrated farming system for sustainable income to small and marginal farmers with seven strategies given by Hon. Prime Minister for doubling farmers income
7. Technology for improvement/ restoration of soil health, organic Carbon and productivity of all crops, Nutrient management through use of farm waste and Nutrient management through testing of microbial strains

8. Germplasm maintenance and utilization of *desi* and indigenous seeds and breeding for yield and quality improvement with use of farmer's experiment
9. Seed viability enhancement through advance priming and pelleting technologies for low volume and high value seeds and high volume low value seed, Effective management of stored grain pests
10. Human resource development for seed production and promotion of agri-preneurship in rural area, seed village hub in endemic pockets & clusters
11. Strengthening of local market and promotion of e-marketing

- **Work plan 2021-22 and 2022-23**

Year 2021-22

To create awareness among the farmers for the good quality higher crop production with use of low cost technologies, value addition, storage, grading, packing, marketing etc. under *atma nirbhar* bharat mission through khedut sibirs/seminars/trainings/demonstrations such as with focus on Narmada & other river irrigation command area

1. Training on value addition in banana, soybean, ginger turmeric and other crops to earn more by farmer's group
2. Training on grading and packing of *Bhalia* wheat, ginger turmeric, banana soybean and other crops like internationally famous Basmati rice of India
3. Promoting natural and organic farming in selected 7 crops in middle Gujarat through strengthening of farm advisory service through use of different social media

Year 2022-23

- Policy suggestions to policy makers – Promotion to agri-startups and incubation for students & farmers
- Adoption and implementation of university technologies by Government of Gujarat

- Establishment of micro enterprise at village level

- **Policy suggestions – if any**

  Technology support to small and marginal farmers for establishment of storage facilities, value addition practices and related fund support etc.

- **Outcome of strategy**
  - Adoption of good agricultural practices will increase crop productivity and conserves agro-ecology
  - Value addition will increase an employment and income of small & marginal farmers
  - Establishment of micro enterprises at village level with involvement of rural youth & women through KVK in selected clusters for leading towards doubling farmer's income motive

7. Junagadh Agricultural University

Current Issues related to Agricultural Development in Saurashtra region:

Economical

- Market prices of farm produce are so volatile and unrealistic.
- Terms of trade for farmers with respect to that of non-farmers are often so low.
- The price spread of a commodity is highly skewed in favour of middlemen or intermediaries over the farmers.
- Escalating cost of cultivation and low productivity.
- Inadequate farm credit matching the requirements of the farmers and credit disbursal often not farmer friendly.
- Cumbersome procedure for farm product exports, processing and organic certification.
- Limited cooperative and dairy sector in this region.

Infrastructural

- Severe shortage of agricultural labourers.
- Insufficient irrigation facilities.
- Inadequate electricity and unsuitable timing for agricultural operations. Inadequate and poor quality rural roads and transportation facilities.
- Large scale availability of spurious inputs on seeds, pesticides, growth regulators, fertilizers and other agro-chemicals.
- Flooding of the market with unstandardized and unscientific organic inputs. Lack of processing and value addition at community/village level.
- Insufficient storage facilities for seed and farm produce at local levels.

Natural and Technological

- Serious problem of vertebrate pests.
- Outbreak of new pests, diseases and weeds.
- Deteriorating level and quality of groundwater.
- Salinity ingress in coastal areas.
- Contamination of soil and water due to industrial pollutants.
- Depletion of soil organic carbon
- Increasing farm risks due to climate change.
- Continuous decrease in farm-holding size making them untenable for investments.

Strategies and work plan-2021-22 and 2022-23

Current Situation/Status	**Suggested Strategies**	**Work plan 2021-22 and 2022-23**	**Outcome**	**Policy suggestion**
• Produced breeder seeds/ foundation seeds on state and central indent. • Certified and truthful seeds. produced and supply to farmers • ICAR seed Hubs on groundnut and pulse crops. • Recently	Production and supply of improved seeds of different varieties of field crops	• Planning of seed production programme for newly developed and under cultivated varieties. • Conducting more demonstrations of variety have specific characteristics like oil content, salt & climate tolerant, fortified on farmers' fields for awareness and make self-	• Farmers are able to reduce purchase costs of seeds, obtain higher yield and price of produce and minimize risks.	• Provision of funds for additional demonstrations.

released high yielding variety GG 32 in groundnut, G.Til 5 in sesame, fortified GHB 1129, GHB 1225, GHB 1231in pearl millet, GW 173 (Early maturity, late sowing, heat tolerance), GW 11 (Restricted irrigation, late sowing), GW 451 (Yield and grain quality), GJW 463 (High yield early sown, heat tolerance), GW 499 (late sown) in wheat, GU-2 in urd bean, GJP-1 in pigeon pea, GG 5 (irrigated) and GG 6 (Conserved moisture) in chickpea.

sufficient for seeds.

- Decided target of demonstrations and seed production on demand, fund & land availability.
- Arranging selling units at local level research stations/KVKs to reduce traveling/transportation expenditure of farmers.

Productio -

• Kesar mango (GI 185) is a popular and export quality variety in this region. • Sonpari and Amrapali varieties are suitable for this region. • Canopy management and HDP technologies are more useful for quality yield produce. • GJP-1 is the high yielder variety of papaya, which is dioecious in nature and high fruit set even during summer. • Produced & supply of seeds and seedling of GJP-1	n and supply of plating materials of horticultural crops	• Increasing production of planting materials (Grafts/seedling/seeds) of different cultivated and newly introduced crops/varieties and supply to stakeholders at a cheaper rate. • Propagating low cost production technologies like bahar treatment in guava, lime, pomegranate, custard apple etc., off seasonal production, spraying of growth regulators, bio-enhancers and micronutrients. • Awareness programme on HDP, rejuvenation and canopy management to obtain more fruit yield per unit area	• Reduce cost of planting materials, fertilizers and agro-chemicals. • Higher yield and better market price.

• Developed 35 ha elite farm for DxT hybrids of coconut and 15 ha under development. • Produced about 40,000 seedlings of coconut in which 8000 TxD hybrid and 14000 DxT hybrid. • Produced and sold banana seedlings through tissue culture. • Developed GJCA-1 variety in custard apple. • Introduced fruit crops like dragon fruit, apple ber, apple, Italian lime, atemoya, black pepper, vanilla, saffron, *Meliadubia*, sandalwood, etc.		and minimize pests & diseases problem and removal of old mango trees.		

• Developed 26 varieties/hybrids in brinjal, tomato, okra, onion, garlic, Indian beans, sponge gourd and ridge gourd. • No marketing seed chain for vegetables in Gujarat • Made non-exclusive license agreement with three private agencies for production and marketing of vegetable varieties. • Produced and marketed seeds of vegetables to farmers directly.	Production and supply of seeds of vegetables	• Increasing production and supply vegetable seeds and sapling. • Arranging selling units at local level research stations/KVKs to reduce traveling/transportation expenditure of farmers. • Make non-exclusive license agreements with private agencies for production and marketing of vegetable varieties under PPP mode.	• Reduce cost of seeds and traveling/transportation expenditure of farmers. • Higher yield with better quality.	-
• 10 ha GOPCA certified organic plots for experiments and seed production.	Production and supply of organic inputs	• Start organic seed production of different field crops as per demand.	• Area expansion of organic farming. • Healthy soil and healthy food.	-

• Vermicompost units and cow urine collection units.				
• Produced and marketed bio-rational like Trichoderma, Beauveria, biofertilizers (Azotobacter, PSB, KSB), HNPV, SNPV, fruit fly traps & lures and pheromone traps & lures.	Production and supply of bio-rational for control of pests	• Increasing the production of all bio-rational by ELP and by use of passed out students on contractual basis. • Arranging selling units at local level research stations/KVKs to reduce traveling/transportation expenditure of farmers.	• Reduced cost of agro-chemicals used for plant protection and nutrients. • Employment generation.	• Exclusion of Govt. institutes/SAUs for production and market licensing of bio-rational.
• Minimum cultivation of vegetables and fruit crops in the space of terrace and home.	Kitchen gardening	• Supply of seeds/seedling of vegetables as well as awareness programmes through KVKs.	• Availability of healthy foods to individual family • Opportunity for entrepreneurship.	• Provision of grant to supply of seed kits & seedling
• Minimum honey bee keeping in Saurashtra region even	Apiculture	• Organizing a need based training programme on the startup of apiculture.	• Employment generation.	• Provision of grant for startup of apiculture

though sufficient area of fruit, vegetable and seed spices crops. • University started honey bee cultivation and training.				through Govt. scheme for rural youth.
• Established IFS model at JAU Campus for irrigated area. • Started work on IFS at DFRS, Targhadia for dryland area under sponsorship of CRIDA, ICAR, Hyderabad.	Promotion of Integrated Farming System for irrigated & rainfed area	• Documenting the information of interested small & marginal farmers. • Training programme on IFS model site.	• Reduced risk, recycle of byproduct, eco-friendly.	• Provision of grant for startup of IFS through Govt. scheme for rural youth.
1. Amreli:- Groundnut 2. Bhavnagar:- Onion 3. Devbhoomi Dwarka:- Groundnut 4. Gir Somnath:-	Promotion of One District One Crop (Produce) for better returns	• Facilitation for formation of FIGs and FPOs. • Training programmes on cultivation of particular crops/ technology for	• Increase in incomes and local employment • Decline in migration.	• Provision of grant to establish hub unit at district level through Govt. scheme for

Mango 5. Jamnagar:- Groundnut 6. Junagadh:- Coriander 7. Morbi:- Sesame 8. Porbandar:- Gram 9. Rajkot:- Groundnut 10. Surendranagar:- Cumin		horizontal spreading. • Training program for post-harvest processing, export, and linking buyers, producers and other stakeholders. • Developing GAP for export promotion		promotion and spreading. • Developing Good
• Prepared district wise agriculture contingency plan and made available on university website. • Two AMU are functioning each in South and North Saurashtra Agro-climatic zone for forecast weather information and	Weather-based agro-advisory services	• Making a farmers' group with a mobile network. • Training on advisory for crop cultivation practices according to the weather forecast.	• Managing vulnerability and stress mitigation to climate change.	-

advisory for weather calamities. • Two DAMU programmes one at Amreli and second at Jamnagar for providing weather information.				
• Developed several technologies on grading and processing technologies by university for agro-processors and farmers. • Established mini-industry units at rural areas on groundnut oil and pigeon pea dal under PPP mode. • ARYA project is running at KVK, Targhadia for self-employment.	Post-harvest management & value addition	• Awareness programme on raising the level of processing from primary/ secondary to secondary/ tertiary for commodities. • Spread of ARYA project subject to grant provision.	• Employment generation through startup.	• Provision of grant for startup of Agro-Processing Unit through Govt. scheme for rural youth.

• Developed technologies on soil health management and package of practices.	Sustainable yield production	• Organizing specific training on fertilizer application on soil test basis, cultivation of salt tolerant crops/varieties in salt affected areas, use of biofertilizers/bio-agents, weed management, plant protection, bio-consortia, organic manures, soil amendments etc.	• Sustainable yield and soil health.	-

8. Gujarat Organic Agricultural University

Introduction :

Krishi is the solemnity of India's development and self-reliance whereas the farmer is the backbone of the krishi. For better performance the body needs a strong backbone similarly for atma nirbhar krishi need of an hour is to make the farmer stronger and adaptable to changing situations. Due to the increase in demand of organic products during the current pandemic and 689.20 million USD organic products exported in 2019-20, it is not early to say that Organic Agriculture shall pave the way for Atmanirbhar Krishi.

Organic Farming provides a holistic environment to farmers in which he is able to harness the benefits of limited resources which make farmers self-reliant. To support organic farming and farmers the government must have a policy for Organic Farming that should include proper framework like production, processing and marketing of Organic Produce.

Current Issues :

Farmers willing to adopt organic farming want to become self-reliant but they need a participatory group or community approach, which shall form a model of single window solution for getting inputs at reasonable rates and harvest the produce in bulk which attract big buyers and lucrative price for their produce. Considering the land holding of farmers, it is recommended to have a direct marketing concept through forming Farmer Producer Organizations (FPOs). The multi- farming, medicinal- aromatic plant farming in organic systems shall be a silver lining for atma nirbhar krishi. Soil health as well as water are important resources for farming and need conservation technology like Zero till/ minimum till, Broad Based furrow, Mulching with crop residue, green manure are proven methods which may play a panacea.

Strategies :

Promotion of Integrated Organic Farming System shall assure the guaranteed income from a piece of land. Organic agricultural commodities which are produced in glut need to be processed. This leads to a sustainable solution for surplus produce and makes farmers atma nirbhar. Organic Agriculture Economy Zones may be developed which shall furnish a platform to bring together the buyer, seller, consumer, scientist and policy makers at designated place and MSP like structure may be introduced for organic produce and this zones/structure shall offer the benefit to both the farmers and the consumers, respectively.

Research in Organic Farming needs an hour for atma nirbhar krishi, as of now no scientific tool or recommendation or package of practices available with organic farmers. The organic farmers are experimenting on their farms which may give temporary solutions to their problem but which cost them to spend more and take a lot of their time in experimenting. The universities must do refinement and validation of available indigenous technological knowledge and provide sustainable measures which shall bestow impeccable solutions to biotic and abiotic maladies.

Currently, farmers as well as manufacturers are perplexed with inputs authentication which shall be corroborated with the export. The University shall provide one window solution to farmers as well as entrepreneurs by recommendations based products through university's world class laboratories. Furthermore, the university shall have a mechanism for awareness for farmers, students, entrepreneurs and common peoples of the society about organic and sustainable farming, respectively.

Outcomes :

Despite a decline in the agriculture sector's contribution to GDP, food grain production and productivity has risen. This credit must be given to the scientist, students and farmers who constantly work hard in research, education and on field, respectively. Thus, for making krishi atma nirbhar we need to make farmers atma nirbhar and the foremost thing we need to evince the way to hone the different sectors like production, processing, packaging and marketing of organic agriculture with scientific tools and modern technologies. The university shall be provided with the adequate staff, land,

infrastructure and recognition of courses designed by this university for smooth execution and implementation of strategies and actions.

9. Navsari Agricultural University

Introduction :

South Gujarat has a total geographical area of 24.03 lakh hectares, out of which 14.69 lakh hectares area is under cultivation. Out of the total cultivable area, 7.71 lakh hectares area is irrigated and remaining 6.98 lakh hectares area is under rainfed agriculture. South Gujarat has thick forest with 7.52 per cent area cover. Agro ecologically South Gujarat has coastal and semi arid regions. Agro climatically, it has been divided into South Gujarat Heavy Rainfall Agro climatic Zone covering Navsari, Valsad, Dang and Tapi districts with rainfall more than 1500 mm. Remaining districts viz Surat, Bharuch and Narmada districts come under South Gujarat Agro Climatic Zone with 1000 to 1500 mm rainfall. South Gujarat has 160.4 thousand hectares under fruit crops with a production of 36.57 lakh MT. Productivity of rice, sorghum, sugarcane and cotton in South Gujarat is more than the average productivity of the Gujarat state. Livestock in Gujarat are 27.13 lakh including cattle, buffalo, sheep, goat, camel and horse. The per capita availability of milk in Gujarat is 592.0 ml against 375.0 ml in India. Gujarat ranks second in the productivity (3.98 t/ha) of shrimp and scampi.

Current Issues :

Natural Resource Management

- More than 3.2 lakh ha (15 percent) of the total command area of South Gujarat is unproductive due to water logging, secondary salinization and sea water ingress. Another 25 per cent area is critical and on verge to become saline.
- Wastage of good quality irrigation water through over irrigation and thereby depletion of nutrients from the root zone in around 1.4 lakh ha area in the mid plain area of the canal command.
- Irregular availability of water in tail end regions of the coastal area and water scarcity in hilly areas after the rainy season due to lack of water harvesting

system. High water consuming crop sequences like paddy-paddy and paddy-sugarcane.

- Improper use of fertilizers and natural resources, poor adoption of Good Agricultural Practices for the cultivation of crops.

Crop Improvement

- Poor adoption of the seeds of improved varieties of paddy, pulses, millets, sugarcane, cotton, sorghum, vegetables, etc. Around 60 per cent of total cultivated area is still under old outdated, low productive, susceptible crop varieties.
- Inadequate seed storage facilities for medium and long time storage of seeds in villages lead to substantial damage to the important seeds.
- Low production and productivity and heavy losses of crop due to different biotic and abiotic stresses.
- Malnutrition problems, especially among the women and children in hilly regions.

Crop Protection

- Improper following of crop pests and diseases management strategies due to erroneous identification and diagnosis. Pests and diseases cause 30-35 percent yield losses in different crops.
- Emergence of new pests and diseases in different crop ecosystems.
- Over dependence of chemicals for the pests and diseases management.
- Less awareness about the non chemical strategies of pests and disease management.

Horticulture

- Low planting density and poor canopy management of perennial fruit crops.
- Highly perishable nature of horticultural produce (5-39 per cent).
- Inefficient input use management and high cost of cultivation.
- Irregular and poor bearing due to climate change.

Suggested Strategies :

Natural Resource Management

- Adaption of subsurface drainage and proper use of excess water through crop intensification, popularization of high water demanding crops.
- Introduction and awareness about MIS related technologies viz., fertigation, mulching, improved variety/hybrid.
- Soil and water conservation measures in hilly areas and efficient utilization of stored water through modern methods of irrigation.
- Crop diversification through introduction of situation wise suitable crops based on the soil site suitability criteria and availability of water.
- Intensifying implementation of soil health card based recommendations to the farmers for the better nutrient management for optimum production of crops.

Crop Improvement

- Increase adoption of improved varieties and seed replacement rate of different mandate crops. Productivity of pulses in South Gujarat is around 20 per cent less than the state average and needs to be enhanced by replacing poor quality seeds with the improved seeds. Ensure availability of good quality seeds of improved variety, promotion of seed village and seed hub in the local area.
- Popularization of indigenous seed storage facilities.
- Crop diversification by introduction of area specific high yielding, biotic and abiotic stress resistant varieties of different crops.
- Utilization of new fortified, improved early maturing varieties /hybrids of different crops viz., rice finger millet, little millet, pigeon pea, niger, etc.

Crop Protection

- Popularization of rapid and reliable detection tools for effective management of diseases.
- Reliable forecasting module for the early forewarning of pests and diseases for timely implementation of their management strategies.
- Early detection of invasive insect pests and diseases and preventing them from establishing a new agro ecosystem.

- Promotion of Area Wide Integrated Pest and Disease Management (AWIPDM) in different districts as per local needs.
- Popularization of novel and effective biocontrol agents (Trichoderma, Pseudomonas, Trichogramma, Entomopathogenic fungi, etc) and augment their population for effective management of pests and diseases.

Horticulture

- Promotion of crop diversification, high density planting and adoption of Urban and Peri Urban horticulture.
- Augmenting post harvest processing of horticultural crops for the value addition and increased shelf life of horticultural crops.
- Mass production of quality planting materials, enhancement of input use efficiency and popularization of precision farming techniques, Site specific crop management strategies.
- Promotion of climate resilient varieties of horticultural crops.

Work Plan 2021-22 & 2022-23 :

- On-farm and off-farm training of the farmers of sixty villages of the seven districts of South Gujarat viz., Navsari (17), Valsad (5), Tapi (14), Surat (9), Dangs (10), Narmada (10) and Bharuch (5) will be arranged during the above mentioned period.
- Demonstration of improved region specific technologies in adopted villages of different *talukas*.
- Use of social media for the promotion of improved technologies
- Day to day crop specific advisories through the use of IT facilities.

Outcome of strategies :

- Increased seed replacement rate and thereby enhanced productivities of mandated crops.

- Soil improvement by sub surface drainage, better use of resources and eco-friendly inputs.
- More water available for agriculture and allied use in hilly areas.
- Minimized crop loss due to insect pests and diseases.
- Increased productivity with improved quality of horticultural produce suitable for export fetching higher returns.

10. Kamdhenu University

Current Situation : In Gujarat, Dairy sector provides income, employment and nutrition to lakhs of small and marginal farmers and the smallholder dairy farming system is a sustainable model, with a level playing field in the market place provided by Dairy Cooperatives. Nutrition is a key for improving milk production. Problems of imbalanced feeding followed by improving genetic potential of Dairy animals, increasing village level institutions and processing infrastructure for increasing market access, ensuring clean milk production, improving animal housing as per the climate, effective disease infertility management needs urgent strategic micro planning to enhance milk production.

Current Issues :

- Per capita production of Dairy animals is low.
- No. of Nondescript animals with low productivity is high.
- Livestock Farming: 70% (approx) in hands of landless, marginal & small farmers.
- Quality and availability of Fodder: LOW
- Effective diagnostic and clinical services are inadequate.
- Poor genetics.
- Breeding Issues: Multiple players – Single window & regulatory authority.
- Real time Census: Not available. 100% tagging & identification. Bovine registry.
- Micro planning: Production, Nutrition, Disease Diagnosis, Prevention and Treatment.
- Automation in Farm Management and Production.
    - Costly
    - Lack of solutions for instant troubleshooting.
    - Maintenance issues.
    - Farmers Knowledge.
        - Scientific Knowledge?
        - Frequent Trainings?
- Artificial Insemination Network and Coverage.

- Preferably certified semen for AI; else, elite bulls with rotation policy.
- No dedicated major pasture lands

Suggested strategies :

- Formulation of policy to support landless, small and marginal dairy farmers and also for marketing of products.
- Increase scope of Cooperative Dairy Network.
- Animal Waste Management and creation of Dung Value Chain for slurry management.
- Promote marketing of organic manure, bio-pesticides from cow dung and urine and research in its actual outcome for publicity.
- Gauchar land development, fodder & seed bank.
- Mini instrumentation bank for dairying and milking at village clusters under cooperatives.
- Setting of FPOs for sheep, goat, camel, horse, poultry etc.
- Diagnostic study to assess the preliminary situation of the farmers and level of agriculture in the area for micro-planning.
- Promoting applied research in prioritized areas in animal nutrition and livestock production.
- Application of Artificial Intelligence, Web and mobile advisory services.
- 100% Vaccination and deworming drive.

Work Plan 2021-22 :

- Genomic based selection of animals for breeding.
- Certified semen be used for AI.
- Provide high genetic merit bulls where AI infrastructure is lacking.
- Strengthening extension services for scientific management of animals.
- Categorize vaccines for diseases that cause economic losses (FMD, Brucella) in order of priority and future strategies.
- Promote technical and extension services to control and prevent animal diseases, environmental pollution etc.

- Increase availability of fodder and feed: Village cluster based TMR Units, Seed and Fodder Bank, Silage if surplus.

Work Plan 2022-23 :

- Genomic based selection of animals for breeding.
- Ensure steady incomes of marginal and small farmers by increasing their bovine stock to at least 5 per household.
- Preventive strategies for parasitic and haemoprotozoan diseases of production animals.
- Promote scientific efforts towards food safety, quality and also supply of quality hides & skins by timely recovery of carcasses.
- Expansion of Information Network for Animal Productivity and Health (INAPH) Network of NDDB.
- Establish community-based shelters for heat stress/cyclones.
- Train Faculties and Veterinarians for verticals in disease diagnosis, epidemiology, specialized extension services etc.
- Train AH Diploma Holders in Animal Waste Management, Ethno-veterinary Practices and Data Entry in INAPH.

Policy Suggestions : Nil

Outcome of strategy – Ex : Increase in income, productivity, production, employment, microenterprises etc.

- Increased use of INAPH will facilitate micro-planning in the livestock sector and generate data for scientific studies and management.
- Training in Animal Waste Management will enhance production of organic manure for agricultural use.

  Training in Ethno-veterinary practices will reduce usage of drugs, reducing cost promoting local production of plant based products for animal use.

11. Gujarat Organic Products Certification Agency (GOPCA)

Introduction : It is a body of the Government of Gujarat functional since 2009. It functions as an autonomous body, registered under Societies Registration Act, 1860. The general criteria and principles of accreditation shall be based on ISO Guide 65 / ISO / IEC17065. GOPCA, is the only State Government Certification Body that carries out impartial third-party inspection & certification of organic production and handling under NPOP standards; equivalent to EU standards (European Union standards).

Strategy and Outcome: GOPCA has a way clear towards future development and accordingly the following strategies and their outcome has been attended:

- **Recruitment of regular staff:** GOPCA needs to work on standards prescribed by APEDA for maintaining organic integrity. GOPCA in coming time try to fill this post through recruitment in order to smoothly do certification work. The certification work requires 100 % attention which could be delivered only through permanent staff.
- **Identification of Potential areas:** GOPCA shall try to identify the areas where group organic farming can be possible. It would result in the formation of an Internal Control System. More ICS –More the organic products and less the breach of standards.
- **Certification of the whole chain:** Presently the certification is done for farmers & crop production. GOPCA shall cover the whole channel from producer to consumer. The GOPCA in future shall carry out the certification for food processing which ensures availability of 100% organic products to consumers.
- **Apply for NOP certification:** NOP accreditation of GOPCA shall facilitate the farmers to export their produce to the USA and other countries, which gives a good amount of foreign revenues to farmers. GOPCA shall also cover the wild as well as aquatic certification, if permanent staff is given to this agency. The certification has the strength to give a green economy to the country by providing multi solution in single shot. ATMANIRBHARTA could be achieved with adoption of organic farming and specially certified organic farming.

14. Gujarat State Seeds Corporation Limited (GSSCL), Gandhinagar

Establishment, Main Objective and Activity.

Gujarat State Seeds Corporation Ltd., established in April 1975 popularly known by its brand name “GURABINI

- To supply Good quality seeds at a reasonable rate
- To ascertain adequate supply of quality seeds of low value-high volume crops viz; Groundnut, Wheat, paddy, Gram etc.
- To promote, establish, improve, develop, administer and to help the growth and modernization of the seed industry.

Current Situation: -

- **Production: -**
    - GSSCL produces an average 2.37 lacs qtl. Good quality seed of different crops and varieties by taking seed production programmes through their reputed and progressive seed producer farmers and in a year 2020-21, Near to reach up to 2.56 lacs qtl.
- **Seed Storage capacity:**
    - GSSCL has constructed its own total 51 godowns for scientific storage of various types of seeds. The storage capacity of GSSCL own godowns is 231000 quintals per season
- **Seed processing capacity: -**

    O GSSCL has total 24 processing machineries and installed capacity 4,24,032 quintals

- **Seed Distribution capacity**: -

    o GSSCL distributes average 2.55 lacs qtl. good quality seeds and in current year-2020-21 it will be targeted to reach up to 2.65 lacs qtl. GSSCL has 1501 active dealer networks in the state among which Co-operative dealers are 528 and Pvt. dealers are 973. GSSCL is handling

mainly seeds of high volume and low value crops like Cereals, Oilseeds & Pulses to cater to the needs of farmers as a part of social mandate.

- **Human Resources: -**
    - Seed Production, Processing, Storage and Distribution requires Specialized technical and scientific manpower. GSSCL having total 204 approved technical and non-technical staff strength among which 101 posts are filled while, other 103 posts are vacant till date.

Current issues: -

- **Production: -**
    - Demand for seed production depends on seasonality, discipline, price fluctuation, Rainfall pattern, climatic condition. In vegetable crops, no promising/popular varieties/hybrids are available. Non availability of promising genetic break through (hybrids/varieties) for seed multiplication which beat the previous older varieties/hybrids, Lack of experienced and skilled staff, Lack of enough storage/seed warehousing facilities.

- **Seed Storage capacity: -**
    - GSSCL has a need of Godown storage capacity of 3.00 lacs qtl. among which GSSCL having its own Godown with storage capacity of 2.31 lacs qtl., while other remaining Godown capacity will be met through rent. Due to old structures, Godown needs to be upgraded for state seeds storage at different places.

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- **Seed processing capacity: -**
    - Lack of up gradation/renovation of existing Godown and machinery, lack of automation in seed processing and small packing machinery.

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- **Seed Distribution capacity**: -
    - Some specified and remote area dealer networks are not available, cropping patterns change by farmers as per crop value and market trend, Staff shortage etc.
- **Human Resources: -**
    - Corporation staff strength are going to downward trends due to heavy retirement. Only 50% of the staff are available against sanctioned posts and also need to increase sanctioned posts. (Sanctioned post: 204 & available staff only 101.)

Suggested strategies: -

- **Production: -**
    - GSSCL has a target to achieve 3.01 lacs qtl. Quality Seed production upto year-2024-25 on yearly basis and it will be targeted to reach 3.51 lacs qtl. Upto year – 2029-30 on yearly basis. This targeted seed production will increase 27% and 48% respectively than the current average seed production capacity of the corporation.
- **Seed Storage capacity: -**
    - GSSCL has planned to construct 11000 MT godown capacity under phase-1 of RADF project (NABARD funded) which is expected to be ready by March 2023. Moreover, under phase-2 of this project contains construction of 9000 MT godown capacity.

- **Seed processing capacity:**
    - GSSCL proposes 2 (two) seed processing plants under SMSP scheme for its Gandhinagar and Mehsana branch and Suggested Automation in small packing seed. Suggested advance additional processing machinery like Destoner, color sortex machine, automatic packing & weighing machine, movable trolley, plastic pallets, hydraulic ladders, conveyor mechanism, Thiram packing machine, dust collector etc. in all processing units.

- **Seed Distribution capacity**: -
    - GSSCL targeted to distribute good quality seed 3.04 lacs qtl. (yearly basis) upto 2024-25 and it will also be targeted to reach upto 3.62 lacs qtl. (yearly basis) upto year – 2029-30. This targeted seed distribution will be increased 19 % and 42 % respectively than the current average seed distribution capacity of the corporation. Whatever the gap will be addressed by procurement from the national/state seeds Corporation
- **Human Resources: -**
    - Corporation wants to open a new branch office/Sell Depo's at every district of the state and looking at the expansion of production, processing and marketing operations requires three regional divisions in the State for better administration. Rajkot(Saurashtra), Nadiad (Middle and South Gujarat) and Mehsana (North Gujarat)

Work plan 2021-22 & 2022-2023

- GSSCL has a target to achieve 2.67 lacs qtl. Quality Seed production up to year-2021-22 and it will be targeted to reach 2.81 lacs qtl. up to year – 2022-23.
- GSSCL proposes 2 (two) seed processing plants under SMSP scheme for its Gandhinagar and Mehsana branch in the year 2019-20, it is under progress.
- GSSCL has a target to achieve 2.75 lacs qtl. Quality Seed distribution up to year-2021-22 and it will be targeted to reach 2.85 lacs qtl. up to year – 2022-23
- GSSCL gradually replaced old varieties with newer varieties. i.e. in 2017-18, the ratio of old verities was 74 % which is decreasing at 57 % in a year – 2020-21.
- The Corporation has proposed to the Government to fill 42-technical staff & 14-non- technical staff by direct requirement. The Corporation is awaiting approval from the Government.

Outcome of strategy: GSSCL currently distributes average 2.55 lacs qtl. good quality seed on yearly basis and it will be targeted to reach up to 3.04 lacs qtl. In upcoming years. Due to this, increasing turnover from 200 cr. to 240 cr, at present GSSCL distributes approx. average good quality high yielding/hybrid seed to 2.60

lacs farmers and it will be targeted to reach up to 3.10 lac farmers in upcoming years. In upcoming years GSSCL will recruit 87 vacant posts at different capacities which will give direct employment benefit, while other work like seed storage, processing-packing will generate indirect employment. More production, more storage, more processing-packing and more seed distribution ultimately increasing the requirement of processing-packing material like., gunny/cloth bag, sealing wax, label, seed treatment material etc. that will boost up micro entrepreneurs.

Part 3: Detailed Roadmap of the Action Plan for Aatmanirbhar Farm Sector of Gujarat

Directorate of Agriculture

1 Introduction

Gujarat is a state in Western India and Northwest India with an area of 196,024 km^2 (75,685 sq. mi) with the longest coastline (24% of Indian sea coast) 1,600 kilometers (990 miles), dotted with important major, minor and intermediate ports. It provides the advantages of greater global access as well as lower transportation costs.

Gujarat is reported as the progressive Indian state in terms of gross state domestic product (GSDP) as well as holistic development. Gujarat offers a model for economic progress and development for fellow states of the country. Gujarat is well known for industrial development across the sector albeit agriculture growth in the state is eye-catching and provides a strong pathway for further agriculture based development.

1.1 Gujarat Agriculture Resources

1.1.1 Agro climatic Conditions

Gujarat has fallen under agro climatic zone no. 13 named as Gujarat Plains and Hills which is further classified in 8 (eight) agro climatic zones based on agro climatic situations. Gujarat has varying topographic features though a major part of the state was dominated by parched and dry regions. The average rainfall in the state varies widely from 250 mm to 1500 mm across various zones. Out of 8 agro-climatic zones, five are arid to semi-arid in nature, while the remaining three are dry sub-humid in nature. Deep black to medium black soils dominate the soil types in the state specially in Middle Gujarat, South Gujarat and Saurashtra area while Sandy to sandy loam soil prevailing in North Gujarat and North west zone of the state.

Output of the agricultural sector in Gujarat State has been largely dependent on the south-west monsoon. The State frequently experiences erratic behavior of the south-west monsoon, which can partly be attributed to the geographic situation of the State. The wide variation in rainfall received by different parts of the state has been the characteristic feature of monsoon. Average rainfall of the state is 831 mm (average of the period of 1990 to 2019).

1.1.2 Land resources

Gujarat state has nearly 50% of its geographical area under agriculture purpose with net sown area of 98.91 lakh ha. Kachchh is the biggest district in the state in terms of area as it possesses 7.33 lakh ha. area followed by Banaskantha (6.91 lakh ha.), Surendranagar (6.21 lakh ha.) and Rajkot (5.36 lakh ha.) which are having more than 5 lakh ha. area under crop production.

Mahesana, Botad, Kheda, Gandhinagar, Amreli, Vadodara and Morbi are the districts which have more than 70% of their geographical area under cultivation. Kachchh, despite having the highest net sown area in the state, possesses the lowest cultivated area against district geographical area. Net sown area against geographical area in the Kachchh is only 16% as majority of area categorized as total barren and unculturable land (14.59 lakh ha., 32%) and culturable waste (15.24 lakh ha., 33%).

Gross cropped area in the state is continuously increasing in the state with increasing irrigation facilities. Gross cropped area has increased at 21% over the period of time as it was 107.91 lakh ha. in 2001-02 which reached 131.08 lakh ha. in 2017-18. The cropping intensity in the state has increased significantly from 111.5% in 2001-02 to 132.5% in 2017-18.

Anand is the only district in the state which covers its net sown area more than once as its cropping intensity is 208%. Banaskantha, Porbandar, Dahod, Aravalli, Kheda, Gandhinagar, Girsomnath and Mahisagar are the districts which have cropping intensity more than 150%.

1.1.3 Irrigation resources

Gujarat is known as an arid and semi-arid region as its 58% area falls under this category. Net irrigated area in the state is 48.38 lakh ha. (2017-18) which is mainly contributed from Tube wells (17.54 lakh ha., 36%), wells (13.30 lakh ha., 27%) and canal network (11.40 lakh ha., 24%). With government initiatives towards water conservation, canal area improvement and other work, net irrigated area is increasing. It was 30 lakh ha. in 2001-02 which increased up to 48.38 lakh ha.

Gross Irrigated Area (GIA) is very important as it indicates area covered more than once from the same irrigation resources. It also indicates consistency in availability of water. GIA in 2001-02 was 35.72 lakh ha. which increased up to 74.60 lakh ha. with growth of 108% over the period.

North Gujarat has highest irrigation coverage as 61% of net sown area is under irrigation and 66% of gross cropped area under irrigation followed by Middle Gujarat (54% of net sown and 62% of gross cropped area under irrigation), South Gujarat (45% of net sown and 59% of gross cropped area under irrigation). Saurashtra includes Kachchh having less irrigation facilities as only 42% of net sown area and 48% of gross cropped area under irrigation.

Micro irrigation, a smart tool for irrigation with ease in operation as well as an opportunity to cover more area from the same irrigation source is very well taken in the state with dedicated special purpose vehicles. With concentrated efforts in the state, a total of 19.67 lakh hectares area covered under Micro Irrigation benefitting 12.28 lakh farmers with an annual average achievement of approximately 1.25 lakh hectares / year.

1.1.4 Farmers & Land holding

Gujarat farmers classification characterized as 2/3 of total operational land holders belongs to marginal and small category having merely 1/3 of the total operational land. 53.20 lakh operational land holders registered in the state possess 99.77 lakh ha. area.

Distribution of Number and Area of Operational Holding to Gender & Major Size Classes

Size class	Number of holdings					Area operated (in Ha.)				
	2015-16			Total	%	2015-16			Total	%
	Male	Female	Total *	2010-11	Variation	Male	Female	Total *	2010-11	Variation
1	2	3	4	5	6	7	8	9	10	11
Marginal (Below 1.0 Ha.)	1671166	347199	2018827	1815634	11.19	889043	183871	1073154	884822	21.28
Small (1.0 to 1.99 Ha.)	1347803	267581	1615788	1429021	13.07	1951173	386414	2338174	2074884	12.69
Semi Medium (2.0 to 3.99 Ha.)	970589	179180	1150254	1079533	6.55	2678009	492469	3171855	2988660	6.13
Medium (4.0 to 9.99 Ha.)	418591	76778	495869	512651	-3.27	2365600	435724	2804446	2930431	-4.30
Large (10.0 & above Ha.)	32281	6591	39888	48771	-18.21	438360	90462	590150	1019669	-42.12
All sizes	**4440430**	**877329**	**5320626**	**4885610**	**8.90**	**8322185**	**1588940**	**9977780**	**9898466**	**0.80**

Note: * Also includes number and area of Institutional holdings in total, which are negligible

Summary of operational land holding is as under;

1.2 Cropping Pattern & Production status

1.2.1 Area

Cotton is an important crop in the state which contributed to nearly 25% of net sown area with an area of 26.5 lakh ha. in 2019-20. Food grain crops contributed 41 lakh ha. area including wheat (13.9 lakh ha.), paddy (9.04 lakh ha.), pulses (9 lakh ha.), Bajara (4.5 lakh ha.) and Maize (4.38 lakh ha.) during the year of 2019-20. Oilseed crops are an important crop category in the state with acreage contribution of 28.7 lakh ha. including Groundnut (16.88 lakh ha.) and castor (7.36 lakh ha.).

Horticulture has emerged as one of the high potential sub sectors in Agriculture. It is a supplier for a large number of agro based industries which offers good avenues for generation of employment opportunities both in rural and urban areas. The Horticulture economy has been gaining momentum as the area under fruit crops, spices and vegetables has increased. Area under total horticulture crops in the state during the year of 2019-20 was 18.3 lakh ha. with the contribution of fruit crops (4.46 lakh ha.), vegetables (6.54 lakh ha.) and spices crops (7.09 lakh ha.).

1.2.2 Production

State is performing well in food grains, cotton, oilseeds and other crop production. Production of food grains during 2019-20 estimated at 95.57 lakh tonnes including 85 lakh tonnes of cereals and 10.5 lakh tonnes of pulses. During the year 2019-20, the production of cotton bales each of 170 kg estimated to 86 lakh bales. The production of oil seeds is estimated at 66.5 lakh tonnes during the year 2019-20 including a major share of Groundnut with 46.5 lakh tonnes. Castor is one of the important non-edible oilseed crops in the state with more than 14 lakh tonnes production in 2019-20. During the year 2019-20, the production of fruits, vegetables and spices are estimated at 92.61 lakh tonnes, 132.29 lakh tonnes, and 10.96 lakh tonnes respectively.

1.2.3 Productivity

Productivity, production per unit area is a key factor to analyse the suitability of crops in the particular situation and its adaptability over prevailing agro climatic conditions.

State performed well on the productivity front with the highest productivity in the country in major crops. State stood first in the country in productivity of Castor (2541 kg/ha., national average 1902 kg/ha.), Gram (1285 kg/ha., national average 1078 kg/ha.), Fennel (2070 kg/ha., national average 1570 kg/ha.), second in Groundnut (2422 kg/ha., national average 1893 kg/ha.), Cotton (655 kg/ha., national average 443 kg/ha.), Tur (1243 kg/ha., national average 967 kg/ha.), Banana (65.63 MT/ha., national average 34.86 MT/ha.), Potato (28.56 MT/ha., national average 23.96 MT/ha.) and third in Cumin (1004 kg/ha., national average 710 kg/ha.).

Interactive effect of crop acreage promotional activities (area) and technological innovations (productivity) made the state in position to contribute ample share in the country's total production. Share of major crops of the state in the country's total production is Castor (95%), Fennel (76%), Cumin (56%), Groundnut (44%), Cotton (31%), Sapota (28%), Papaya (21%), Pomegranate (16%), Banana (15%) and Okra (15%). (* productivity data 2017-18)

1.3 Activities of Agriculture department and status

Directorate of Agriculture working under the aegis of the Agriculture, Farmers Welfare & Cooperation Department, Government of Gujarat is working for multi-disciplinary activities at a multi-disciplinary level.

Extension, pest surveillance, input supply management, enactment of agriculture inputs related acts, incentivizing agriculture, agriculture statistics are the key activities of the department which are interchangeable over a time. Earlier extension and activities related to technology transfer was a major focus area of the department which changed to schematic support to the farmers for a period which now turn into farmers welfare activities.

The agriculture sector represents all the strata of society and agricultural development in the state prospers all the stakeholders without regard to their social and economic status. Schemes or programmes being implemented by the department have special provisions for priority to weaker sections of society with more incentives compared to other special groups.

1.4 SWOT Analysis

1.4.1 Strength

- Diversified agro-climatic zones with different varieties of soil and crops
- Enthusiastic and highly entrepreneurial farmers
- Longest sea coastline
- Well-developed infrastructure
- Well-developed co-operatives
- The rail as well as road transport system, which are essentials for agricultural development, are also well – knitted in the state
- Assured Electricity Supply, dedicated feeder for agriculture
- Availability of ample solar and wind energy round the year
- Good transportation, port and marketing facilities attract industries including agro based industries in the state

1.4.2 Weakness

- 58% arid and semi-arid area
- Uneven distribution of rain
- Declining land holding
- Saline and water logged area
- Post-harvest glut in commodities and price crashing
- Inadequate network of extension machinery in the State
- Poor infrastructural facilities at Taluka places
- Insufficient attention towards extension personnel's
- Lack of long period climatic data of taluka and districts
- Inadequate processing facilities

1.4.3 Opportunity

- Crop based cluster and Agri. export zone (eg. Groundnut, Millets, Castor, Durum wheat etc.)
- Export potentiality
- Investment in agriculture sector
- IT network
- Public – Private partnership
- Use of solar energy in agriculture
- Rational utilization of available water resources through adoption of micro irrigation system
- Shifting consumer preference
- Organic Inputs Production Hubs
- Large rural market
- Storage and warehousing chain
- Cereals, oilseeds and pulses fodder for supplement of fodder
- Weather based assessment of crop growth and production
- Establishment of weather forecasting centers
- Weather based advisories at village level
- Feasibility of summer cultivation of many crops with high yield potential and high productivity
- Waste land problematic land development

1.4.4 Threats

- Inadequate and erratic nature of rainfall
- Frequent draught
- Soil erosion, Depletion of water table, Salinity ingress / Sea water ingress
- Problems of wild animals (Nil Gay, Roj, Pig etc.)
- Market fluctuation

- Smaller land holdings limiting the scope for adoption of intensive crop production technologies, which are capital intensive
- Labour intensive agriculture
- Changes in socio-economic conditions, with younger generation from farming community preferring urban employment in place of agriculture

2 Focus Area

Agriculture is an umbrella of activities ranging from production to consumption. There is need of identification of the area of intervention for which strategies to be defined for further development in the state keeping in view of the ecological, economical and social sustainability. To prepare Roadmap of Agriculture for 2030, focus area derived with potential of its further classification based on Gujarat Agriculture status, available resources and SWOT analysis.

2.1 Sustainable Production System

Sustainable Production System includes food security, nutritional security along with economic profitability of the production system. It also includes use of available resources in a way that there should be practices which do not affect the production ability of resources for offspring. State has envisaged to adopt crop basket in a balanced way where acreage of cash crop and oilseeds crop is maintained at current level with plan to increase return from the same area. Increase productivity of cereals, increase area and productivity of nutri-cereals, increase area and productivity of pulses are the key factors where the state has a vision to work with all possible tools, technology to reach an excellence level. There is also a need to cater adaptability of new crops with prevailing agro climatic conditions which should be encompassed with involvement of best agronomical practices and better agricultural inputs. Synergy with integrated farming systems especially horticulture crops should also be maintained where all available resources extend to development of high value horticultural crops in the state.

Sustainable Production System is directly linked with its marketability and profitability without which it's difficult to retain the acreage of a particular crop though the state has importance of it for domestic consumption. It should also be

kept in mind during implementation of strategies and thrust should be given on marketing structure.

2.2 Decrease in cost of production

Decrease in cost of production is actually the adoption of practices which are cost effective in nature, easily and affordably available, support production systems to gain more from unit area and prevent unnecessary expenses in the farm operations. Gujarat has already taken lead in implementation of organic farming and natural farming in a big way which has an inbuilt goal of reduction in cost of production. State will adopt these practices further with refinement, involvement of scientific approach and development of complete protocol of production system where all these systems respond well.

Cost of production is often more responsive with its correlation to productivity. Production from unit area is the most important factor to calculate economic yield and sometimes it becomes more responsive with involvement of investment either in input or in farm operations.

State will focus in a way where maximum return from the unit area will be taken by achieving the highest efficiency of resources involved.

2.3 Input Supply Chain management

Input Supply Chain is actually the lifeline of any sector and comparatively more important for agriculture as input supply chain for agriculture is dynamic in nature rather than static. Seed, Fertilizers, Pesticides, Water, Farm machineries and Farm laborers are the key and most important inputs being explored in the agriculture sector and interdependent in the production system. Absence or less use of any one or more than one badly hampers the production system and sometimes become more critical if not provided timely.

Focus for input supply chain management should be concentrated on availability on time, at the right place, in required quantity and with adequate quality. State has a vision to develop shifting from practices being used in agriculture to cater the laborer shortage and involve more precision in farm operations with technology. Water is the precious input for agriculture that needs to be used wisely and for that promotion should be done for the adoption of micro irrigation and other water saving

technology in all the areas either blessed with ample water sources or are facing water scarcity.

2.4 Database Management

Data in the agriculture sector are not only the figures but are the key drivers for policy preparation, strategic management and insight for problems solutions. Acreage available for cultivation, their properties in terms of fertility and productivity, water sources, aquifers, input required and supplied, operational landholders and their dependents, laborers involved, cost involved in production system, crop stress measures, rainfall, dry periods, relative humidity and other climatic factors production per unit area, gross value added by production, supply demand, market surplus, market rates, price trends are the data involved in agriculture sector which are multifactorial in nature and very important to run the agriculture business with economic viability and sustainability.

Department has already initiated technological involvement in acreage related database management which needs to escalate further with advancement of technology and involvement of analytical tools. It will provide an opportunity to collect and compile the right database at the right time which are crucial for policy decisions, incentivizing agriculture and management of procurement operations. Real-time database of agro climatic factors, crop stress measures will facilitate real-time crop advisory and analysis of market dynamics support farmers in making decisions of when to sell and where to sell. Comprehensive databases including land records, mapped resources, cropping patterns, subsidy availed or applied to avail, bank details are the basic database needed to aggregate on one platform to create a fast delivery mechanism.

2.5 Delivery Mechanism

Agriculture being considered as traditional faced constraints in delivery mechanism as it is not being treated as an important factor. Extension, technological transfer, agronomic advisory, agro-climate based advisory, input supply, incentives disbursement etc. are the data in agriculture sector that are not only the figures but are the valuable input needed to deliver timely and based on case to case requirement.

With technological involvement in agriculture, extension and technology transfer are being promoted to shift on IoT platforms in consideration of fastness and quick delivery nature of these platforms. Agriculture is differ farm by farm and farmer by farmer needs personal reports and individual analysis which is not possible without human resource involvement. There is a need to deploy more and more technical human resources which cater to the needs of farmers, identify bottlenecks and suggest measures to overcome them. It should also be necessary to equip all these functionaries with IoT platforms and devices to create a quick support system.

Online farmers' enrollment and Involvement of direct benefit transfer have evolved in the recent past for incentives disbursement which also need to be strengthened with facilities of ease in enrollment and ease in operations.

2.6 Institutionalization of Farmers

Gujarat is known for its cooperative movement in the milk sector which established the world renowned AMUL model. Milk collected as a single commodity from the farmers and delivered to customers in terms of the number of processed products. This model also supports farmers in fulfillment of their production system through providing quality feeds, minerals and animal health related services.

Agriculture activities that are more complex in nature than animal husbandry and involvement of more than 50 commodities at a time need institutional mechanisms which cater the need of inputs, production support and marketability of produce. AMUL model with required changes in implementation module is need of time which will be fulfilled by upfront support to farmers producers organization especially farmers producers companies.

Farmers Producers Companies need to strengthen in terms of human resources, capacity building and financial resources. Organic input production at cluster level, involvement of FPCs in seed supply chain, input depot under farmers organizations' operations, agronomist support, primary processing facilities at individual FPC level, advance processing and packaging facilities at federation level, common brand owned by farmers, distribution chain, tie-up with retail chains etc. shall be the key activities for promotion of institutionalization of farmers in the state.

3 Key Strategies

Focus area for Roadmap of Agriculture 2030 framed with vision to support agriculture in range of INPUT to OUTPUT. It was drafted with ideological inclination which supports a decision system in achieving goals through framing and implementation of strategies. Key strategies Identified based on SWOT in support to focus area briefly described here;

3.1 Extent the reach to the farmers

The agricultural production system evolving day by day needs regular technical support being provided to the farmers. Earlier there was deployment of technical personnel per 500 farm families in a training and visit system which has not been maintained in the agriculture system since long. Presently this ratio increased up to one technical person per 2500 operational land holders with average 4500 ha. area per technical person.

To extend the reach to the farmers, phase wise increase strength of field functionaries and deploy as per ideal ratio and more precisely there shall be one resident technical person per village which serves all the needs of farmers of a particular village.

3.1.1 Single Window for Farmers at Block Level

Farmers are well familiar with fulfilment centers available locally for their requirements except agriculture. Field functionaries are segregated and difficult for farmers to locate and the same way farmers have to visit different district or regional places for agriculture, horticulture, training related requirements.

These scenarios shall be changed through establishment of a common center in each block. Phase wise establishment of block level agriculture and allied sector offices and training facilities shall be created which shall act as a single window system where all agriculture related requirements including area based training, personal guidance, disease pest advisory, incentives provided to the farmers.

3.2 Nourishing natural resources

Natural resources are plenty in nature in some areas while in scarcity in others. As states need holistic development across the area and prosperity for all the farmers, they need to nourish natural resources and make available to all with all possible extent. Soil health management including soil analysis, promoting production and use of organic inputs especially bio fertilizers and other innovative products shall be done to improve and sustain soil productivity. Similarly, water conservation and harvesting programmes shall be taken up in a big way to cope with moisture stress to the crops and especially in the area where water sources are scarce and no reach of canal networks.

There is ample barren, uncultivable and problematic soil in the state which has potential to develop and use for plantation purposes. These idle resources should also be nourished.

3.2.1 Soil and Water analysis based crop and nutrient recommendations

Soil Health Card, a novel approach initiated in the state since long back, needs to evolve more extensive. Earlier there was a plan of issuance of Soil Health Cards once in four year. Now the state has to focus on issuance of soil health cards once in a year. Keeping in view of the limited resources available with the agriculture department and multi-dimensional activities, the state should evolve an ecosystem where self-sustained entrepreneur models establish and support the government to achieve this goal.

This model shall exclusively function for soil and water analysis, mapping of resources and results with suitable crop recommendations and crop based, site specific nutrient requirement.

3.2.2 Potential use of canal command area including SSNNL

Ground water based irrigation systems are being widely explored in the state though large and medium water storage structures including dedicated canal network available in the state. There should be a plan from the irrigation department for efficient and maximize use of available water storage and canal network. Cropping pattern shall be supported accordingly.

3.3 Technological Involvement

State is progressive in nature and adopted new technologies time by time including cutting edge satellite imageries, remote sensing and artificial intelligence technology. There is scope of intensive use of these technologies with area specific crop modeling approaches.

Precision farming, use of UAV, different types of censors, leaf temperature base analysis, sensor based water requirement assessment, color based harvesting and sorting and many more state of art technology being used in different countries need to be studied and adopted with required local modifications.

Startup for sourcing and development of requirement based technology shall be promoted to develop indigenous technology thus most possibly it will be available cost effective and affordable.

3.4 Climate resilient Agriculture

Gujarat is an example of climatic adaptability built over a period of time as a diversified cropping pattern including high value crops widely growing in the state though there is 58% of arid and semi-arid area, monsoon vagaries and other climatic factors. It should be supported with a more scientific approach where area specific agromet advisory dissemination, crop, area and weather based disease pest forecast, heat tolerant varietal development, smart technology and practices for efficient water management shall be done.

Group of different stakeholders including agriculture and horticulture departments, state agricultural universities, extension functionaries, national institutions with importance shall be formed to monitor and review the situation, activities and their results on a regular basis and suggest evolving models for more adaptability.

3.5 Input availability and Strengthening of quality control

Timely availability of quality inputs is one of the key functions of the department which is being taken care of by the existing staff of the department. Agriculture department is responsible for enactment of different agriculture input related acts including Fertilizer Control Order 1985, Insecticide Act 1968, Insecticide Rules 1971, Seed Act 1966, Seed Rules 1968, Seed Control Order 1983 and Environment Protection Act 1986.

Department is handling 40 lakh MT of fertilizers and preparing a plan for seed availability. There are more than 18,000 agro input dealers in the state which have regular visits by quality control officers to assure the quality of the inputs. Number of agro molecules, mix and micro fertilizers, number of varieties, and number of bio products are continuously increasing in the agriculture input market which needs more efforts and a vigilant system. Although increasing the value and volume of the agricultural inputs, the quality control system of the department has been working with old staff patterns since long. There shall be a dedicated agriculture inspector per taluka instead of the present structure of one inspector per 2-3 taluka.

Department has adopted an ease of doing business policy for issuance of agriculture input related manufacturing and selling licenses through e-portal. Same way, there should be an IT based vigilance system, sample tracking and for that agriculture inspectors should be equipped with proper IT systems.

At present quality control and input testing laboratory, 3 of each input (seed, fertilizer, pesticide) function in the state which should be upgraded with the latest machinery and equipment. Department shall have a plan for establishment of quality control laboratories for all inputs at every region of the state.

3.5.1 Input quality advisory

Seed, Pesticides and Fertilizers are the inputs for which quality parameters should be maintained and in absence of quality inputs farmers have to suffer production loss in the business. As the number of companies, sellers and products for all three inputs are increasing, there should be input quality related advisory along with stringent quality control mechanisms. There shall be a ICT based advisory model for input quality advisory and a list of spurious inputs with brand name and company name should be disseminated to educate farmers about what to purchase and what not to purchase.

3.6 Risk Management

3.6.1 Ease of claiming crop insurance

Crop insurance as a scheme has been implemented in the country for a long time and the government spent a huge budget over premium subsidy. Although government intervention is at a different level, there are different issues in

payment of insurance at the time of crop damage in case of any natural calamities. To calculate crop damage individually is not an easy task as agriculture spreads in lakhs of acreage. So there shall be an auto mechanism with all possible triggers which cause crop damage or production loss and in these cases insurance should be paid directly to the farmers account. Area specific agro meteorological situations and crop specific disease pest model may be used for this purpose.

3.6.2 At a time relief in case of crop damage due to natural calamities

Crop insurance is choice based and not adopted by all the farmers, government intervene and offer relief in case of crop damage during the natural calamities without discrimination of insurance taken or not. Input Subsidy is being provided in such cases where fresh enrollment is being taken from the farmers and assess crop damage percentage individually as per present mechanism. As crop loss assessment is a tedious task with limited staff, there shall be an auto mechanism for crop loss assessment based on agro meteorological situation and crop specific model. In such cases, relief should be provided to all the farmers based on an integrated database as suggested in this roadmap without fresh enrollment every time.

3.7 Skill up gradation

Agriculture sector is changing every day. New technology, agro molecules, varieties, irrigation techniques, type of fertilizers, mode of application, dose of application, farm machineries, soil and crop specific tools are the areas where farmers have to educate for a better crop production system. It should be done on a regular basis without compromising and it shall be done only when agriculture field functionaries look after this dedicatedly and without workload of other activities. Adequate number of extension professionals as suggested in this roadmap is a way to roll out a proper plan for skill upgradation.

Farmers are not aware about market dynamics and it shall be part of the skill up-gradation programme as it has an impact on the final output of farmers' efforts.

There shall be taluka based training facilities supported by district farmers training centers. At present, there are no such facilities at taluka level and only 26 districts have farmers training centers. Farmers Training Centers in remaining districts and phase wise taluka wise training facilities shall be established.

Due attention shall be given for skill up-gradation of all extension functionaries and all technical officers and there should be a training calendar for all staff.

3.7.1 Revival of Krushi Mahotsav Approach

Gujarat has initiated a unique approach for agriculture extension and knowledge dissemination famously known as Krushi Mahotsav. Krushi Mahotsav initiated in 2005 with the aim to educate farmers of the state by covering all villages and knowledge regarding agronomical practices, agriculture inputs and other technologies were imparted by agriculture scientists prior the sowing season. State has seen fruitful results of the initiative and made a giant leap in agriculture production and farm income.

This concept changed over a time but still has core value. There shall be a mechanism of doorstep training and knowledge dissemination prior to the sowing season just like krushi mahotsav.

3.7.2 Women involvement in decision system

Role of women in the agricultural activities are highly important and their involvement in sowing to harvesting indicate that women involvement in decision support will bring fast adoption of the technologies. Transplanting, weeding, harvesting and threshing like drudgery activities need to attend with more mechanization and more efficiency. There shall be a mechanism of involvement of women not only in farming activities but also in decision systems like what to grow, what practices to adopt, what technologies need to adopt, where to sell etc. Department shall create a mechanism for boosting women farmers/ laborers for their active involvement in agriculture. Department may conduct dedicated training and skill upgradation programmes especially for women farmers.

3.8 Market Intelligence & Remuneration Price Mechanism

Agriculture is a Production to Profit oriented approach. Production is achieved and even continuously in leap through extension and input support. But farmers are

facing problems in profitability as there is huge fluctuation in the price of commodities. Principle of utilities in agriculture economics provided guidelines for how to get maximum price through selection of time and place for sale (when to sell and where to sell). The Market Intelligence system is a beneficial tool for farmers to decide it. There shall be a dedicated unit with domain experts for market intelligence to forecast the price trend of different commodities in different markets at different times. Market rate based advisory based on market intelligence should also be there.

Government is working for remunerative prices through different methods mainly supported by the Procurement Support System (PSS). At present there is no such formal structure available for PSS and each and every time the government has to find out resources for procurement operations. There shall be a permanent structure for PSS in all APMCs or at other places in case of facilities not available to APMCs and should be equipped with assaying facilities. It will facilitate timely operation of PSS and also earn opportunity cost.

3.9 Storage Chain

Storage is essential for agriculture marketing chains. Farmers can earn the benefit of market intelligence advisory only when they have a facility of storage. Storage structures establishment should be categorized in two ways; i) Institutional storage (large scale warehouse) and ii) small storage (farm storage. State government took up an initiative to support farmers in establishing small storage at farms. It's a good imitative but there is scope of reinventing scheme with incorporation of pakka ceiling instead of corrugated sheet or any other option. Subsidy amount shall also be increased to attract more and more farmers to establish micro storage chains. On implementation of the scheme, IT based mapping shall be done.

3.10 Agriculture Export

Agriculture export is a good alternative to earn more return from the marketable surplus. Huge production supported through technological involvement, extension and better support formed a market glut situation resulting in depressive prices. As Gujarat having export benefits over other states as a state having number of ports with excellent facilities, there shall be a plan for promotion of agriculture export from

the state. Identification of supply demand at world level, identifying the countries dependent on agriculture export, and studying the harvesting window of other countries are the key factors needed to consider for promotion of exports. To promote agriculture export from the state, the state shall create a common platform for these types of information sharing as well as set up in different countries to facilitate sellers of state. State Agricultural Universities should also work on development of protocol to meet country wise export standards.

3.11 Value addition

Value addition is a tool to add value in a product to earn double the value of the product. Value addition is different based on the nature of the product and their processing requirement in the market. State shall identify crop wise clusters for promotion of value addition in the state and establish Agro Estate based on GIDC pattern. It will facilitate entrepreneurs to invest in agriculture based value addition. Other incentives like tax relief, electricity relief may also be considered.

3.12 Non-Farm Income

Non-farm income is considered one of the most important factors in doubling farmers' income. Agriculture being seasonal in nature, farmers have enough spare time in the lean season to adopt alternative earning activities. State government recently launched the Kisan Parivahan scheme in which assistance was provided to the farmers for purchase of medium size goods carriage vehicles. This scheme provides an opportunity to attain last mile connectivity in agriculture as well as to use this vehicle in local goods transportation and get return from it. State shall promote all such village based cottage industries and agro industries to provide an opportunity to farm families to earn income.

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1. Directorate of Horticulture

1. INTRODUCTION

1.1 Gujarat comes under agro climatic zone no.13 named as Gujarat Plains and Hills which is further classified in 8 (eight) agro climatic zones based on agro climatic situations. 1.2 Gujarat has varying topographic features though a major part of the state was dominated by parched and dry regions.

1.3 The average rainfall in the state varies widely from 250 mm to 1500 mm across various zones. Out of 8 agro-climatic zones, five are arid to semi-arid in nature, while the remaining three are dry and sub-humid in nature.

1.4 Deep black to medium black soils dominate the soil types in the state specially in Middle Gujarat, South Gujarat and Saurashtra area while Sandy to sandy loam soil prevailing in North Gujarat and North west zone of the state.

1.5 Output of the agricultural sector in Gujarat State has been largely dependent on the south-west monsoon. The State frequently experiences erratic behavior of the south-west monsoon, which can partly be attributed to the geographic situation of the State. With varied climatic conditions which has good potential for cultivation of numbers of crops.

1.6 Horticulture has emerged as one of the high potential sub sectors in Agriculture. It is a supplier for a large number of agro based industries which offers good avenues for generation of employment opportunities both in rural and urban areas.

1.7 To accelerate horticulture Development in the state, a separate department of Horticulture had been established in year 1991 with following mandates:

- To increase area and production of Horticultural crops.

▪ Promotion of kitchen gardening and small scale processing.

▪ To impart support for post-harvest management-processing, value addition, marketing. ▪ Promotion of export.

▪ Development of Arid Zone Horticulture.

▪ Extension Activities – Training, Seminar, Exhibitions, Publication.

▪ Development of the coastal line through coconut cultivation etc.

1.8 The significant progress is 4 times increase in the area and production from 3.50 % to 15% in the last 28years since 1991-92 to 2019-20.

1.9 As Production of Horticultural crops is technology and skill driven, the Government is providing support on technological intervention and skill development.

2. **Expansion of Horticulture in the State**

2.1 Traditional agriculture cropping system of the state is also diversifying towards horticultural crops due to high remunerative values. Considerable growth in area coverage and production has been observed in the last fifteen years. Area and production of horticultural crops has increased by 66% and 103% respectively. An average 4.5% annual growth has been achieved in area expansion of Horticultural crops during this period. Area under total horticulture crops was 11 lakh ha. during 2005-06 which raised to 18.30 lakh ha per Crop wise APY of year 2005-06 to 2019-20 is attached as **Annexure-I**.

2.2 Because of the Arid, Semi-Arid and dry humid climate of the state, traditionally cultivation of horticultural crops like Mango, Chiku and Banana was concentrated in specific pockets of Middle and south Gujarat and near the coastal area of the Southern part of the Saurashtra region.

2.3 Whereas North Gujarat was considered a bowl of seed spices

like Cumin only. But with increased irrigation facilities, considerable area has been diversified towards new horticulture in the Arid and Semi-arid regions.

2.4 Kachchh, characterized by hot summer, dryness, and 250 mm rainfall in a year emerged as the highest crop diversification towards horticultural crops with 245% growth in total area of horticultural crops in the period of the last 15 years. Growth patterns in Kachchh were observed as 143% growth in fruit crop area, 191% in vegetables and 447% in spices for the same period.

2.5 Fruit crops like Pomegranate, Papaya, Guava and Date palm have been introduced in the Arid area of North Gujarat and Kutch . “Gir Kesar Mango " and Kutchi Date " have unique identities in the country.

2.6 Spice crops like coriander and cumin have been introduced in the Arid and semi-arid areas of Saurashtra region. Such crops are now becoming commercially important crops of the cropping system of this region. Gujarat state enjoys first position in production of seed spice like cumin and fennel which contributes more than 55.83% and 76.32% respectively of the total production in the country. *(**Source:** Statistics of Horticulture at a glance 2017-18).*

2.7 More than 100% growth was observed in the vegetable area in the region of North Gujarat, Middle Gujarat and South Gujarat during the last 15 years. North Gujarat area especially Banaskantha, Sabarkantha, Aravalli and Mehsana districts established an identity of Potato area. Production of potato varieties such as table purpose and processing purpose for domestic and commercial processing use respectively have taken up at large scale which eventually developed the storage

and processing facilities in this area. The potato Farmers's effort makes Gujarat proud with the second highest productivity potato (28.56 MT/Ha) in the country. *(**Source:** Statistics of Horticulture at a glance 2017-18).*

2.8 Tribal areas also emerged as vegetable producing districts to change their identity of millets and minor crops. Tapi and Surat are hotspots for Okra production, Cucurbitaceous crops concentrated in Navsari district.

- The Horticulture economy has been gaining momentum as the area under fruit crops, spices and vegetables has increased.
- Area under total horticulture crops in the state during the year of 2019-20 was 18.3 lakh ha. with contribution of fruit crops (4.46 lakh ha.), vegetables (6.54 lakh ha.) and spices crops (7.09 lakh ha.).in 2019-20 and total Production was 237.83 lakh MT as mentioned in District Wise- crop wise APY of year 2019-20 as **Annexure-II**.

2.9 Status of Horticultural Crops Area in Gujarat

Fruit Vegetables Spice Flower Total 2005-06 2019-20

Area Increased in % (Lakh Ha.)	Fruit	Vegetables	Spice	Flower	Total
	154	**172**	**166**	**286**	**166**

- In the last 15 years, there is growth of 154 % in the Fruit cultivation area, 172 % in Vegetable cultivation area, 166 % in Spices and 286 % in Flower crop cultivation area which makes around 166% of total growth achieved in area expansion of Horticulture throughout the State.
- With increased facilities of irrigation and with support of Government farmers are driven

towards more profitable horticulture farming.

▪ Fruits, vegetables and flower crops normally accrue 4 to 8 times higher profits than other crops. ▪ Horticulture farming system has high initial costing compared to traditional farming for which the government provides support on quality planting materials, area expansion, technology intervention, capacity building and infrastructure development for horticulture under various schemes.

2.10 Status of Horticultural Crops Production in Gujarat

(Table to be placed- Request Horticulture Dept to provide word file of the given document)

Production of Fruit Vegetables Spice Flower Total from 2005-06 2019-20

Production Increased in % (Lakh MT)	Fruit	Vegetables	Spice	Flower	Total
	192	**210**	**217**	**467**	**204**

▪ When the production of Horticulture crops of the year 2019-20 is compared to the year 2005-06, there is a growth of 192 % in Fruit crop production, 210% in Vegetable crop production, 217 % Spices production and whereas there is tremendous growth in flower crop production with 467 %. **3. Current Situation**

▪ Gujarat has a notable contribution to the Indian horticulture sector.

▪ In Gujarat, total area under cultivation is 96 lakh hectare, out of which area under horticultural crop is 17%.

▪ Production of fruit crops is 92.61 Lakh MT. in which major crops are:

- Banana (46 Lakh MT), Middle & South Gujarat Major Clusters
- Mango (12 Lakh MT), - South Gujarat & Saurashtra Major Clusters
- Sapota (3 Lakh MT), - South Gujarat Major Cluster
- Citrus (6 Lakh MT),
- Pomegranate (6 Lakh MT).

▪ Production of Vegetable crops is 132.30 Lakh MT. in which major crops are:

- Potato (37 Lakh MT), - North Gujarat Major Cluster
- Onion (14 Lakh MT), - Bhavnagar & Saurashtra is Major Processing Clusters • Brinjal (14 Lakh MT),

- Tomato (14 Lakh MT),
- Okra (9 Lakh MT)

▪ Production of Spice crops is 11.00 Lakh MT. in which major crops are:

- Cumin (5 Lakh MT), - North Gujarat Major Cluster
- Fennel (1 Lakh MT)- North Gujarat Major Cluster

3.1 Status of Gujarat at National Level

3.2 Gujarat state contributes 6 to 6.5 % shares in fruit and vegetable area and 14.6 % share in spice area whereas 9 % share in fruit production, 6 % share in vegetable production and 12 % share in spice production in total national horticulture development in the year 2018-19. (***Source:*** *NHB data of Year 2018-19*)

▪ Gujarat stands 3rd in Production of Seed Spice crops, 4th in Production of Fruit Crops and 6th in Production of Vegetable & Flower Crops.

▪ The State is occupying 2nd, 5th and 7th place in area of spices, fruits and vegetables respectively. ▪ In Production, fruits and spices are at 4th position while vegetables are at 5th position in the country as **Annexure III.**

3.1 Crop Profile

▪ Gujarat state is at 1st position in area of fruits crops like Papaya, Sapota and spice crop like Fennel, whereas it also enjoys the leading position of 2nd for crops likes Pomegranate, Okra and Cumin, 3rd for coriander and 4th position of Brinjal and Garlic in total horticulture area of the country.

▪ At national level, 1st position in production of horticulture crops such as Sapota, Okra and Cumin while at 2nd position for fruits crops likes Papaya, Pomegranate and Banana, 3rd position
for crops like Brinjal and coriander and lastly at 4th position in production of Potato, tomato and Garlic. State has a monopoly in production of Kutchhi dates.

▪ Gujarat is leading in productivity of spice crop fennel with highest productivity at national level then at 2nd position for Banana and Potato, at 3rd position for Pomegranate and Cumin, at 4th position for garlic and lastly at 5th position for the productivity of papaya in the country.

▪ India's monopoly crop with medicinal properties- Isabgul at world level has its processing

industries majorly developed in Gujarat giving it status of monopoly in processing as per the details in **Annexure IV**

▪ In other words, horticulture crops are high value crops and the demand for these crops is now increasing in the world.

3.2 Current Scenario of Horticulture Development in the State.

▪ Looking at the importance of horticulture crops, the State Government is putting considerable emphasis on the development of horticultural crops viz. Fruits, Vegetables, Spices and Flowers. ▪ As a result of various steps taken by the State Government, the Department of Horticulture has implemented in the year 2005-06 “National Horticulture Mission (NHM)” in the state. ▪ “Gujarat State Horticulture Mission (GSHM)” registered society has been formed with a view to double the horticulture production and income by adopting an end to end approach with simultaneous development of post harvest infrastructure and marketing facilities. ▪ The mission is being implemented in 21 potential districts and covers important crops of state viz. Mango, Sapota, Amla, Banana, Papaya, Lime, Cumin, Fennel, Flowers, Medicinal and Aroma crops.

▪ While remaining districts are covered by the fund of State as per guidance of State Horticulture Mission (SHM) norms.

▪ Horticulture farming involves skills and technology to get higher production, for which the government has given emphasis on Skill development through developing many crop specific COEs which impart training on new technologies to farmers and farm laborers.

▪ Précising farming is an important aspect for production enhancement, so the department is providing financial support to various components of the précise crop production system. ▪ Horticulture produce being highly perishable in nature, the actual production of horticulture is reduced due to post harvest losses. To prevent that, the promotional activities and financial assistance is given to the farmers on horticulture post harvest infrastructures like On-farm pack houses, Grading Sorting lines, integrated pack houses, cold storages, Mango and Banana ripening chambers, cold chain, integrated pack houses etc which can ultimately cause an increase of total crop production through reducing post harvest losses.

4. SWOT Analysis of Horticulture Sector in Gujarat:

Strengths:

- Diverse agro -climatic conditions suitable for various crops
- Clusters of seed Spices (fennel and Cumin), fruits like banana, chiku, papaya, Kesar mango, pomegranate and kutchi Dates and vegetables like Potato, okra, tomato.
- Government support for integrated development
- Established 3 CoEs under indo-Israel project, other than that 7 more CoEs at different locations and 23 Department horticulture Nursery
- Good quality planting material
- Area expansion linked with Micro irrigation
- Higher productivity and quality of produce

Opportunities:

- Scope in area expansion of fruits and dry land horticulture
- Potential for processing and export of Horticulture crops.
- Establishment of value chain
- Skill development

Weakness:

- Longer gestation period and high end technology driven
- High Cost of Inputs i.e Hybrid Seeds and IPM / INM
- Inadequate value chain
- Shortage of extension machinery and manpower for programme implementation ▪ Inadequate facilities at Market place

Threats:

- High cost of production and unstable prices to farmers
- Natural calamities due to Climate Change

4.1 **Current Issues**

- Higher initial investment for plantation of horticultural crops
- Development of Rain fed area and problematic soils
- Perishable nature of horticulture crops; Lack of PHM infrastructure at production level ▪ Limited Know how and crop production skill of farmers

- Shortage of skilled labours
- Limited market support for Fruits and Vegetables

4.2 Challenges

- Risk management against natural calamities
- Small scale cultivation and limited farmers institution
- Lacking of Quality control mechanism of Nursery plants
- Fragile Value chain, Unorganized retailing
- Limited investment for processing and export infrastructure
- Lack of Manpower for horticulture extension and technology adoption
- Development of export and processing clusters
- Development of Floriculture and Aromatic Industries
- Assured supply of Fruits and vegetables
- Promotion of Fruits and Vegetable based food habits
- Residue free production

5. **Initiatives**

- Promotion through providing financial assistance and guidance on following major components in done by the department :
- **Quality Planting Material:** Quality planting material which is true-to-type and disease free is an essential factor for good production. There is a shortfall between the required and available quantity of good quality planting material.
- For that, Planting Material infrastructures like- Small Nursery, High tech Nursery, Plug Nursery & Tissue Culture Lab are being promoted and established throughout the state in Public and Private sector.
- **Promotion of Tissue culture planting material:** High and quality production can be achieved through hi-tech Horticulture such as Tissue culture planting material.
- Provision of providing Subsidy on cultivation of fruit crops as Date Palm and Banana and vegetable crops like cucurbitaceous through Tissue Culture planting material.
- **Promotion High Density Plantation:** High Production per unit area can be obtained through High Density Plantation. Demo of HHDP and HDP in mango is carried out at COE,

Talala for farmers. ▪ **Promotion of protected cultivation such as mulching:** Through adoption of protected cultivation practices such as Mulching in fruits crops like Banana and Papaya and vegetables such as Watermelon and muskmelon cultivation, very good yield is produced along with quality of production has been enhanced.

▪ **Rejuvenation in Old Orchard:** Through Rejuvenation in old and unproductive Orchard, the production is increased.

▪ **Trellis "Mandap":** To get Quality Produce of Cucurbitaceous crop through Trellis Mandap.

▪ **Free Input Kits:** Distribution of Free Hybrid Vegetable Kits to SC/ST Farmers for upliftment of their livelihood

▪ **Protected Cultivation Technology:** based on greenhouse and poly house effect ensures efficient land and resource utilization.

▪ **Focus on Farm Mechanization & Promotion of Agro Service Providers and Custom Hiring Centers (CHCs):** Focus on increased use of tractors, mechanical harvesters for efficiency of crop production, harvesting and post-harvest handling practices.

▪ Through adoption of farm mechanization is horticulture farming the cultural practices such as sowing, weeding, rouging, application of fertilizer & pesticide, harvesting etc have become easy and fast. ▪ **Honey Bee:** For Pollination in Horticulture crops and Earn Extra Income from Honey Bee Products, promotion of Honey bee cultivation.

▪ **Export:** Farmer's registration & quality control from farm to APEDA pack house of Horticulture produce for promoting Good Quality Export

▪ **Chief Minister Horticulture Development Mission":** The uncultured and barren government land is given on lease for 30 year for cultivation of horticulture and medicinal plants.

6. STRATEGIES

ROADMAP OF HORTICULTURE DEVELOPMENT

▪ The ultimate strategy is development of crop clusters and adopts an end-to–end approach. ▪ Area-Production and Productivity enhancement plan of horticulture crops.

▪ Baseline and tentative projections.

Sr. No.	Year	Area (Lakh Ha.)	Production (Lakh MT.)	Productivity (Mt. /Ha.)
1	2019-20	18.30	237.83	13.00
2	2024-25	20.20	305.00	15.00
3	2030-31	22.75	410.00	18.00

6.1 Focus on Skill Development and Training

- Horticulture is a skill driven activity, which starts from nursery to marketing and requires special skill and knowledge.
- **Kitchen Gardening and Canning Center:** Department has Kitchen gardening & Canning training centers at 18 District level which gives preservation & Canning training to Urban & Rural Women for up gradation of skill and becoming Self sustain which leads to Women Empowerment.
- These centers give training to the youth and women within the district and nearby districts covering the whole state.
- There are 7 and 15 days classes arranged respectively and an intensive of Rs. 500 is given to each participant per day during the training.
- **Center Of Excellence:** There are 10 Centers of Excellences which are established in the state for implementing short term and medium term skill development training programs to the youth/farmers/farm labour/students.
- Around 48000 farmers have been trained and about 85000 approx. have visited the demonstrations on these CoEs.
- **Other Skill Development Activities:** To build-up the capacity of farmers through with and within the state tours, Trainings, Exhibitions, competitions of Horticulture Produce and to provide farm advisory services to the farmers.
- Initiatives like development of Horticulture centers of excellence at district level to impart

Horticulture entrepreneur/farming training for farmers/youth of the region in the field of Nursery management, Horticultural crops production, Green house–Net house production etc. • Skill development of farmers and horticultural labors through training and exposure towards new technologies in the field of farming which will help in increasing the production of the crop and also generate employment by skill development.

• Crop specific/technology specific COEs at district level will make it possible to cover all the major horticulture crops and also important technologies which will enhance the skill development of the farmers by maximum training and exposure imbibed from different COEs present in each district throughout the State.

▪ Development of urban horticulture centers under which activities like training on kitchen gardening and canning of horticulture produce is given especially to the youth and women. • The training on kitchen Gardening will help people to have sustainable livelihood and also help in changing and adapting healthy food habits by incorporating more home grown fruits and vegetables in diet.

• Through training on canning, people can get knowledge and skill of value addition of horticulture produce which can turn a horticulture farmer into an entrepreneur to get extra income; it will also create self employment and entrepreneurship/ cottage industries for small groups of women/youth in rural and urban level.

▪ Emphasis on demonstrations on New crops, High density, Precision farming and post-harvest handling technologies at farmer's farm level and also at departmental COEs/Nursery level. • By developing Demonstration farm/unit in each taluka level at farmer's farm level and also at departmental COEs/Nursery level will create awareness towards new crops and technology in the region.

• It will give practical knowledge and adaptation of new crops/technology becomes easy for the farmers.

6.2 Post-Harvest Handling and value chain Management

▪ State produces 224.91 Lakh MT fruits and vegetables. It is targeted to reduce crop losses up to 7.5 % by year 2022 and by 5 % till year 2030.

- Post-harvest handling, Cold chain - storage, value addition and good market network reduces the post-harvest losses of Fruits & Vegetables.
- There are 5-10% of farm losses in field crops whereas 25-30% in horticulture crops. So, Creation of storage facilities like sorting and grading units, on farm storage, warehouses in a wide range is required.
- Department supports infrastructural development, institutionalization of farmers groups and establishment of minimal processing and primary markets to reduce post-harvest losses.
- Total 435 cold storages, 2300 Pack houses, 317 sorting-grading units, 75 ripening chambers, 32 primary minimal processing units, 28 high-tech nurseries, 19 refrigerated van, 18 Biocontrol lab, 18 Primary cooling units and 15 integrated pack houses have been established under centrally sponsored and state plan by department of Horticulture.
- Most of the horticulture produce is mostly seasonal and perishable in nature so cannot be stored for longer periods.
- So, initiatives for activities listed below should be carried out to reduce post harvest losses and to develop the value chain of Horticulture produce.
  - Refrigerator vehicles are very important to transport horticultural produce.
  - Fruits and vegetables require multi-chamber cold storages.
  - Development of agro & food processing clusters and establishment of food processing parks catering to the entire value chain to reduce wastage and increase level of food processing in the State.
  - To promote Export- Establish a National-International level network for rapid movement of the produce with the use of market intelligence & proper market knowledge. • Creation of cold storage and cold chain with protocols for different commodity storage (with budgetary allocation, research for protocol by APEDA & SAUs.
  - Market value loss due to Absence of a market chain must be solved by creating a market chain.
  - Promoting value addition and processing units at FPO level - Support to FPOs and its federation to establish a chain like AMUL.

6.3 Introduction of New Crops:

▪ Varied climate of the state is suitable for a large number of crops.

▪ Increase in the facility of assured irrigation, availability of the technology and good planting material, market demand and industrial need shall be the drivers.

▪ Special drive shall be made for introduction of new crops.

• Examples of introduction of new crop through the above three points are as below; • Kutchhi Dates was an indigenous crop in Kutch region, but with assured irrigation facilities and good planting material imported from other countries caused development of clusters of Date Palm cultivations and promised farmers with good income from it.

• Along with it, other minor arid fruits such as pomegranate, guava, ber, custard apple are gaining popularity in this region. Crops such as Banana and Papaya which have high water requirements are also gaining interest amongst farmers.

• Banaskantha was more into growing rainfed seed spices, but with assured irrigation and exposure towards the technology it has developed into hub of Pomegranate cultivation which was a minor arid crop before 15 years.

• With assured irrigation, improved varieties and technology adaptation of mulching in cultivation of vegetable crops such as Watermelon and muskmelon, farmers are earning good income by taking the season of summer crop.

• During Rabi Season, tribal farmers of Dangs are earning hefty income through cultivation of strawberries which is gradually gaining popularity in other districts also.

• With gaining interest in exotic fruits and vegetable cultivations such as Dragonfruit (Kamalam), pineapple, thai lime, thai Guava, broccoli, colored cabbage, colored capsicum, zucchini are giving scope for new crop cultivation area expansion.

6.4 Enhancement Productivities of fruit crops:-

▪ Contribution of fruit crops in overall production of horticultural produce is 40 %. ▪ Banana, Mango, Pomegranate, Papaya, Guava and Lime are the major fruit crops of the state. ▪ An average productivity of fruit crops is 21 MT/Ha., Focus is made on following activities to increase the yield level of Fruit crops up to 23.40 Mt /Ha. And 25.50 Mt/Ha Till the year 2022 and 2030 respectively.

- Technologies: Adoption of Micro-Irrigation, Mulching, Fertigation, use of Tissue culture plants and good planting material.
- Production system: High density plantation, Rejuvenation of old orchards, introduction of new crops.
- Capacity building: Centers of Excellences, Exposure visits, skill development • Post-harvest management: Support for grading-sorting and cold chain infrastructure. • Increasing area under high yielding crops: Pomegranate, Papaya, Banana

6.5 **Enhancement Productivities of Vegetables crops**:-

▪ The contribution of vegetables in overall production of horticultural produce is 55 %. ▪ Potato, Onion, Tomato, Chilli, Brinjal, Guard crops and Okra are the major vegetable crops of the state.

▪ An average productivity of vegetable crops is 20.02 MT/HaFocus is made on following activities to increase the yield level of vegetable crops up to 22.70 Mt /Ha. 25.10 Mt/Ha till the year 2022 and 2030.

- Technologies: Adoption of Micro-Irrigation, Mulching, Fertigation, Vegetable plug nurseries, Tissue culture plants and Protected cultivation
- Production system: Trellising and IPM/INM
- Capacity building: Centers of Excellences, exposure visit.
- Increasing area under high yielding high value crops: Potato

6.6 Utilization of nonconventional area and diversification of cropping pattern: ▪ Utilization of nonconventional areas is a strategy to bring the uncultivated or less utilized area under cultivation. Crop diversification can be anything from bringing under exploited crops into cultivation to multi-storey cultivation with multiple no. of crops together or to introduce horticultural crops which are having high market potential and high profitability. ▪ The recommended and suitable crop diversification measures should be taken up to shift from low value agriculture to high value agriculture.

- Through crop diversification, wider choice of production of varieties of crop can be achieved from a given area.
- Locally grown crops, indigenous varieties and minor crops and their varieties grown in

particular areas like tribal pockets can be promoted by the government through providing more advanced varieties, technology intervention and financial assistance for it.

- Higher profitability and also stability in production also induce crop diversification.

6.7 Infrastructure support for Good Planting Material/ Quality seeds:

- Healthy and good quality planting material is of utmost importance to increase area and production of Horticulture crops in the State.
- Currently, in Gujarat total numbers of horticulture fruit crop nurseries available are around 443 and 30 Tissue culture Lab approximately.
- There is a shortfall in availability of planting material which can be overcome through establishment of Hi-tech nursery, Plug Nursery, Tissue Culture Laboratory etc. throughout the state.
- Government is giving financial assistance for establishing new infrastructure facilities and also provides assistance on strengthening the available nursery.
- Establishment of state-of-the art nurseries: under PPP model to enhance the supply of quality seedlings in adequate numbers.
- Strengthening and increasing the capacity of Departmental nurseries.

Availability of Planting material						
Sr. No.	**Organization**	**No. of Unit**	**Planting Material (Graft & Seedling)**	**Production (No. in Lakh)**	**Requirement (No. in Lakh)**	**Short Fall (No. in Lakh)**
1	**Departmental**	23	All fruit crop	2	41.5	6
2	**SAUs**	15	All fruit crop	1.5		
3	**NHB Accredited**	105	All fruit crop	12		
4	**Private**	300	All fruit crop	20		

			Papaya	600	600	0
5	**Tissue Culture Lab**	30	Banana	1230	1790	540
			Pomegranate	9	18.5	9.5

6.8 **Quality production and Certification**-

- Promotion of Good Agricultural Practices (GAP): Agro-ecological methodology for increasing the productivity of ‘banana tissue culture propagation’ is an established and popular technology that needs to be promoted.
- Likewise Integrated pest management (IPM), Integrated Nutrient management (INM), irrigation management, popularization of high yielding varieties and enhancing the adoption of crop specific agronomic techniques are the broad interventions of GAP which will improve the level of crop productivity.

▪ Diseases-Pest free areas-Importing countries have their own norms for pest and disease quarantine. ▪ Special disease-pest free zones can be created as per the requirement of targeted countries.

- Special emphasis needs to be made for research & development of methodology and package of practices and includes such activities under plant quarantine measures.

6.9 Conversion with other Departments

▪ Marketing Facilities: Promotion of Markets centers for purchase and sale of commodities. ▪ Retail sales of horticultural produce are widely done by street vendors and there are no standards fixed for the quality and sale by such street vendors.

- Thus, special policy should be established to regulate the fixed standards for the sale by street vendors and upgrade them for direct marketing with support of capacity building, market infrastructure support and with standards of hygiene.
- Gujarat Agro Industries: Promotion of processing at Micro level with help of technology: Implementation of processing of food crops mainly works on establishing projects related to Food parks and Cold Chain.
- Exclusive schemes and programs are required for primary and secondary processing of

fruits and vegetables along with product promotion to escape from glutes, and the concept of Micro and Mini Food Processing Parks at Taluka / Village clusters should be encouraged.

6.10 Support FPOs for Post Harvest Management

- Horticulture produce being highly perishable in nature, it requires proper handling and post harvest management to reduce wastage and to retain long shelf life.
- For proper post harvest management and to create a systematic value chain, FPO are very important.
- In 2020-21, the State government had identified 6 clusters of Horticulture crops and provided financial provision of Rs. 25.00 Crore for establishment of Primary processing unit with integrated sorting grading unit to run 6 FPO.
- Such infrastructure would be created in 3 normal area and 3 in TASP area which would benefit small and marginal farmers of the area
- Such provision is made at the initial stage, which can be provided to other clusters of horticulture crops in future.

6.11 Strengthening of Horticulture Extension system

- In the Department of Horticulture, Horticulture Officer does the extension work at grass root level by direct contact with farmers due to which there is adaptation of new technologies and an increase in area production of horticulture crops.
- The Horticulture Department has 177 taluka level Horticulture Officers for exclusive horticulture extension work. But, 77 taluka level horticulture Officer post is still not sanctioned due to which progress of such talukas is nominal.
- Manpower is the source of extension work at field level and dispersal of government schemes to the farmers. So, adequate manpower is a must for exclusive extension work.

6.12 Development of Export and Processing clusters

- Gujarart is having good potential in horticulture produce.
- During the period of April-November-20, the export of horticulture produce touched 219 Tonne generating income of Rs.1867.36 Crore.

▪ The major horticulture products are processed and fresh vegetables exported. ▪ Processed fruits products like frozen fruits,pulp, juices are also exported. ▪ Thus, there is a high scope of export of Horticulture from Gujarat.

Export Of Fresh and Processed Horticultural Commodities From Gujarat			
2020-21 (April to November)			
Sr. No.	**Product**	**Quantity (In Quintal)**	**Rs. In Crore**
1	Floriculture	164.47	2.11
2	Fruits & Vegetable Seeds	1038.64	17.37
3	Fresh Onion	8268.2	17.37
4	Other Fresh Vegetables	65670.32	160.64
5	Fresh Mango	236.14	7.09
6	Other Fresh Fruits	3748.66	44.12
7	Betel Leaves	222.92	8.39
8	Cucumber & Gerkins (Prepared & Preserved)	6.25	0.05
9	Processed Vegetable	103666.01	1162.82
10	Mango Pulp	8743.47	88.62
11	Processed Fruits, Juices & Nuts	27810.4	358.78
Total 219575.48 1867.36 Source: *Apeda Website*			

6.13 Promotion of floriculture Industries

▪ Gujarat has tremendous scope for floriculture industries.
▪ The major floriculture crops are loose flowers such as Marigold, Mogra, Rose and Lily, but with hi tech greenhouse there is increase in cultivation of flowers like Gerbera, Anthurium and Orchid. ▪ Through value addition in flowers such as dry flower arrangement, extraction of natural dye from flowers, oil extraction etc can create floriculture industries. They have

high demand in foreign countries.

7. Policy suggestions

▪ Medium termed production loan for perennial Fruit crops as per interest rate of Crop loan ▪ Encourage cultivation of fruit crops at public institutions, Green zone and afforestation ▪ Support farmers for large scale cultivation of horticultural crops

▪ Lease Land can be provided to FPOs for Post Harvest management Infrastructure at production clusters

▪ "Khedut Grahak Bazaar" in urban and semi urban areas

▪ Establishment of Fruit and Vegetable supply chain on AMUL model

▪ Dedicated space in Urban planning for retailing of Fruits & Vegetables

▪ Introduction of Nursery Act

8. Work plan 2021-22 & 2022-23

▪ Government supports area expansion, technology intervention, capacity building and infrastructure development for horticulture.

FOCUS AREA	UNIT	2020-21 (Planning)	2021-22	2022-23
Financial allocation	**Rs. Crore**	406.4	440	485
Area expansion	**Lakh Ha.**	18.3	18.7	19.1
Planting material Infrastructures	**No.**	473	485	500
Post Harvest Management :-				
Cold Storage capacity	**MT**	23	23.5	24
Integrated Pack House	**No**	15	17	20
Skill Development for Horticulture Professional (Through CoEs)	**Beneficiary**	2000	2500	3000
Training to Women for Value addition in Horticulture produce	**Beneficiary**	5000	6000	7000

9. Outcome

Sr. No.	Year	Area	Production	Productivity
1	**2019-20**	18.3	237.83	13
2	**2024-25**	20.2	305	15
3	**2030-31**	22.75	410	18

- Increase Area, Production and Productivity of Horticulture crops
- Reduction in Post Harvest Losses
- Establishment of Horticulture infrastructure
- Increase in Farmer's Income

10. Research Needs:

- Development of low cost protected cultivation structures, post harvest techniques. ▪ Improved Varieties which can adapt with climate changes.
- Develop cultivation practices for exotic Horticulture crops through multi location trials. ▪ Improved varieties of under exploited fruits and vegetables.
- Horticulture fruit crops are mostly perennial in nature, their gestation period is long. So it needs improved varieties with a short span of gestation.
- New improved varieties of vegetables and fruits with high nutritional levels, good shelf life and processing qualities.
- Improved and accessible method for remote sensing and Gio tagging technology for crop loss survey.

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Annexures

(Annexure I, II and IV to be placed- Request Horticulture Dept to provide a Word File of the given document)

Annexure I
Estimated Area & Production of Horticultural Crops

(Gujarat State) Area in '000' Hectares,Production in '000' M.T.

Annexure II

ZONEWISE/DISTRICTWISE ESTIMATED AREA, PRODUCTION AND PRODUCTIVITY OF HORTICULTURAL CROPS FOR THE YEAR 2019-20

Annexure III

Status of Gujarat at National Level

		Gujarat	India	% Share	Rank
Fruits	Area	422.4	6506	6.49	5
	Production	8996	97358	9.24	4
	Productivity	21.3	14.96		
Vegetables	Area	613.1	10259	5.98	7
	Production	12254	184394	6.65	5
	Productivity	19.99	17.97		
Spices	Area	567	3878	14.62	2
	Production	980.4	8124	12.07	4
	Productivity	1.73	2.09		

Area in 000 Ha., Production in 000 MT.
Source: *Gujarat Horticulture (Based on Horticulture at a glance 2018)*

Annexure IV

Crop Ranking Profile At National Level

2. Directorate of Animal Husbandry

❖ Current Situation:

Gujarat is home to a total 27 (13.71%) recognized livestock breeds out of total 197 registered breeds of India. Gujarat is bestowed with Gir and Kankrej breed of Cattle along with Mahesani, Surti, Jafarabadi and Banni breed of buffalo which are well known for their milk yield potential. Gujarat is also bestowed with Marwari and Patanwadi breed of sheep; Sirohi, Surti, Mehsana, Kutchi, Gohilwadi and Zalawadi breed of goat; Kutchi and Kharai breed of camel; Kathiawari and Kachchhi-Sindhi breed of Horse etc. In the last decade, rigorous efforts have resulted in registration of 9 new breeds of livestock viz. “Banni buffalo”, “Kharai Camel", “Kachchhi-Sindhi horse”, “Panchali Sheep”, “Halari Donkey”, “Kahmi Goat”, “Nari Cattle”, “Dagari Cattle” and “Kachchhi Donkey” by National Bureau of Animal Genetic Resources, Government of India.

As per Livestock Census-2019, Gujarat possess 269 Lakhs livestock contributing around 5 % to the total livestock population of India. Gujarat stood on 3rd rank for possessing Buffalo population and on 5th rank for possessing female bovines across the country. Banaskantha, a leading district of Gujarat in milk production stood 1st with highest buffalo population in the country.

Status of species wise livestock population of Gujarat and rank in India in livestock census 2019 is as per table given below.

Class	Gujarat	India	Contribution (%)	Rank
Cattle	96.34	1925.23	5.00 %	11th
Buffalo	105.43	1098.52	9.60 %	3rd
Sheep	17.87	742.61	2.41 %	8th
Goat	48.68	1488.5	3.27 %	13th

Horse	0.22	3.42	6.37 %	5th
Donkey	0.11	1.24	9.14 %	4th
Camel	0.28	2.52	10.96 %	2nd
Poultry	217.73	8518.10	2.56 %	12th

As per Basic Animal Husbandry Statistics, 2019 data; contribution of Gujarat in the country's total annual production of various livestock products and position of Gujarat at national level is shown in below table.

Product	**Gujarat**	**India**	**Contribution (%)**	**Position at national level**
Milk (Lakh MT)	144.92	1877.49	7.72	5th
Wool (Lakh Kg)	22.71	404.20	5.62	5th
Egg (Crore)	185.44	10331.76	1.79	14th
Meat (Lakh MT)	0.33	81.14	0.41	21st

Along with production, productivity per animal is a major factor for making animal husbandry more profitable and because of this, emphasis has now been given more on to increase productivity rather than number of productive animals. As per Basic Animal Husbandry Statistics, 2019 data, yield per animal in case of Buffalo, Indigenous Cow, Crossbred Cow and Goat in Gujarat and in India along with rank of Gujarat in country is shown in below table

Category	**Gujarat**	**India**	**Rank of Gujarat**
Indigenous Cow (Kg/Day/Animal)	4.65	3.85	9th
Buffalo (Kg/Day/Animal)	5.39	6.34	12th
Crossbred Cow (Kg/Day/Animal)	9.32	7.85	6th
Goat (Kg/Day/Animal)	0.48	0.45	10th

Animal husbandry and dairying sector has played a vital role in socio-economic development of Gujarat state. Animal husbandry provides employment opportunities to every class of society and is also an important source of income for poor families of Gujarat. Around 29% households of Gujarat state are associated with animal keeping in one or another way. Due to constant efforts and support of state and Central Government with the well-established dairy cooperative structure of AMUL having more than 36 Lakhs members in more than 19000 societies of 22 Milk unions of the state has been strengthened in terms of milk procurement and processing. The procurement of milk through Dairy co-operative set up has reached to 52 % of total milk production in state in 2017-18, which was just 32 % of total milk production during 2000-01.Enhanced infrastructure and remunerative price mechanism in dairy co-operatives of Gujarat has contributed significantly to livelihood of livestock owners of the State.

Rise in production, productivity and procurement in the organized sector has a clear cut reflection on the contribution of the livestock sector in Gross State Value Added (GSVA). As per quick estimate data of Directorate of Economics and Statistics, Government of Gujarat, collective share of crops and livestock was Rs. 1,49,769 crores (13.63 %) to gross state value added (GSVA) at basic price of Rs.13,13,534 crores in year 2018-19; share of crops sector alone in GSVA was Rs. 1,06,240 crores (8.09 %) and share of livestock sector alone in GSVA was Rs. 43,529 crores (3.31%). The share of livestock to the collective share of crops and livestock was 29.06 %.

Animal Husbandry has been an integral source of household income to every class of society; large numbers of families in rural areas get persistent income by rearing milch animals. As per National Sample Survey Office (NSSO) 2013 data, income from livestock in total income of farmers of Gujarat is 24%, which is almost double than national average. Along with economic sides, the livestock sector provides the richest source of animal protein i.e. milk and eggs to the society. Increased milk production of the state has an affirmative impact on per capita availability of milk. In Gujarat, recorded per capita availability of milk was 626 gram per day in 2018-19, which is quite higher than the national average of 394 gram per day.

❖ **Current Issues:**

- Considering the livestock population being reared at millions of households of livestock owners across the state, current animal health and breeding coverage of Gujarat in terms of infrastructure and human resources need to be expanded.
- Though feed and fodder accounts for 65-70 % of expenditure of production, livestock owners give inadequate attention to the feed and fodder aspect.
- Green and dry fodder is not available round the year in many areas of state. Higher cost of feed and fodder for animals is also a major issue which needs to be addressed with appropriate policy intervention and by providing adequate assistance to individual owners.
- Many livestock owners are still following conventional breeding practices and have negligence to timely vaccination regimen.
- Low milk productivity as compared to developed countries is also leading to high cost of production.
- Less attention of livestock owners towards milch animal by-product utilization and less value addition also contribute to being less profitable.
- Lack of ease of credit facility for livestock is still a major issue where livestock keepers are still out of reach to good credit support.
- Animal Husbandry has been adopted as a supplementary income source and not as the primary source because still household rearing of animals with minimum input is preferred.
- Due to lack of disease free zones, export potential for many livestock products primarily milk and milk products is hampered particularly to developed countries.

- Development of private entrepreneurship in the dairy sector is poor most probably on account of Strong cooperative structure in the state. Additionally, farm gate value addition to milk and milk products is meagre in the state.
- It is a crucial requisite to explore the economic utility potential of non-dairy livestock such as Goat, Sheep, Camel, Horse and Donkey to increase income to owners of these animals.
- Milk from sheep, goat, donkey and camel i.e. non-bovine milk has not been explored up to its full potential from an economic point of view.

❖ **Suggested Strategy**:

- It is suggested to establish new veterinary institutes and AI centres to expand the existing coverage to 10,000 livestock units per veterinary institute and 1,000 breedable livestock population per AI Centre.
- There should be focus on devising newer technologies for rapid diagnosis and accurate forecasting of diseases in animals for effective mitigation and control of disease and thereby to reduce the economic losses to livestock owners.
- It is necessary to formulate a focussed breed specific programme especially for conservation and propagation of newly recognized breeds so as to increase population of indigenous breeds of cattle and buffalo with special reference to concern of declination in population of indigenous cattle in livestock census 2019 as compared to livestock census, 2012.
- There should be focus on preservation and propagation of indigenous livestock with inclusion of sophisticated technologies like Sex sorted semen, Embryo Transfer, as our indigenous livestock can sustain extreme climatic conditions and have better heat tolerance and disease resistance.
- Along with this, livestock owners should be encouraged towards scientific livestock keeping by providing appropriate assistance and extension to make livestock rearing as profitable ventures rather than sustainable household activity.

- Heifer rearing programmes can be an important strategy to encourage livestock owners to rearing heifers instead of procuring well grown livestock (especially cross bred cattle) from other states to prevent infectious diseases with those livestock.
- Rural fodder entrepreneurs and progressive farmers should be incentivized to produce fodder as cash crop to counteract fodder deficient status of state, so as to have availability of green and dry round the year. Utilization of wasteland for fodder production should also be explored as well.
- Executing programmes of providing incentives for escalation of AI coverage of the state should be a key strategy to attain maximum output through genetic improvement in addition to providing adequate infrastructure and human resources for artificial insemination in livestock.
- Keeping in view the large number of nondescript animals in the state, up-gradation and improvement of indigenous cattle of Gujarat should be strategically implemented. Nondescript cattle population should be upgraded using semen of bulls of pure indigenous cattle.
- Since huge economic losses are encountered by the livestock industry on account of mastitis; strategic formulation and effective implementation of mastitis control programme along with imparting education to livestock owners to follow necessary scientific measures for prevention and control of mastitis.
- More intensive programmes of fertility improvement should be designed and effective implemented with an aim to make animals to calve which have not calved once in their life; as 5.44% of buffalo, 4.42% of Exotic/Crossbred cattle and 5.35% of indigenous cattle of state have never calved in their life even though they are breedable. This can add to achieving the target of increasing milk production along with reduction in cost of production.
- There is a need to incorporate use of newer technology such as electronic doors to detect estrus/heat of animals. Effort should also be diverted on development and filed application of cow side test for early detection of pregnancy and tools of early detection of sub clinical mastitis as well to prevent economic losses to livestock owners.

- The pertinent issues of nutrient deficiency in animals are also to be dealt with scientific remedies like formulating area specific mineral mixtures to meet the macro and micro nutrients requirements for increasing production/productivity of livestock. Reducing the age at puberty especially in buffalo especially through nutritional intervention may play an important role in making the sector more cost-effective.
- In the field condition, many successful livestock owners are earning a quite handsome income. In 2019-20, many women members of Banas dairy recorded annual milk supply to the tune of more than 50 Lakh per annum. Demonstration of innovative approaches and practices adopted by such successful livestock owners to others may also be one of the important factors to encourage the other livestock owners.
- Long term planning to provide more lucrative incentives for Non-dairy activities like rearing sheep, goat and poultry keeping to especially small farmers and SC/ST beneficiary is required, as non-dairy activities not only diversify the livestock sector but also cater the need of those sections of society who cannot rear dairy cattle due to socio economic conditions. More lucrative incentives can be provided for non-dairy activities like goat rearing, poultry keeping, to all categories of people.
- Research should be targeted in the direction of developing indigenous technology for sorting of semen to reduce cost of production of sexed semen doses. Prediction of fertility of male/female calf at early age and extending shelf life of milk should also be a major area of research in the field of animal husbandry and dairy science.
- Enormous scope exists in exploring the full potential of non-bovine milk viz. milk of sheep, milk of goat, milk of camel for nutraceuticals and for therapeutic purposes. Goat milk has biomolecules having antiviral properties, camel milk has biomolecules having anti-tuberculosis properties, analgesic and anti-inflammatory properties have been observed in various non-bovine milk. Aphrodisiac compound has been isolated from donkey milk.

❖ **Work Plan 2021-22 & 2022-23**

For all the suggested strategies described earlier, the proposed action plan for next two years i.e. for year 2021-22 and 2022-23 includes targets envisaged to be achieved by 2030.

- There is an inevitable additional requirement of Infrastructure and Human Resource for Health and Breeding of livestock in the State, where in particularly at least 100 new Veterinary Dispensaries and 50 new Mobile veterinary dispensaries are required to be established during next two years
- For prompt and accurate diagnosis well-equipped disease diagnosis facilities and other treatment facilities are required to be made available in every corner of the State. Modernization of 99 Veterinary Dispensaries, 10 Animal Disease Investigation Offices and 20 Veterinary Polyclinics has to be carried out in the next two years to expand and strengthen Animal Health Services of state.
- It is also envisaged to establish 2 new ICDP and 250 New AI Centres. Newly constructed FSS at Bhutvad and Mandvi are to be made operational during next two years which requires additional technical staff and supporting staff apart from existing sanctioned staff along with necessary infrastructure.
- Production of 47 Lakh Frozen Semen Doses and 2.50 Lakhs Sexed Semen Doses is estimated during the next two years at Government Frozen Semen Stations.
- Wide range of individual and institutional beneficiary schemes are playing an instrumental role in overall development of the Animal Husbandry sector in the state. During next two financial years, target of various multifaceted scheme will be as follows;
    - Interest subvention for approximately 13000 milch animals will be provided
    - Assistance will be provided for construction of cattle sheds to 630 beneficiaries.
    - Approximately 1,03,000 fodder minikits of improved variety will be distributed to promote fodder production for livestock.
    - Assistance will be provided to 4000 beneficiaries for purchase of power driven chaff cutter

- Approximately 1 Lakh beneficiaries will be covered in providing assistance for cattle feed for pregnant animal and 2.50 lakhs beneficiaries will be covered in providing assistance for cattle feed for each calving animal
- Assistance will be provided for 2260 units of 10 +1 Goat, 10,000 units of 25 RIR/Kadaknath, 400 units of 40 RIR birds to persons with disabilities and 1000 units of 50 RIR/Kadaknath along with necessary training of poultry farming
- To promote self-employment through dairy farming, assistance will be provided for the establishment of 3000 units of 12 milch animal farms and 50 units of 50 milch animal farms.
- To strengthen dairy cooperative structure of state, assistance will be provided to village dairy cooperative societies for 1742 automatic milk collection system, 517 bulk milk cooler, 2763 milk adulteration detection machine with approval of Government of India under National Programme for Dairy Development
- Construction of 460 Dudhghar/Godowns for village dairy cooperative society will be assisted by the Government of Gujarat.
- Projects of assistance for establishment of new 3 paneer plants, 1 cold storage for butter will be taken up upon approval under Rashtriya Krishi Vikas Yojna. Approved projects of assistance for 02 Milk Processing Plant to milk unions of state are planned to be completed by 2023.
- It is planned to organize 132 district shibirs with 400 participants in each shibir. Similarly, 496 taluka shibirs will also be planned with 300 participants in each shibir. Scientific animal husbandry and breeding practices will be taught and literature for the same will be provided to each participant free of cost to participants in these shibirs. Participants will also be guided for various beneficiary schemes.
- Total 1130 best livestock owners of the state will be offered an award to recognize and appreciate best practices followed in various aspects of animal husbandry and dairying. “Prerna Pravas” will also be organized covering approximately 12,400 livestock owners.

❖ **Policy Suggestions**

- State Policy is required to be formulated for minimum requirements and standards of Livestock Health, Breeding and Extension, to bring holistic development in the livestock sector of Gujarat.
- Though Animal Husbandry is now being termed as sustainable rather than supplementary to agriculture, rearing of animals and poultry is still not provided the status of agriculture for land, electricity and taxes.
- Policy intervention is required for effective coordination of all stakeholders at state level for issuing necessary instructions w.r.t. issuing Kisan Credit Card for animal husbandry and providing credit in regards to specific set targets of ground level credit for the animal husbandry sector.
- Comprehensive policy is required to be formulated to encourage dairy activities in Saurashtra and Kutch regions of state to suffice the gap of necessary infrastructure for dairy development.

❖ **Outcome of strategy**

It is expected that the above suggested strategies and work plan for next two years along with suggested activities to be planned in subsequent years till 2030 will bring about following outcomes.

- By establishing 900 new veterinary institutes headed by registered veterinarians and 926 new AI Centres by 2030; Health Coverage of 10,000 livestock units per veterinary institute and coverage of 1,000 breedable livestock population per AI Centre is likely to be achieved by 2030.
- Considering an increment of 6.45 MT every year (5.6 %), it is envisaged to reach annual milk production of 217 MT by 2030 in Gujarat.

- By all suggested strategic interventions, the goal of a rise of 18 – 21 % can be set for productivity of indigenous cows, buffalo and crossbred cows of Gujarat.
- Considering current milk procurement and growth pattern in cooperative set up of Gujarat and by supporting necessary facilities for milk procurement, processing and marketing, the target of milk procurement of 320 LLPD under cooperative network car be made.

3. Sardar Sarovar Project Command Area

1. **Introduction :** "Atmanirbhar Krishi" and "Atmanirbhar Kisan" are important to achieve the goal of "Atmanirbhar Bharat" as announced by the Hon'ble Prime Minister in his address to the Nation on the 74th Independence Day. In keeping with the vision and priorities,the Union Ministry of Agriculture & Farmers' Welfare has taken several initiatives and spearheaded key reforms in agriculture in the recent past. Also, The Government has committed to accord high priority to water conservation and its management through Pradhan Mantri Krishi Sinchai Yojana (PMKSY) with the vision of extending the coverage of irrigation 'Har Khet Ko Pani' and improving water use efficiency 'More Crop Per Drop' in a focused manner with end to end solution on source creation, distribution, management, field application and extension activities.

   Agriculture has been the common occupation of over half of the population of Gujarat. More than two third of the area has been arid, semi-arid and drought prone, therefore, the availability of water has been the limiting factor for the agriculture sector for years. Therefore, efforts are being made for creating water resources, its conservation and optimum utilization of water. Further, looking to ever-increasing demand, maximum water sources are required to be harnessed.

   The mission of the Sardar Sarovar Project is harnessing the untapped waters of the Narmada for the survival of millions of people and environmentally sound sustainable development of the western India by providing the essence of Life-Water & Energy.

2. **Status of command area development :** The Sardar Sarovar Project is one of the largest multipurpose water resources projects of India shared by four major states – Gujarat, Maharashtra, Madhya Pradesh and Rajasthan. With 1,133 cumecs (40,000 cusecs) capacity at the head regulator, and 532 Km length, the Narmada Main Canal is the largest concrete lined irrigation canal in the world. The other features of the project are power generation with installed capacity of 1450 MW, and 35 MW from Canal Top Solar Power Generation.

The Sardar Sarovar Project Command covers an area of 18.55 lakh ha covering 3177 villages in 77 talukas of 17 districts. It is characterized by wide diversity in Agro-climatic and Socio-economic features among the geographical units. The whole area is divided into 13 Agro Climatic Regions considering the natural factors like rainfall, land irrigability class, groundwater quantity and quality and drainage condition.

With a view of covering maximum area that is arid and semi-arid with least utilization of irrigation water while maintaining soil health and safeguarding the environment, 'Narmada Planning Group' has worked for years to incorporate the global expertise through various studies and interactions. The NPG in its visionary plan envisaged the enhancement of 'Irrigation Intensity' and the 'Water Use Efficiency' as the same is now followed for the entire country under the Pradhan Mantri Krishi Sinchai Yojana (PMKSY).

The command area development activities in SSPC has mainly included construction of minor and below network and to empower Water User Associations (WUAs) such that they can distribute and use the water efficiently. Farmers are trained for on farm use of water efficiently including Participatory Irrigation Management (PIM) and specific practices of crop management under prevailing agro-climatic conditions. The status of development of the canal network is given in Table-1. The canal network up to sub minor is developed in 14.92 lakh ha and the remaining area is planned to be completed by December, 2021. However, out of the proposed 4497–WUAs, 3464 are registered and only 69 are functioning. Hence, actual realization as against the envisaged is quite less.

Table-1: Status of Canal Network and Irrigation Potential created (up to Jan.'21)

Particulars	**Unit**	**Total**	**Completion**
(I) Canal System:			

A	Main Canal	Km	458	458
B	Branch Canals (38 Nos)	Km	2731	2641
C	Distributary (727 Nos)	Km	4569	4416
D	Minors (4459 Nos)	Km	15670	14273
E	Sub Minors	Km	48320	40326
	Total (A to E)	**Km**	**71778**	**62114**
(II) Irrigation Potential:				
A	Up to Minor	Ha	1792328	1677513
B	Up to Sub-Minor	Ha	1855411	1492320

3. Strength of SSP for Atma Nirbhar Krishi :

- **Drinking and industrial water supply:** Sardar Sarovar Project is a Lifeline of Gujarat as it provides multiple benefits for better living of people. Besides many direct and indirect benefits, it provides water for industrial and drinking purposes in 10473 villages and 173 towns spreading throughout Gujarat.
- **Vast lined canal network:** It provides water for irrigation in a large command area of about 18.55 lakh ha comprising 3177 villages in 77 talukas of 17 districts. Irrigation water is conveyed and distributed through this network from the main canal head regulator to minor by lined canals and from minor through 'Underground Pipeline' sub-minor up to outlet called 'Sub-chak'. Each minor covers an area of about 400-600 ha, which is called 'Village Service Area' (VSA). Sub minor off-takes from minor and the area irrigated by each sub-minor is called 'Chak', which varies from 30 ha to 60 ha. The sub-minor delivers water up to an outlet which covers

an area of 5 ha to 8 ha called 'Sub-chak'. Hence, SSP has a vast lined canal network of about 71778 km., the largest lined canals network in the country.

- **Large catchment contributing runoff :** The catchment area of Sardar Sarovar Dam is about 88,000 Sq. km., which is one of the largest water resources contributing catchment in the country. Larger catchment provides more stability in water availability.
- **Wide scope of generating green energy:** The Sardar Sarovar Project has an installed capacity of 1450 MW hydro power generation. In addition, SSNNL has successfully commissioned 10 MW 'Canal Top Solar Photovoltaic Grid Connected Power Plant' on Vadodara Branch Canal in November-2014. Also, 10 MW Solar Power Projects on Canal Top & 15 MW Canal Bank on the same branch were commissioned in September-2017. Hence, there is a very good scope of generating electricity on canal top and/or canal bank in the vast canal network available in the entire command.
- **Scope of growing variety of high value crops:** The command area of SSP having varying agro climatic conditions, from arid - semi arid to humid in monsoon. Likewise, rainfall ranges from 1000 mm in the districts towards south to 450 mm in Saurashtra and Kutch. Soil texture ranges from heavy black cotton soil to sandy soil. This wide variation in agro-climate enables it to take a variety of crops.

4. Issues and limitations of irrigated agriculture :

- The foremost challenge in Sardar Sarovar Project command is the twin problems of water logging and soil salinity which is a common environmental problem in the large irrigation projects. In case of SSPC, the outfall conditions are sluggish and parts of which are also affected by salinity. There are some areas or pockets which are very much prone to waterlogging and soil salinity.

- Though the project is based on the principle of 'Participatory Irrigation Management', hardly any 'Water Users' Association' has taken over canal management below the level of the minor canal.
- Some basic issues prevail related to crop management and productivity. With the introduction of canal irrigation, the farmers are practicing more water intensive crops and applying excessive chemical fertilizers which may cause soil degradation in future.
- The irrigation water allowances for the different 'Agro Climatic Region' have been worked-out keeping in view the soil classification, groundwater availability, crops grown and climatological factors. Particularly, in poorly drained flat lands with relatively higher water tables, very limited water allowance has been planned. This is absolutely not followed by the farmers nor could the system be provided.
- •As per 'Water Use Plan' considering available water, the estimated average delta at field level is about 330 mm. The actual availability may be even less to meet the irrigation requirement during Rabi and one or two life saving irrigations during Kharif which itself is a great challenge and difficult to achieve.
- •Realization of felt need among farmers of effective use of water as a precious commodity is far from achievement. Though the farmers are reluctant, adoption of 'Micro Irrigation System' on large scale is essential; at least there is a need of improvement in conventional methods of irrigation and adoption of on farm water saving technologies which is so far from the adoption.
- The cases of excessive seepages are observed randomly in the entire command area. This limitation is coupled with over irrigation being practiced by the farmers which may create critical situations against productivity in many areas in future.

- Inherent soil salinity exists in the major area of the command. The areas under highly saline and very highly saline category have increased in Phase-II, whereas, the areas under strongly alkaline and very strongly alkaline category have increased in entire command after the introduction of irrigation. This must be checked earlier to sustain the present productivity.
- There is an acute shortage of staff having concerned expertise for farm level development and water distribution/ management as well as for guiding the farmers from time to time regarding crop management practices and irrigation related issues. Also, the specific condition of the command area requires certain strategic actions of land reclamation, providing sound drainage system, providing design dimensions of conventional methods, adoption of micro irrigation system on large scale, providing the facility of on farm storage and solar pumping system and other on farm development activities for which the required expertise of agriculture engineering is not available.
- The Farmers facing problems in receiving irrigation water timely because of non-functional status of complete canal network up to sub-chak due to missing links and direct lifting from the canals became normal practice among the farmers in head reaches. Continuing these practices will create a dangerous situation for correction in future.

5. Strategies for mitigation of the issues : The Sardar Sarovar Project command has vast areas with varying topography, geo-hydrological and agro climatic conditions. There are specific problematic areas and inherent as well as management issues as discussed. In order to address prevailing issues, following mitigation measures consist of preventive and corrective location specific strategic activities which are required to be carried out.

- **Reclamation of Problematic Lands: -**

- Adoption of soil improving farm practices. (crop residue recycling using equipment like 'Rotavator' and 'Shredder').
- To carry-out on-farm land reclamation interventions (construction of peripheral bunds, drainage ditches, "Chhalati" (out lets) and installation of "Holiya").
- Promoting the practices of subsoiling, deep ploughing and leaching.
- Adoption of gypsum application and other soil amelioration measures as per requirement.

- **Construction of Field Drainage System: -**
  - To undertake measures to improve soil internal drainage.
  - Create awareness among the farmers about the importance of drainage for preventing water logging and soil salinity.
  - Design and installation of field drains, surface/ sub-surface drainage network and bio-drainage as per requirement, step-by-step within sub-chak, chak and up to VSA level.
- **On-farm Development Practices to Enhance WUE: -**
  - Adoption of precision land leveling, land configuration and water saving techniques, UGPL within farms and designed dimension of conventional methods of water applications.
  - Construction of on-farm water storage facility (sump) and conveyance system.
- **Water Resources Management at Farm Level: -**
  - Construction of water harvesting and surface storage structures like farm ponds.
  - Construction of open/bore wells to create additional water resources at farm level.
  - Adoption of on-farm rainwater conservation and run-off water recharge practices through Dug wells, Holiya etc.
  - To encourage conjunctive use of groundwater specifically crop based conjunctive use where good quality ground water is available.
- **Adoption of Micro Irrigation System: -**

- On-farm Development of the system comprising land configuration, construction of water storage tank, installation of solar pump set and Micro Irrigation System.
- Capacity building among the farmers for selection, replacement and re-installation of components for better maintenance of the system, acid treatment and flushing fertigation techniques and utilization of the whole system in compatibility of canal operation.

- **Soil Health Management and Organic Farming: -**
  - Promoting practices of soil enrichment of organic matters and fertility management.
  - Adoption of green manuring and recycling of crop residue/ organic farm wastes. c. Promoting organic farming and restricted use of chemical fertilizers and pesticides.
- **On-farm Use of Non-Conventional Energy: -**
  - Installation of solar panels and pump-set for operating MIS and stationery farm equipment.
  - Promote bio, solar and wind energy operated equipment/ appliances for on-farm value addition and harvest and post-harvest practices.
- **Economic Activities by FIGs/ WUAs: -**
  - Facilitate the WUAs/ FIGs/ FPOs for installation of small-scale processing plants and coordination to provide market linkages.
  - Promote Custom Hiring Centres' for adoption of mechanization specifically use of feasible modern equipment of higher cost.
  - Cluster development of high value crops, coordinated to provide linkages of value addition for specific Agro-ecological situations, primary processing and marketing.
- **Development of Water Distribution Network: -**
  - Design and installation of water convey systems from sub-chak to individual fields.
  - Device irrigation scheduling compatible with canal operations as well as rotational water supply system and its implementation.

- Community mobilization for repair and maintenance of canal network from minor head to up to the field.

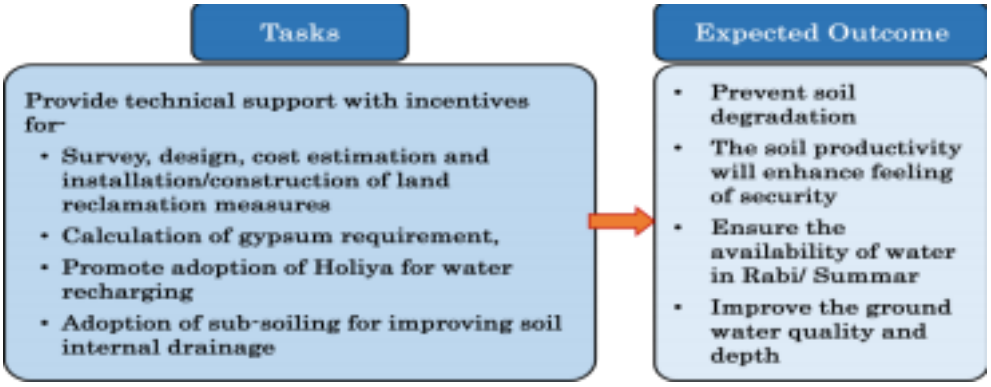
6. Enhancement of irrigation activity and WUE:

- **Required:**
  - Empower the farmers for sound soil and water management practices to achieve higher irrigation intensity and sustainable crop production while maintaining soil health in the command area.
  - Educate the farmers for efficient use of available irrigation water and adoption of improved agricultural practices to achieve higher water use efficiency in commands.
  - To create a sense of ownership among the farmers of Sardar Sarovar Project Command by disseminating information and development of skill to achieve higher water use efficiency following the approach of Participatory Irrigation Management.
- **Actions required:**
  - There is a strong need to increase Water Use Efficiency (WUE) to increase water productivity, employing a sustainable trade-off between productivity and water saving.
  - On-farm augmentation and water transfer from surplus to scarce area is necessary for sustainable development of water resources and combating recurring shortages in many parts of the command particularly in tail end far reaches.
  - The minor level irrigation systems must be designed and operated, may be automatic based on 'Crop Water Requirement' to ensure uniform distribution of water as well as field application methods of conventional and PINS+MIS to improve quality of production and protect the environment.
  - Efforts should be made encouraging participatory irrigation management (PIM); •The use of solar power for pumping and on farm storage of water promotes high tech agriculture improving the water productivity.

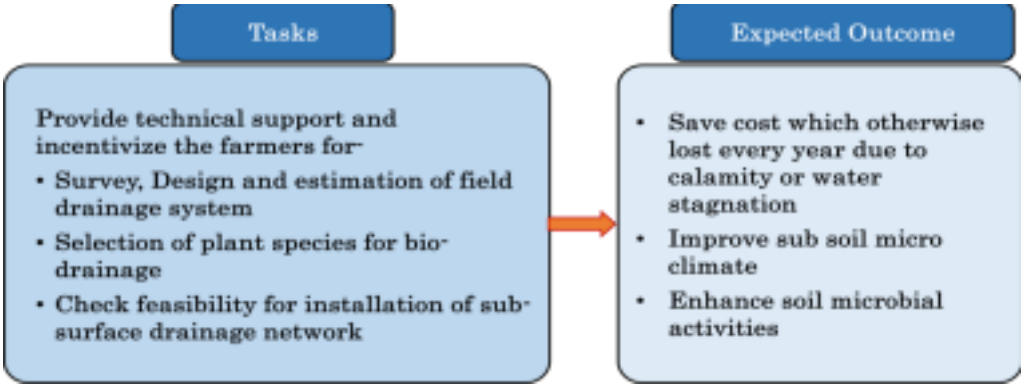
- In the era of "Digital and Make-in India", there is a strong need for development of Decision Support System (DSS) for scientific decision making and automation in water distribution up to possible extent for efficient management of irrigated agriculture.

7. Activity wise tasks and expected outcomes:

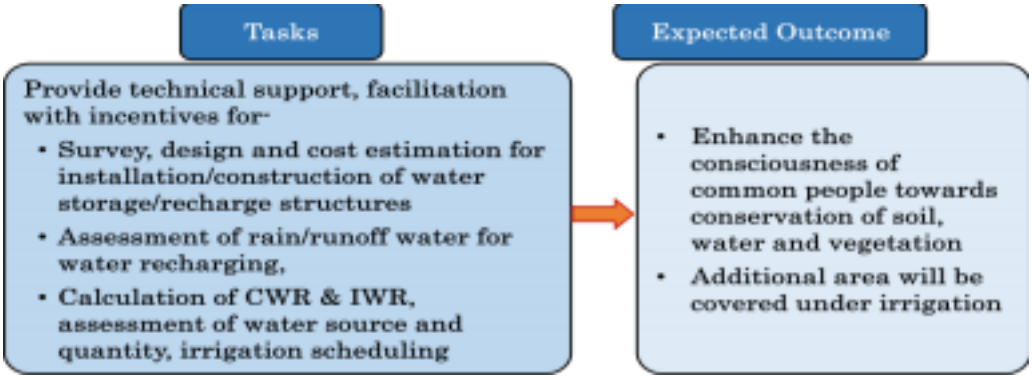
- **Reclamation of problematic land;**



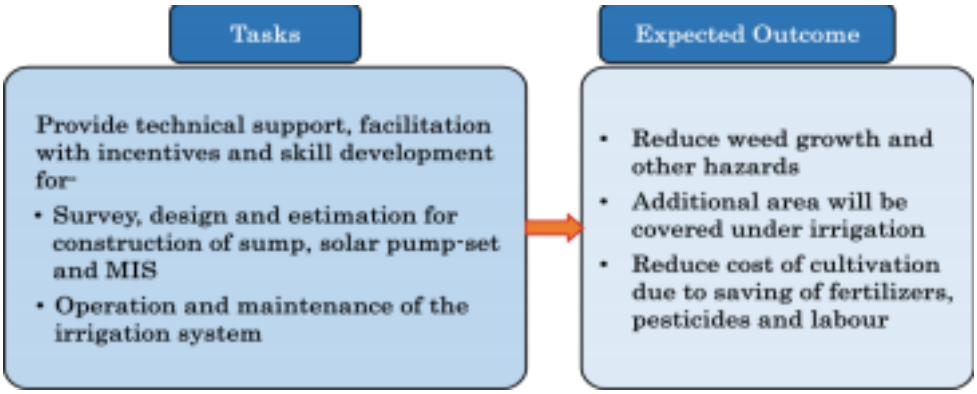
- **Installation of field drainage system;**



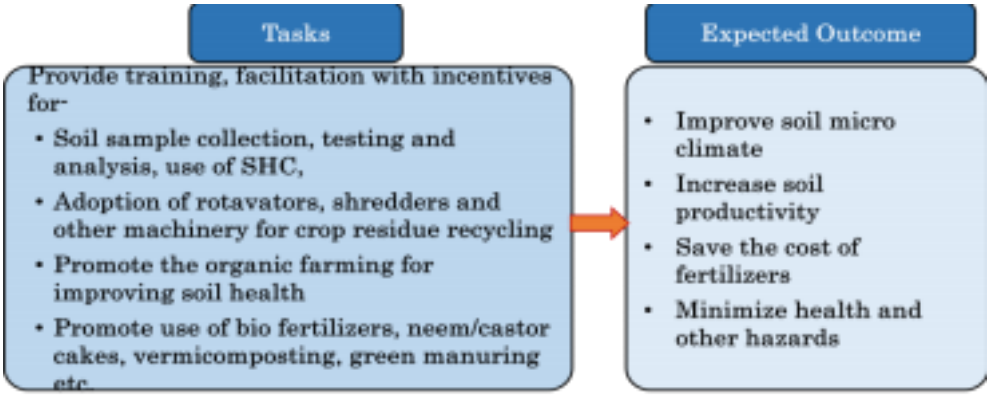
- **OFD to enhance WUE and water distribution;**



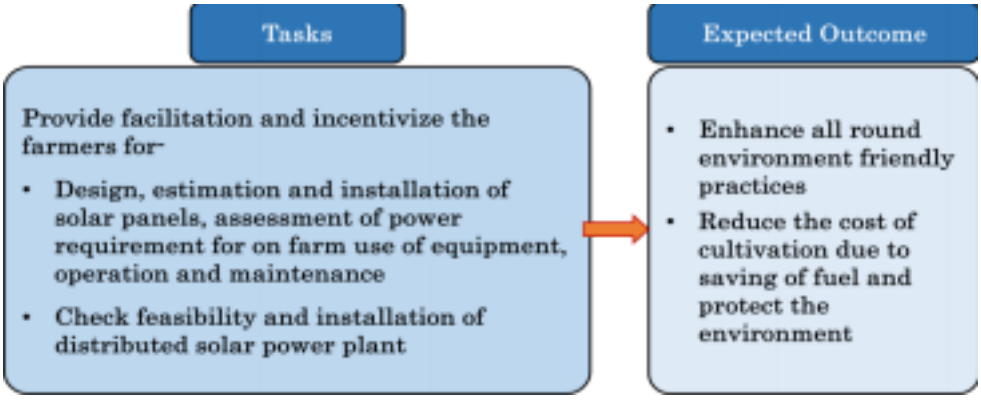
- **Adoption of Micro Irrigation System;**



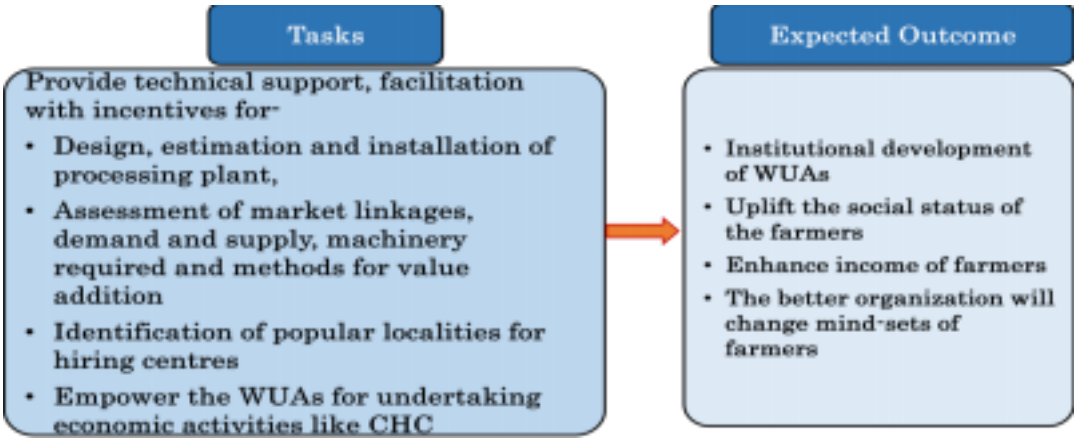
- **Soil health management and organic farming;**



- **On farm use of non-conventional energy;**



- **Economic activities involving FIGs/WUAs;**



8. Work plan 2021-23 to undertake proposed activities :

- Keeping in view the issues and the activities required being undertaken, it is being planned to undertake the narrated activities along with development of

distribution network from sub-chak up to the fields.

- The implementation may be initiated by undertaking all the proposed activities as per technical feasibility in each of the 13 Agro-climatic conditions on pilot basis.
- Equal numbers of the present posts of Agriculture Wing shall be full-fledged filled-up by appropriate expertise as recommended by the high level experts' committee of SSNNL.
- It is proposed to achieve smooth functioning of the secluded agriculture wing and significant progress of pilot development in each of the 13 Agro Climatic Regions by the year 2023.

9. Potential Outcome :

- The Sardar Sarovar Project generates benefits through irrigation, hydropower and supply of water for domestic and industrial uses. The irrigation creates additional opportunities of direct employment in the agricultural sector and indirect employment opportunities because of backward and forward linkages.
- The cropping pattern in the command has witnessed a major shift towards high value crops like cotton, castor, pulses, spices, fruit crops, vegetables etc… Availability of assured water has led to use of improved and high yielding varieties of seeds and use of fertilisers. The agricultural production in the command area has registered notable increases in production of major crops, which has created additional employment. Assuming that increasing mechanization will substitute bullock power, and the total employment directly generated by the project are substantial in the processing industries like ginning and pressing, seed crushing, flour and rice mill, sugar and groundnut oil milling.
- The MSME current focus sectors under Agro-based industries are, Food Processing, Bamboo Products, Dairy, Leather Products, Sericulture, Bee Keeping, Mushroom Production, Agro-machinery, Agri. Inputs etc… The Sardar Sarovar Project has a wide scope for development under the Agro MSME scheme, which requires focusing more on innovation, entrepreneurship, science

and technology, research skill and experiences to convert the knowledge into wealth. The mechanization in agriculture will boost the Agro-based industries, which ultimately provide opportunities to micro-entrepreneur as a part of the MSME sector in the state.

10. Policy suggestions :

- The water distribution system up to sub-minors is in the stage of completion. Therefore, it is now high time to focus on-farm development and farm level activities to achieve the benefits envisaged under the project.
- The actual realization of 'Participatory Irrigation Management' as against the envisaged is quite less. In order to cope up the situation, there is a need-
    - To provide regular manpower at village level to guide and boost the beneficiaries to adopt participatory irrigation management such as to provide a system in place for better distribution of water among the beneficiaries, repair and maintenance of distribution system and collection of water charges in the command and
    - The farmers have to accept their responsibility and become a member of WUA should be made mandatory in Narmada Command.
- There is a wide gap and spatial variations in the irrigation potential created and actual irrigation. Also, there is a need for a change of farmers' mind-set from 'more water more yield' to 'precise irrigation more yield'. Both off-farm and on-farm planning and implementation are essential at the level of individual farmers for improving productivity and WUE at least cost. Hence, innovative changes in the existing policies needs to be framed introducing-
    - A system to incentivize and shift the farmers' behaviour towards adaptation of new technologies.
    - Farmers' should be encouraged for scientific planning and management of soil and crop in view of large problematic areas and facilitate them by keeping close contacts by the grass root level staff.

- Farmers and field engineers should work closely for bridging the gap between potential created and potential utilized
- There should be a single authority to look after in dealing with the farmers in all aspects of water distribution, maintenance of system, collection of charges and to motivate the farmers for innovative agricultural and economic activities.

- The specific condition of the command area requires certain strategic actions of conjunctive use of ground water possibly through 'crop based conjunctive use', distribution system from sub-chak to fields, land reclamation, providing drainage system, providing design dimensions of conventional methods, Conveyance losses of water need to be reduced by resorting to pressurized irrigation from flood irrigation, on farm water augmentation and storage, mechanization and use of non conventional sources of energy specifically solar pump-sets, and other on farm development activities like precision land levelling for which the expertise of agricultural engineering should be utilized for holistic approach.
- The Sardar Sarovar Narmada Nigam Ltd., had constituted a high level experts' committee for strengthening of the agricultural wing and activities including manpower requirements. The committee completed the task and recommendations as-
  - Creation of a secluded unit and to use the expertise of Agricultural Engineering.
  - Creation of cadre posts of agricultural engineers in the Dept. of NWRWS&K OR in the Dept of Ag F W & CO and make appointment on priority as per existing RRs
  - To fill-up equal numbers of the existing vacant posts first on contractual basis by recommended expertise through a statutory board/ expert committee as per criteria proposed till the regular appointment and start the recommended strategic activities as per Geo-hydrological feasibility in each of the ACR on Pilot basis followed by regular appointments.
  - On achievement of smooth functioning by the proposed set-up, it should be strengthened in the second phase by providing an appropriate

additional setup of 300 posts of Agricultural Engineers and 186 posts of 'Field Technicians' for successful operationalization of water distribution and to replicate all the envisaged activities in the entire command by the year 2030.

- Subsequently, to transfer all responsibility of management of the system from minor and below by developing an organization like earlier ADC or well functioning CADA elsewhere in the country.

11. **Conclusion :**

The Atma Nirbhar Krushi vision-2020-30 note on Sardar Sarovar Project Command was presented before experts and dignitaries. Dr. Ar. Pathak, Rtd. Vice Chancellor, Junagadh Agricultural University; Dr. N. C. Patel, Rtd. Vice Chancellor, Anand Agricultural University; Shri B. M. Modi, Director of Agriculture, GoG. and Shri P. M. Vaghasiya, Director of Horticulture, GoG. have expressed their comments and consented this content.

The productivity enhancement in the irrigation project commands is becoming essential considering the huge investment incurred so far. The situations of other command areas are also more or less similar to SSP commands. In the context of change in agriculture under the influence of climate change, the use and application of engineering is a need of time. The majority of the schemes of various departments for the benefits of farmers are pertaining to agricultural engineering. Merging these schemes will facilitate the farmers in ease of availing benefit. Large number of agricultural engineering experts are contributing in the services of the states namely Tamil Nadu, Odisha, Madhya Pradesh, Rajasthan etc.. Hence, it is high time to create a secluded set up in Gujarat also specifically w.sp.r. to productivity enhancement in irrigation commands by undertaking the strategic activities as discussed on priority for farmers' welfare by creating resilience in agriculture.

5. Anand Agricultural University

The Anand Agricultural University has been making incessant efforts since its inception to achieve excellence in pursuit of its mission to provide teaching; research and extension education services related to agriculture and allied sciences to develop excellent human resources and innovative technologies for services to the farming community with the motto of making Gujarat and India agriculturally prosperous.

Considering the tribal area, *Bhal* area (rainfed) and area under *desi* cotton in the jurisdiction of Anand Agricultural University, 10 important crops have been identified viz. Maize, *Bhalia*wheat, Ginger, Turmeric, Soybean, Banana, *desi* cotton, Tomato, Chilli and Okra to envisage future challenges under *Atma Nirbhar* Bharat Mission

Current status

Currently maize, ginger and turmeric are grown in tribal areas, where small and marginal holdings are relatively more, therefore, need to develop indigenous technology based on local need. *Bhalia* wheat is a GI (peculiar) crop of the state, which has no special value added products. Soybean is a newly introduced crop in the state. Banana needs proper transportation and marketing.*Desi* cotton needs special attention to increase area under cultivation.

Average and potential productivity of selected crops

Sr. No.	Block	Crop	Average productivity	Potential productivity	Districts covered	Remark
1	Tribal area	Maize	1780 kg/ha	7000 kg/ha	Dahod, Panchmahal, Mahisagar, Chhotaudepur and parts of Bharuch and	Small & Marginal holdings
2		Soybean	675 kg/ha	2200 kg/ha		
3		Ginger	15 t/ha	25 t/ha		
4		Garlic	7.85 t/ha	10 t/ha		

					Narmada districts	
5	Bhal area	Bhalia wheat	1000 kg/ha	1600 kg/ha	Ahmedabad, Botad	Saline Soil & Water
6		Gram	850 kg/ha	1500 kg/ha		
7	Wagad cotton zone & other areas	Desi Cotton	325 kg/ha	925 kg/ha	Parts of Bharuch, Ahmedabad, Botad, Surendranagar, Patan, Kutch and Rajkot districts	5.0 to 5.5 lakh ha (20% of total cotton area) Demand of high yielding long staple *desi* cotton variety
8	Middle Gujarat	Chili	11.0 t/ha	23.0 t/ha	Anand Kheda Vadodara	Farmer also getting income through raising nursery
9		Tomato	29.0 t/ha	50.0 t/ha		
10		Okra	9.0 t/ha	15.0 t/ha		

Current issues

1. Poor adoption of good agricultural practices
2. Unavailability of quality / pure seeds and dominance of private varieties
3. Inadequate storage facilities and reuse of own seeds
4. In adequate value addition
5. Lack of organized Agricultural Marketing
6. Inefficient use of local resources and indigenous technologies like BPKP
7. Lack of multiple technologies usage package for small and marginal holding farmers to support livelihood

- **Suggested strategies**

Following strategies will be adopted for above mentioned crops for increasing productivity and following of GAP besides value addition and proper marketing.

1. **Management of various insect-pests by using Bio-control agents, Bio-pesticides and Population dynamics of major insect pests and Integrated Pest Management (IPM)**

   Injudicious use of chemical pesticides led to increased input cost besides residue in agriculture produce. Therefore to reduce the use of chemical pesticides for safe food is highly required. Different technologies on use of biological control have been developed by AAU and can be used/implemented at farmers/cluster level.

   (a) Promote the use of bio-agents

   To control various pests in different crops, AAU has identified several bio-agents and mass production for research and demonstration purpose is in progress

Sr.	Crops	Pests/Diseases	Key bio-agents for the demonstration
1	Maize	Stem borer, Fall armyworm	*Trichogramma chilonis, Bacillus thuringiensis*
2	Chickpea	Pod borer Wilt complex	*Trichogramma chilonis, Bacillus thuringiensis,* *Trichoderma harzianum* *Pseudomonas fluorescens*
3	Ginger	Soft rot	*Trichoderma harzianum, Pseudomonas fluorescens*
4	Soybean	Semi looper, *Spodoptera litura*	*Bacillus thuringiensis*

- **Up scalin**

  Further, *Beauveria bassiana* and *Metarhizium anisopliae* are also important entomopathogenic fungi for controlling various pests.

Note: Bio control laboratories can be established at cluster level by self-help groups as small agri- preneurship etc. (Annexure- 1)

(b) Promote the use of indigenous botanical pesticides viz,

- Neem seed kernel extract (NSKE) 5%
- Neem leaves extract (NLE) 5%
- Neem oil 1%
- *Lantana camara* extract 10%
- Garlic bulb extract 5%

Above indigenous botanical pesticides have antifeedant, oviposition deterrent and repellent effects on insect pests which reduced their population and thereby damage

Activities will be undertaken

- To enhance the use and adoption of bio-intensive pest management strategies, large scale field demonstrations will be taken up in various crops.
- Training will be given to farmers for identification of Nuclear Polyhedrosis infected larvae, multiplied by themselves and again used for spraying against *Spodoptera litura* (SlNPV) and *Helicoverpa armigera* (HaNPV) accordingly.
- Ladybird beetles and Chrysopa are important predators for the agro ecosystem. Inclusion of maize in the intercropping system to increase the population of these useful predatory natural enemies will be advocated.

- On-campus training will be conducted for the farmers of tribal areas to enhance awareness and hands-on training/demonstrations on use of bio-agents/bio-pesticides.
- Forward linkages will be developed between farmer groups and KVKs to facilitate the distribution of bio-agents produced at farm level.
- Imparting the IPM training to farmers to upscale their knowledge regarding pest management.

Population dynamics of major insect pests and Integrated Pest Management (IPM)

Indigenous approaches viz., use of insect pests resistant varieties, Deep ploughing, Install bird perches, Destruction of crop residues (composting), Irrigation management etc.

2. Bio control of diseases of crops and Integrated disease management (IDM) strategies

(1) Bio control of diseases of crops

Most of the species of Trichoderma, viz., T. harzianum, T. viride, T. virens (Gliocladium virens) are used as biocontrol agents against soil borne diseases and wilts

(2) Integrated Disease Management (IDM) strategies viz.,

Involves following practices:

Cultural methods

Physical methods

Biological methods

Chemical methods

Use of resistant varieties

Crop	Variety
Maize	GASCH-11 (Madhuram), Narmada Moti, HQPM-1

	or GAYMH-1 & 3
Soybean	NRC-37, NRC-86 (Ahilya-6) or JS-2098
Desi cotton	Gujarat Anand Desi Cotton 3 (Wagad Gaurav)
Bhalia wheat	Gujarat Wheat 1 or Gujarat Anand Durum Wheat 3

Note: The laboratory established for biological control of pests can also be used for production of bio-agents for control of plant diseases.

3. Value addition in different crops and produce

Promote value addition through food processing, storage facility, knowledge of packaging, forwarding, transportation etc. for getting higher return

Value added products containing Green Wheat (*Ponk)* and Chickpea hola (*Ponk*), Moringa powder, Ginger powder etc.

The technologies developed at AAU, Anand for making Ponk, Jadariyu, Khakhra, Ginger powder, Moringa Powder etc. can be advocated among the farmers on individual or cluster basis on PPP mode.

(i) Making Green Wheat (*Ponk*):

Duram wheat (GW-1) earheads in milk stage should be roasted in hot air over at 200˚C for 20 minutes. Then dehullled roasted wheat seeds (*ponk*) should be shadow dried for 30 minutes. The *ponk* duly filled in food grade airtight plastic container will have safe storage life about six months. The cost of wheat ponk is Rs. 60/kg (Rs.30 wheat price + Rs.30 labour charge)

(ii) Making Chickpea ola (*Ponk*):

Chickpea (GG-2) pods should be roasted in hot air over at 200˚C for 20 minutes. Then dehulled roasted chickpea seeds (*ponk*) should be dry in oven at 100˚C for 1 hour.. The *ponk* duly filled in food grade airtight

plastic container will have safe storage life about four months. The cost of wheat ponk is Rs. 140/kg (Rs.70 chickpea price + Rs.70 labour charge)

(iii) Making Jadariyu by incorporating Green Wheat (*Ponk*) and Chickpea *ola* (*Ponk*) in combination

Standardized Formula for Jadariyu (250 gm):

Sr. No.	Ingredients	Amount
1.	Green Wheat (*ponk*)	70 gm
2.	Chickpea hola (*ponk*)	30gm
3.	Milk	40 ml
4.	Ghee	50 gm
5.	Sugar	40 gm

Cost of 250 gm Jadariyu = Rs. 84

A healthy value added Jadariyu can be prepared by using 35% wheat *ponk* flour, 15% chickpea ponk flour, 25% ghee, 20% sugar and 5% milk. The Jadariyu duly filled in food grade airtight plastic container will have safe storage life about fifteen days.

(iv) Making value added Wheat *Ponk* Khakhara

Wheat *ponk* khakhara can be prepared by incorporating 70% wheat ponk flour with wheat flour. The product duly packed in aluminium foil will have safe storage life about 75 days. Cost of wheat ponk khakhara is Rs.102/kg.

(v) Making value added Chickpea *Ponk* Khakhra

Chickpea *ponk* khakhra can be prepared by incorporating 35% chickpea ponk flour with wheat flour. The product duly packed in aluminium foil will have safe storage life about 45 days. Cost of chickpea *ponk* khakhra is Rs.189/kg.

Estimated Cost of equipments required for small scale business (Approx.):

Sr. No.	Material	Price (approx.)
1.	Tray dryer (12 trays capacity)	Rs. 60,000 to 70,000
2.	Steel airtight container for storage (100 kg capacity)	Rs. 1500 to 2000
3.	Vessels for product development (Big kadhai, big spoons, big flat plates etc.)	Rs. 10,000 to 15,000
4.	Gas stoves / burner	Rs. 2000 to 3000
5.	Fully automatic Khakhra making machine	Rs. 2,50,000 to 3,00,000
	Total	**Rs. 3,23,500 to 3,90,000 (Approx. Rs. 3.5 to 4.0 lakh)**

(vi) Ginger and Moringa powder

GreenHouse Dryer/Tunnel Dryer can be used to dry the green ginger and moringa leaves with the best final product.

- Low cost drying
- Dried faster than open sun drying i.e., 2/3rd time
- No dust and dirt deposited on the product
- Colour and flavour retain better than solar and sun dried products

Cost of the structure is about 55000/- to 60000/- having dimensions of 15(L)x10(W) x 8(H) and covered with a UV stabilized plastic sheet of 200 micron and with one exhaust fan.

Capacity of the dryer is about 1000 kg per batch.

4. Post-harvest storage of agriculture produce

The storage of agricultural commodities between harvesting and selling period is important to maintain quality besides reducing the losses. Storage of bulb crops viz., ginger, garlic etc. in tribal can improve with minimum cost.

(i) Storage of Garlic

Hanging bunches of garlic in a loaf of house with string in an open method. Wherein damage of insect-pest deteriorates the quality of garlic. Proper aeration and use of mosquito nets etc. will provide protection against insect – pest damage. (Figure 1)

(ii) Storage of Ginger

- In tribal area, farmers generally prepare heap of ginger and covered with wet cloths (Jute bags) while as per method developed by IISR, Kozhikode, Kerala prepare square or rectangular structure of bricks, cover it with soil and dung mixture and storage room treat with chlorpyrifos
- First of all, 2 – 4 cm sand layer at bottom and store it with mosquito net in the structure. Cover it with plywood having hole and fit it dung for all 4 sides

  (Ref. IISR, Kozhikode, Kerala)

5. Up scaling seed enhancement into designer seed treatment technologies with improved local seed varieties and botanical pesticides prepared by farmers and effective seed / grain management

- Indigenous materials (Ash, Bio-pesticides, Bio-fertilize, viz.) can be evaluated as seed treatments
- Indigenous Technical Knowledge and advance modern technologies should be used for enhancing seed quality
- Training will be given for seed production and post harvest handling of quality seeds in different crops
- Grain should be stored in air tight containers (bins).

- Before storing grains, sun dry them and maintain the moisture below 10%.
- Farmers are using ash or fine sand/soil as indigenous technology for managing stored grain pests.
- Grain pests can be effectively managed by mixing dried neem leaves 8 to 10% in stored grain, neem seed kernel powder 1 to 2% up to 6 to 9 months.

6. Increasing water use efficiency through adaptation of micro irrigation system and developing low cost technologies for *in situ* moisture conservation

- Promote use of micro irrigation
- Utilizing crop residues as mulch 5 to 10 t/ha in crop/s helps to conserve soil moisture which ultimately enhance WUE, resulted in enhancing soil microbial activity and higher crop production

7. Integrated farming system for sustainable income to small and marginal farmers with seven strategies given by Hon. Prime Minister for doubling farmers income

- IFS: It is a scientific integration of interrelated and interacting farm enterprise with efficient use of prevailing farm resources (land, family labours, capital etc.) for getting year round income especially in handicapped zones.
- It includes cropping along with livestock rearing, fisheries, poultry, bee keeping, agroforestry, bio gas plant, mushroom production, etc.

8. Technology for improvement/ restoration of soil health, organic Carbon and productivity of all crops, Nutrient management through use of farm waste and Nutrient management through testing of microbial strains

a. Fertilization as per Soil Test Value (SHC)

b. Use of organic mulch (Annexure II)

c. Use of bio fertilizers
d. Need based nutrient management (LCC chart)
e. Use of farm organic waste (Crop residue, weed biomass, dung & urine etc. (Annexure III)
f. Integrated Nutrient Management

9. Germplasm maintenance and utilization of *desi* and indigenous seeds and breeding for yield and quality improvement with use of farmer's experiment

- Exploration of germplasm collection for seed of desi and indigenous varieties / crops.
- Maintenance and evaluation of desi and indigenous varieties.
- Use of indigenous and desi varieties for improvement of yield and quality.

10. Seed viability enhancement through advance priming and pelleting technologies for low volume and high value seeds and high volume low value seed, Effective management of stored grain pests

- Establishment of seed processing unit in identified seed villages under subsidized rate for Co-operative society, NGOs /SHGs or free of cost to village panchayats including PRIMING & PELLETING facilities.

11. Strengthening of local market and promotion of e-marketing

Rural Periodical Markets

- Rural Haats/Rural periodic markets which play a vital role in rural marketing and constitute first contact point for the producers-sellers do not have adequate facilities required for operational, technical and pricing efficiency.
- Improvement in the efficiency of the rural markets has a direct impact on farmers' level of income.

- These markets need improved services for users to facilitate marketing of the local produce, creating an element of market security for the growers.
- The rural market can also be used for effective credit, input marketing and procurement activities.
- Apart from other things, *Haats* need to be provided with mobile banks on *Haat* days by Gramin Banks.

eNAM

- National Agriculture Market (NAM) is a pan-India electronic trading portal network to create a unified national market for agricultural commodities which provides a single window service.
- About 1,000 markets located in 18 states and 3 union territories are integrated on eNAM by the year 2020.
- e-NAM has registered a user base of 1.66 crore farmers, 1.31 lakh traders, 73,151 commission agents and 1,012 farmers producers organisations (FPOs) in the last four years.
- Major challenges include inadequate marketing infrastructure, lack of coordination between the institutions and poor market information, lack of scientific storage, warehousing, limited access of agriculture produce markets due to huge variation in the density, very limited markets having the facility of assaying and grading, diverse standards for agricultural commodities, less involvement of traders, poor internet connection, interrupted power supply etc.

Strengthening local periodical markets and focussed attention on eNAM can go a long way in solving the marketing problems of the farmers and rural people in the country including Gujarat and make India self-reliant.

12. Encourage and educate the farmers for……

a. Nursery developments to make self sufficient and as a business
b. Farm/backyard gardening to fulfill daily requirement

c. Kitchen / terrace gardening management in urban area to fulfill daily requirement

- **Work plan 2021-22 and 2022-23**

Year 2021-22

To create awareness among the farmers for the good quality higher crop production with use of low cost technologies, value addition, storage, grading, packing, marketing etc. under *atma nirbhar* bharat mission through khedut sibirs / seminars / trainings / demonstrations such as with focus on Narmada & other river irrigation command area

- Exploration for collection of local and indigenous varieties of important crops (Seed and planting material)
- Training on value addition
- Training on grading and packing
- Promoting natural and organic farming
- Training on preparation of bio-pesticides
- Training on identification of bio agents and mass multiplication
- Training on establishment of micro enterprises.

Year 2022-23

- Policy suggestions to policy makers – Promotion to agri-startups and incubation for students & farmers
- Adoption and implementation of university technologies by Government of Gujarat
- Establishment of micro enterprise at village level
  (1) Biological control laboratory
  (2) Value addition unit (*Ponk, Jadariyu, Khakhra*, Ginger and Moringa powder)

- **Policy suggestions – if any**

(1) Technology support to small and marginal farmers for establishment of storage facilities, value addition practices and related fund support etc.

(2) Biogas Plant for small and marginal farmers

(3) Use of gram/panchayat waste land (instead of cultivable land) for solar power projects

- **Outcome of strategy**
  - Adoption of good agricultural practices will increase crop productivity and conserves agro-ecology
  - Value addition will increase an employment and income of small & marginal farmers
  - Establishment of micro enterprises at village level with involvement of rural youth & women through KVK in selected clusters for leading towards doubling farmer's income motive
  - Small and marginal farmers will be benefited by knowing seed production technology
  - Setup own nursery to procure own seedling to reduce the cost and get income by selling the nursery product
  - They will be benefited by producing their own vegetables and fodder by kitchen gardening.
  - Conserve own land races by means of seed banks in his area.

Annexure I

Village level production and utilization of bio-agents

Preamble:

Bio-agents that can be mass produced at farm level/village are as follows

Egg parasitoid – *Trichogramma* spp.

Microbial biopesticides *Trichoderma harzianum, Pseudomonas fluorescens, Bacillus thuringiensis*

The use of ITK (Indigenous Technological Knowledge) for the manipulation of bio-agents/microbial inoculants to minimize pest and disease intensity in crop production is not a new strategy. Raw organic materials such as crop residues, animal wastes, food garbage enhance their suitability for application to the soil after having undergone composting. By taking the idea from ITK, the

innovative technologies for the mass multiplication of bio-pesticides by utilizing very inexpensive and easily available sources such as grains, agricultural waste can be developed to facilitate the production and use of bio-pesticides by the farmers for their own fields. This approach emphasizes the self-sustenance of the key bio-inputs required for the crop production.

The simple and cost effective methods will be adopted to facilitate production of bio-agents. The required nucleus culture will be provided by the Govt. research organization to take up farm level production. The mass produced bio-agents will be utilized by the group of farmers to meet their requirement. Further, linkages can be developed between farmer groups and KVKs to facilitate the distribution of bio-agents produced at farm level.

Objectives:

- To promote on-farm/village level production and utilization of bio-agents
- To make the farmers self-reliance production and utilization of bio-agents

Basic requirements for the production of bioagent *Trichogramma* spp. and biopesticide – *Trichoderma* spp, *Pseudomonas fluorescens* and *Bacillus thuringiensis*

Infrastructure:

Tricho card production unit:

Basic infrastructure facility is required for the culture and tricho card preparation. For the production of Trichocards, Two rooms (15x20 feet) will be required for rearing *Corcyra cephalonica* and preparation and storage of trichocards (one room for each).

Biopesticide production unit:

For the production of biopesticide *Trichoderma* spp. *Pseudomonas fluorescens* and *Bacillus thuringiensis,* infrastructure facility is required for the sterilization of raw materials, inoculation, incubation, packing and storage unit.

Area required (Approx.): 1000-1200 sq.ft.

Equipments/others:

Sl. No.	**Equipments/others**	**Quantity required**	**Approximate price (Rs.)**
1	Sterilization facility – Pressure cooker (15 ltr. capacity), Gas stove	2 No. each	40,000
2	Low cost inoculation hood	3 No.	6,000
3	Refrigerator (small- 180 litre capacity)	2 No.	20,000
4	Packing unit and its materials	2 No.	2,000
5	Raw materials for the production of bio-pesticide, tricho-cards/month	Sorghum grains, jaggery, groundnut etc.	3,000
	Miscellaneous	Polypropylene bags, plastic trays and iron racks	5,000
Total			**76,000**

Scale of production:

Trichocards:

Trichocards can be produced on a small or medium scale and it is particularly suitable for village level/farm level, which can produce and distribute these for local use. At

village level a tricho card unit with production capacity of 250-300 cards/ month could be undertaken.

Bio-pesticides:

Trichoderma spp. – 400-500 kg/ month
Pseudomonas fluorescens – 300-400 kg/month
Bacillus thuringiensis – 300-400 kg/month

As the production technology of some of these agents is relatively simple, the local farmers/SHGs can be trained to undertake the production.

Man power requirement:

- Skilled assistant - 1
- Semi-skilled assistant – 2
- Unskilled labours- 3

Similarly, this laboratory can be established at cluster level on co-operative basis under PPP mode as below

Facilitating center for the production and utilization of bio-agents at cluster level

Bio-agents that can be mass produced at cluster level

Egg parasitoid – *Trichogramma* spp.
Microbial biopesticides - *Trichoderma harzianum*
Pseudomonas fluorescens, Bacillus thuringiensis

Objectives:

- To promote cluster level production and utilization of bio-agents

- To train the farmers to take up on-farm/village level production and utilization of bio-agents

Requirements for the production of bioagent *Trichogramma* spp. and biopesticide – *Trichoderma* spp, *Pseudomonas fluorescens* and *Bacillus thuringiensis* at cluster level

Infrastructure:

Tricho card production unit:

Basic infrastructure facility is required for the culture and tricho card preparation. For the production of Trichocards, Two rooms (20 x 20 feet) will be required for rearing *Corcyra cephalonica* and preparation and storage of trichocards (one room for each).

Biopesticide production unit:

For the production of biopesticide *Trichoderma* spp. *Pseudomonas fluorescens* and *Bacillus thuringiensis,* infrastructure facility is required for the sterilization of raw materials, inoculation, incubation, packing and storage unit.

Training facility:

Facility will be required to facilitate the capacity building programmes to train the farmers/SHGs to take up on-farm production.

Area required (Approx.): 1500-2000 sq.ft.

Equipments/others:

Sl. No.	Equipments/others	Quantity required	Approximate price (Rs.)
1	Autoclave - 100 litre capacity	1 No.	3,00,000
2	Autoclave - Portable	1 No.	50,000
3	Inoculation chamber	2 No.	4,00,000
4	Hot air oven	1 No.	1,50,000

5	BOD Incubator	1 No.	1,50,000
6	Orbital shaker	1 No.	1,50,000
7	Fermenter system – 200 litre capacity (semi-automatic type)	2 No.	50,00,000
8	Refrigerator (medium- 300 litre capacity)	2 No.	50,000
9	Packing unit and its accessories	1 No.	10,00,000
10	Weighing balance	2 No.	1,00,000
11	Raw materials for the production of bio-pesticide, tricho-cards/month	Growth medium, sorghum grains, ground nuts etc.	25,000
12	Miscellaneous		5,000
Total			**73,80,000**

Scale of production:

Trichocards:

Trichocards can be produced on medium or large scale at cluster level and can be distributed for local use or commercial selling of tricho cards. At cluster level a tricho card unit with production capacity of 500-600 cards/ month could be undertaken.

Bio-pesticides:

Trichoderma spp. – 1000-1500 kg/ month
Pseudomonas fluorescens – 800-1000 kg/month
Bacillus thuringiensis – 800-1000 kg/month

Man power requirement:

- Technical assistant – 1
- Training assistant - 1
- Skilled assistant - 1
- Semi-skilled assistant – 4
- Unskilled labours- 4

Marketing potential:

- Considering the negative effects of indiscriminate use of pesticides, importance for organic farming and promotion of sustainable farming practices it is estimated that there will be scope for bioagents units at cluster level/co-operative basis.

- There is a potential to establish linkage between farmer groups/co-operatives and KVKs to facilitate the production and distribution of bio-agents produced, which ensures employment to the rural population.

Annexure II

Use of organic mulch

Organic mulch such as crop residue etc. can be used as a surface mulching

- This is a unique and simple method particularly for recycling.
- Although decomposition of mulch is a slow process, its biomass and C/N ratio during the course of one crop season is appreciably reduced and this facilitates its incorporation in next season at a low cost.
- The experiments have shown that straw mulch has beneficial effects on moisture conservation, erosion control, weed control, on fluctuation of temperature, and population of beneficial soil microflora which ultimately result in increased yield of crops.

Happy seeder is shredding equipment use to manage the crop waste as organic mulch as mulch

Annexure III

Use of farm organic waste (Crop residue, weed biomass, dung & urine etc.)

Farm wastes can now be considered to include cattle-shed wastes such as cattle and buffalo dung and urine, other livestock and human excreta, crop wastes of cereals, pulses and oilseeds, stalk of corn, cotton, tobacco, sugarcane trash and agro-industries by products such as oil-cakes, paddy husk and bran, bagasse, press mud, (Pressmud is an industrial waste available from the sugar mills. For every 100 tonnes of sugarcane crushed about 3 tonnes of pressmud cake is left behind as a by-product. fruit and vegetables wastes etc.

- Estimates of agricultural waste availability suggest that the average value for crop wastes is 350 mt and that of animal wastes it is 650 mt.
- Hence around 1000 mt of agricultural wastes are available in the country.
- Recycling of wastes in agriculture brings in the much needed organic and mineral matter to the soils.
- Since most recyclable wastes are organic, they directly add organic matter and the plant nutrients contained in it.
- Nowadays more efficient and versatile recycling processes and technologies have become available which if applied on the required scale can bring recyclable wastes into the mainstream of farm input management strategies.

Farm wastes can be recycled in soil by different methods:

1. Incorporation (ploughed in the soil)
2. Burning
3. Surface mulching
4. Composting

From the above mentioned methods, composting is most appropriate and scientific method

- Compost is the stabilized and sanitized product of composting which is beneficial to plant growth.
- It is estimated that the organic waste available in India can supply about 7.1, 3.0 and 7.6 million tons of N, P2O5 and K2O, respectively.
- These organics therefore, need to be recycled and put to productive use.
- In view of these facts greater attention is being paid in developing composting technology.

Nutrient content in different crop residues

Sr. No.	Crop residue	Nutrient (%)			
		N	P_2O_5	K_2O	Total
1.	Rice	0.60	10.18	1.38	2.17
2.	Wheat	0.48	0.16	1.18	1.82
3.	Sorghum	0.52	0.213	1.3	4 .09
4.	Maize	0.52	0.18	1.135	2.05
5.	Pearl Millet	0.45	0.16	1.14	1.75
6.	Barley	0.52	0.18	1.30	2.00
7.	Finger Millet	1.00	0.20	1.00	2.20
8.	Sugarcane	0.40	0.18	1.28	1.86
9.	Lantana	2.50	0.25	1.40	4.15

Compost making includes three important and vital scientific principles

1. Narrowing down of the carbon: nitrogen ratio to a satisfactory level (10:1 or 12: 1)

2. Total destruction of harmful pathogens and weed seeds ensured by high temperature evolved during decomposition and stabilization.
3. At the optimum temperature of 60-65 0C required for decomposing all harmful pathogens are destroyed.

Essential requirements for composting

- Bulky organic refuse such as stubbles, cotton stalk, tur stalks, groundnut shells, weeds leaves, dust bin refuse, etc.
- A suitable starter: Cattle dung, urine, night soil, sewage, urea, rock phosphate or any other readily available nitrogenous substance. The mixture should contain 1 to 1.25 % N on dry weight basis (i.e., C:N- 30:1). Microbial cultures also hasten decomposition.
- Addition of enough water to keep the moisture content of the material at a level around 50%.
- Presence of sufficient supply of air, especially in the initial stages of decomposition.

Method of Composting

1. Conventional method
2. Farm yard manure
3. Indore method
4. Bangalore method
5. Coimbatore method
6. Chimney method
7. NADEP method
8. Compost bin method
9. Wire cage method
10. Amrut mati method
11. Vermicomposting

6. Sardarkrushinagar Dantiwada Agricultural University (SDAU)

Current Situation: Overwhelmed and enormous increase in human population on one side and changing climatic scenarios over centuries on other side have increased the pressure on natural resources which led to over exploitation of earth's natural resources and is also being continued from last several decades at both global and national level. In particular, this increasing pressure on natural resources is directly or indirectly related to national food security. **S**ardarkrushinagar **D**antiwada **A**gricultural **U**niversity is one of four SAUs that came into existence on May 1, 2004. Its jurisdiction spanned over 22.45^0 to 24.42^0 N latitude and 68.9^0 E to 73.9^0 E longitude covering seven districts of North and North West Gujarat *viz.*; Banaskantha, Sabarkantha, Patan, Mehsana, Gandhinagar, Aravalli and Kachchh. Major area under the desert is located in the Northern area of Kachchh and patches of desert are located in eastern side of Kachchh, Banaskantha (Nadabet) and Patan (Santalpur). Coastal area of the Kachchh covers 406 km at the North West border. **Climate:** The region has subtropical monsoon climate with an annual rainfall 402 - 694 mm and temperature max 45 ^{0}C and min 5^{0}C. **Soil:** Soils of North and North West Gujarat are sandy loam to sandy texture. Soil salinity being a major constraint in North West of North Gujarat and desert of Kachchh. Most of the soils in North Gujarat are low in organic matter, poor in N, medium in P and K content and also few pockets face S, Fe and Zn deficiency.

Land Use Pattern (in ha)	Gandhinagar	Mehsana	Sabarkantha	Aravalli	Patan	Banaskantha	Kachchh
Net sown area	164954	350860	241411	203566	415295	741754	679933
Gross Cropped area	273012	438575	284889	237435	447443	1152006	727733
Cultivable waste/	5958	5243	6643	7951	15686	19195	73697
current fallow/ other fallow	8467	14055	24122	11729	63943	30939	490168

Area under forest	2044	7200	76644	49688	46546	111182	306770
Non Agriculture	22622	31500	24608	17801	45145	81649	339000
Permanent pasture land	11797	30442	17803	16303	28326	65139	70058
Total Geographical Area	215838	439300	406622	323200	566772	1045197	1957639
Cropping Intensity (%)	159.74	125.0	120.04	116.01	108.83	155	104

Water Resources: The *Sabarmati*, *Saraswati* and *Banas* are the main rivers of North Gujarat. The major source of irrigation is ground water through tube-wells which consummately covers 88 per cent. Availability of poor quality or saline water is another constraint of water in North and North West Gujarat. Banaskantha district stands first in area under micro-irrigation adoption at the national level. **The major crops** of this region are castor, potato, mustard, wheat, pearl millet, groundnut, cotton, sorghum, maize, rapeseed, sesamum, fennel, cumin, isabgol *etc.*

Agriculture in North and North West Gujarat is highly diversified with an integrated farming system that is primarily attributable to **well-developed animal husbandry-based systems.** The co-operative dairy sector in North Gujarat is well known over the globe for economically empowering women and poorest of the poor farmers. **Cropping Pattern:** The cropping pattern in North and North West Gujarat is diversified. Agriculture in North Gujarat predominantly hovers around non-food crop economy, the nicknames like “Oil bowl”, “Seed spices bowl", “Castor bowl, “Lemon bowl, “Tomato bowl”, “Potato bowl” *etc.* Ground-Nut Potato-Pearl Millet is most remunerative cropping sequence of the region

Districts	**Crops**
Banaskantha	Castor, Pearlmillet, Groundnut, Potato, Cotton, Pulses, Wheat, Cumin, Pomegranate, Fennel, Isabgol, Papaya, Amaranthus, Forage crops
Mehsana	Wheat, Pearl Millet, Mustard, Castor, Cumin, Pulses, Potato, Tobacco, Isabgol, Forage crops, Lemon

Sabarkantha	Cotton, Maize, Groundnut, Castor, Wheat, Potato, Pearl Millet, Vegetables, Pulses, Forage crops
Gandhinagar	Castor, Cotton, Guava, Vegetables, Pulses, Wheat, Paddy, Groundnut, Fennel, Chilly, Forage crops, Flowers
Patan	Pearl Millet, Castor, Cotton, Pulses, Carrot, Wheat, Cumin, Fennel, Isabgol, Mustard, Forage crops
Aravalli	Cotton, Maize, Pearl Millet, Groundnut, Castor, Soybean, Sorghum, Wheat, Vegetables, Pulses, Forage crops
Kachchh	Date palm, Pearlmillet, Cotton, Castor, Groundnut, Wheat, Mustard, Forage crops, Kesar Mango

Horticulture: Farmers' of North Gujarat have done proud in achieving notable productivity in potato *i.e.,* 87 MT/ha which is highest in the world. The region is ascribed as "seed spices bowl" of the country, where cumin, fennel and isabgol are the main crops grown . *Kutchi* Date has been assuming a unique identity which has gained international market in several parts of the globe for which SDAU has started to get GI Tagging. During last decade, Banaskantha district has emerged as a pathfinder for growing as well as developing packages and practices for pomegranate cultivation, which has led to **"*Padmashree* Award"** to farmer of this region for the first time in the history of Indian agriculture for bringing revolutionary change in economy of farming community. **Animal Husbandry:** Strong and organized dairy industry having 271.28 lakhs livestock and 135.69 lakhs MT of milk production; predominant of which are located in North Gujarat *(Banas*, *Dudhsagar* and *Sabar* Dairy). Well recognized breeds in SDAU jurisdictions are *Kankrej* cattle, *Mehsana* buffalo, *Banni* buffalo, *Mehsana* goat, *Patanwadi* sheep, *Kutchi-Sindhi* horse, *Kutchi* and *Kharai* Camel. *Kankrej* is a well known cattle breed and has become the identity mark of Gujarat even in Brazil and Latin American countries. **Linkages** :DAU has a strong network of linkages with state and national organizations, institutes and industries. The university has signed several MoUs with regional and national organizations/institutions in the field of Research, Education and Extension activities. Some of the international agencies with which the university has made linkages include ICRISAT, CYMMIT, CPRI, APAARI, IFARD, IAITA etc. Some of the national agencies are ICAR, NAARM, ICMR, CSIR, DBT, DST, ISRO,

IMD etc. and others like State Department of Agriculture, Horticulture, Animal Husbandry, NABARD, SAUs, NGOs etc. **SDAU - Potential :** Big university with a land of 1965.065 ha devoted for agricultural development; State-of-art Infrastructure facilities; Diversified courses for integration and better output of agricultural education; Strong research base; expansion to span newer and frontier areas of research; Enterprising farming community; Network of research centres for location specific research; Network of extension centres for effective dissemination of technologies; Linkages with international, national as well as state organizations/institutes and other stakeholders

- **Current Issues:** Of the eight Agro-climatic zones of Gujarat, SDAU is spanned over two zones viz., North Gujarat Agro-climatic zone and North West Agro-climatic zone. Key needs pertaining to research areas in the SDAU include:

  Arid and semi-arid region with inadequate and uneven distributed rainfall

  Salinity problem in most of the Kachchh region

  Soils are low in organic carbon due to light textured soil and extremes of high and low temperatures

  Soils are low to medium in N and P and some pockets of region are facing S, Fe and Zn deficiency

  Fragmented and small land holdings

  Depleting soil fertility resulting in low productivity

  Poor water quality and depleting ground water table

  Migration of rural youths towards urban and peri-urban areas with disinclination trends towards farming

  The predominant source of irrigation is underground water, which is squandered more than it is replenished

  Extreme events like drought and inundation

  Decreasing trend in total factor productivity

  Non-scientific way of agricultural input management

  Degradation of pasture land in Kachchh region (Banni –pasture land)

Extinction of valuable grass species from the pasture land in Kachchh region (Banni –pasture land) due to adverse weather and expansion of invasive species like Prosopis

Large swathe of the geographical area is wasteland

Changing cropping pattern due to availability of Narmada water for irrigation in rainfed areas

Poor seed replacement rate in self pollinated crops

Non-scientific ways to handle manures and farm waste & crop residues

Degradation of pasture land in Kachchh region (Banni –pasture land)

Extinction of valuable grass species from the pasture land in Kachchh region (Banni –pasture land) due to adverse weather and expansion of invasive species like Prosopis

Knowledge deficit among farmers as major constraint for realizing higher production

Large number of low and unproductive animals with uncontrolled mating leading to deterioration of genetic resources

Denuded landscape and meagre tree cover

❖ **Suggested Strategies**

A:- LONG TERM SUGGESTED STRATEGIES

1.Genetic Resource Management

1.1 Field crops

- Evolvement of varieties/hybrids suitable for aberrant weather conditions and soil types
- *In-situ* and *ex-situ* conservation of indigenous and wild germplasm of field crops of North Gujarat
- Procurement and conservation of quality protein maize, sweet corn, baby corn, popcorn, high oil corn, as well as land races

- Biotechnological approaches for the conservation and multiplication of plant genetic resources
- Development and utilization of central database for storage and retrieval of information on plant genetic resources
- Breeding of high yielding, low HCN content, multi-cut and better quality with more tillering, quick regeneration capacity and high leaf stem ratio genotypes (high quality proteins) in forage crops
- Exploring wild germplasm to introgress novel genes and traits into cultivated species for development of climate resilient crop varieties
- Integration of conventional breeding with genome resource tools for enhancing crop yield and quality of major crops

1.2 Horticultural crops

- Identification, collection, evaluation, maintenance and utilization of genetic resources of arid fruits, flowers, vegetables, spices and ornamental crops
- *In-situ* and *ex-situ* conservation of important indigenous (date palm, mango, pomegranate, potato, vegetables, spices, *isabgol*, ornamentals) and wild germplasm (medicinal and aromatic plants)
- Identification of genetic stock of date palm for resistance to insect pests and diseases
- Identification, development and cultivation of exotic unconventional vegetables under protected cultivation
- Biotechnological approaches for the conservation and multiplication of plant genetic resources particularly in date palm, mango, potato and seed spices
- Collection, conservation, evaluation and characterization of germplasm of under exploited fruit and forest trees
- Screening and evaluation of germplasm for abiotic and biotic stresses

1.3 Microorganisms

- Isolation, identification and utilization of agriculturally important microorganisms in the processes of bio-fertilization, bio-processing and bioremediation for plant diseases in crop plants

1.4 Insect-pests

- Conservation and enhancement of natural enemies-predators/parasites/fungi /entomophilic nematodes/baculoviruses
- Development of resistant varieties against different crop pests
- Conservation and efficient utilization of natural pollinators

1.5 Livestock

- Management of *Kankrej* cattle, *Mehsani* & *Banni* buffaloes, *Patanwadi* & *Marwadi* sheep, *Mehsani* & *Kachchhi* goats and *Kachchhi* camel
- Creation and maintenance of elite herds of indigenous breeds

2. Crop Improvement

2.1 Field crops

- Development of salinity, drought and thermo tolerant varieties suitable for arid regions
- Development of extra early varieties with high yield to fit in late sowing conditions
- Development of male sterile lines for hybrids in pigeon pea, pearl millet, sorghum, mustard, castor and maize
- Evolving high nitrogen fixing varieties of legumes and green manure crops
- Development of high yielding, early maturing, stress tolerant and export quality varieties/hybrids of seed spices, Bt cotton (indigenous), pulses, oilseeds (castor, mustard, sesame) and cereals (wheat, pearl millet, maize, sorghum)
- Development of nutritionally fortified varieties of cereals and pulses
- Development of improved quality varieties with high nutritive values and zero anti-nutritional factors particularly in mustard, pulses and pearl millet
- Development of castor varieties suitable for mechanical harvesting
- Chemical Hybridizing Agent (CHA) based hybrid wheat

2.2 Seed production

- Refinement of production technologies for higher quality seed production

3. Crop Management

3.1 Crop production

3.1.1 Field crops

- Organic farming technology particularly for seed spices to enhance avenues for export
- Tuning situation specific production technologies with special emphasis on ecosystem (*kharif*/spring/*rabi*/solo/inter-crop/mixed crop) and utility (vegetables/grains/value added products)
- Introducing alternate land use systems (ALUs) in prevailing cropping systems of North and North west Gujarat

3.1.2 Horticultural crops

- Standardization of greenhouse/net house crop production technology for nursery, floriculture and vegetables
- Enhancing the marketability of horticultural products through organic farming, value addition, processing, MIS, fertigation, waste utilization and mechanization
- High density planting in arid fruit crops

3.2 Crop protection

3.2.1 Integrated pest management (IPM)/Integrated plant disease management (IPDM)

- Development of IPM modules of different crops of North and North West Gujarat
- Critical estimation of ETL of important pests of field and horticultural crops
- Monitoring and surveillance of emerging pests and diseases under global warming and mapping of pest and disease free areas
- Identification of parasites/predators and fungi for biological control of major pests
- Identification, development and sensible use of Host Specific Pheromones in minimization of pest population without disturbing environment

3.2.2 Biological control

- Generation of bio-intensive integrated pest management modules for different crops
- Conservation and enhanced use of proven bio-agents in different cropping ecosystem i.e., natural enemies / predators / parasites / fungi / entomophilic nematodes / baculoviruses

3.2.3 Control of nematodes

- Biological suppression of nematodes by use of crop and nematode specific microbial agents

3.2.4 Residue recycling and management

- Large scale testing for agricultural residues in soil, water, organic matter, plant and concentrated products
- Studies on impact of agro-chemical residues on the soil, plant and human health
- Regular monitoring of food commodities for pesticide residues, heavy metals, industrial pollutants; mycotoxin and drugs

4. Integrated Farming System

4.1 Field crops

- Identification of remunerative crop sequences for N and NW Gujarat
- Development of climate smart IFS model for different agro-ecological regions
- Identification of remunerative and sustainable IFS models for small and marginal farmers of North and North West Gujarat

4.2 Horticultural crops and Agroforestry

- Organic farming modules particularly in seed spices and arid fruits for export and open market from North and North West Gujarat
- Exploitation of arid fruits for utilization of wastelands of Patan and Kachchh districts
- Development of different MPT based agroforestry systems like *neem*, *khejri*, *ardu*, *sisum*, *hardwickia*, *bakam neem* (*Melia dubia*)
- Adoption of nutrient recycling through agroforestry systems

5. Organic Farming

- Development of organic nutrient management modules in food grain crops, vegetables and fruits of North and North West Gujarat

6. Soil and Water Productivity

6.1 Soil resource inventory and management

- Management of water and wind erosion of soils
- Development and popularization of carbon sequestration technology for improving soil health
- Management of low cost technology for problematic soils-saline, alkali and waterlogged soils
- Development of eco-friendly bioremediation modules for problematic heavy metal contaminated soils
- Standardization of technologies for reducing water-logging and improving drainage

6.3 Nutrient management

- Nutrient management through resource conservation technology

7. Agricultural Engineering and Renewable Energy

- Development of engineering techniques to mitigate effect of climate change on agriculture
- Implication of biogas plant for local energy requirement specially for farm operations
- Biogas and solar energy based small farm equipments
- Energy management and utilization of conventional and non-conventional energy sources in agricultural production and processing activities

8. Post-Harvest Management and Value addition

- Advanced post harvest management technologies in seed spices viz., cryogrinding in cumin (to prevent essential volatile oil loss) for export promotion

9. Livestock production and management

- Sustainable & high-tech dairy farm management

- Genetic improvement of important native livestock breeds like Kankrej cow Mehsani and Banni buffalo Patanwadi, Marvadi, Mehsani Goat,- Sheep; Kachchhi and *Kharai* Camel etc
- Breed development and convergence among the farmers for Marwari horse as an instrument for guarding and racing purpose
- Scientific management practices for housing, feeding and management of livestock species

10. Fisheries

- Development of suitable varieties of inland fish in Narmada command areas of North Gujarat

11. Dairy technology

- Use of rapid chemical biosensor based methods/kits for the detection of adulterants and preservatives in milk and milk products
- Isolation, purification and characterization of novel bacteriocins / antimicrobials with broad antimicrobial spectrum for bio-preservation

12. Agricultural Economics and Marketing

- Demand supply analysis and consumer study on food products
- Economic analysis of agriculture diversification, natural resource management, policy reform and food processing industry
- Agriculture technology evaluation, assessment and its impact on agriculture sector
- e-resources for market forecasting in agriculture sector and global exposure
- Application of image processing techniques and use of ICT utilizing Artificial Intelligence in Agriculture DSS.

B:- SHORT TERM SUGGESTED STRATEGIES

1.Genetic Resource Management

1.1 Microorganisms

- Development of efficient strains of essential plant nutrients

- Nutrient availability through microorganisms and recycling of agricultural residues through microbial consortia
- Use of nanotechnology for enhancing efficiency of useful microorganisms

1.2 Insect-pests

- Setting up of well specialized laboratories for mass production of important bio-pesticides like *Metarhizium anisopliae*, *Beauveria bassiana, Lecanicillium lecanii*

1.3 Livestock

- Development of pro/prebiotics for nutrient utilization
- Establishment of breed's societies for conservation of animal breeds

2. Crop Improvement

2.1 Field crops

- Development of product specific varieties of potato, wheat etc.
- Use of speed breeding and satellite breeding strategies to shorten varietal development process
- Introduction of new/unconventional nutritious crops like quinoa, amaranths etc.
- Research on impact of global warming and climate change on crops
- Development of *rabi*/summer castor near coastal region to fulfill the demand of industries
- Crop diversification in the niche crops of North and North West Gujarat particularly in wheat & barley
- *Durum* wheat varieties for high *beta carotene*, excellent grain quality and export purpose
- High leaf yielding and better quality varieties of *Rustica* tobacco
- Development of high yielding and quality hybrids of pearl millet

2.2 Horticultural crops

- Emphasis on improvement of potato, arid fruits, date palm and vegetables to increase input use efficiency

- Protected or controlled environment cultivation using green house, net house technology for nursery, floriculture and vegetables
- Starting of research for mass multiplication of date palm, potato, *kankoda*, capsicum, tomato, papaya, gerbera, chrysanthemum and philodendron for commercial exploitation
- Intensified research on the development of improved varieties of medicinal and aromatic plants of North and North West Gujarat and particularly in Kachchh e.g. Senna, Noni etc.
- Propagation techniques for arid fruits and medicinal plants
- Screening of nematode resistant germplasm of vegetables, fruits, ornamentals and medicinal crops

2.3 Seed production

- Farmers participatory seed production programme
- Production of quality seed and planting material through establishment of SEED VILLAGES through co-operatives and FPOs.
- Dissemination of quality seed production technology to the farmers/seed producers through regular trainings

3. Crop Management

3.1 Crop production

3.1.1 Field crops

- Innovative crop husbandry with emphasis on plant geometry, energy and integrated crop management for efficient, economic, eco-friendly and sustainable crop production technologies for field crops.
- Farmer friendly low cost input technology of bio-agents
- Better use of ICTs and daily weather forecast to the farmers to avoid climate risks
- Use of crop simulation models and adoption of contingent crop planning for aberrant anticipated weather situations
- Application of nanotechnology for improving fertilizer and pesticide use efficiency

3.1.2 Horticultural crops

- Controlled environment farming (Hi-tech Horticulture)
- Development of rejuvenating technologies for old orchards of pomegranate, citrus, mango, guava, sapota etc.
- Production of pesticide residue free food products by commissioning cow based natural/organic farming
- Enhancing use of *Azolla* and biofertilizers at farmers' orchards.

3.2 Crop protection

3.2.1 Integrated pest management (IPM)/Integrated plant disease management (IPDM)

- Integrated and eco-friendly pest management with added use of botanicals like neem and custard apple
- Promotion of modern equipments like motorized sprayers, ULV sprayers and drone technology for the pest management
- Establishment of laboratories for mass rearing of identified biotypes
- Development of plant origin insecticides/pesticides using ITK systems

3.2.2 Biological control

- Identification of strains of bio-agents having multiple resistance to agrochemicals and their mass production technology

3.2.3 Control of nematodes

- Survey of nematode prevalence and yield losses for identification of hot spots by parasitic nematodes in nematode prone crops.
- Soil-solarization technology for the control of root knot nematodes in nursery of horticultural crops
- Study on plant extracts, soil amendments and cultural practices to minimize damage of nematodes

3.2.4 Residue recycling and management

- Promotion of in-situ and ex-situ crop residue recycling through use of decomposing microbes

4. Integrated Farming System

4.1 Horticultural crops and Agroforestry

- Exploration of commercial floricultural crops suitable to the region

5. Organic Farming

- Promotion of organic products having export potential
- Organic nutrient, weed and pest management strategies to maintain the ecological balance
- Development of organic pest management schedules

6. Soil and Water Productivity

6.1 Water management

- **Adoption of in-situ moisture conservation and ex-situ water harvesting for critical stage irrigation**
- Studies on wetting pattern of different soil types and development of suitable MIS systems
- Development of sensor based irrigation management systems
- Identification of crop geometry to reduce the MIS installation costs
- Judicious use of saline water in agriculture and salt affected soils
- Identification of crops/cropping systems based on water availability and length of growing period
- Development of short term and medium range weather forecasting models
- Technologies on conjunctive use of rain, ground and canal water for optimal use of water

6.2 Nutrient management

- **Low cost input technologies for micronutrients like S,Zn,Fe,Mo and B etc management for quality production of cereals ,oil seeds and pulses.**
- Identification of efficient strains of nitrogen fixers (*Rhizobium*, *Azotobacter*, *Azospirillum*), Phosphate Solubilizers & Mobilizers and VAM

- Identification of microorganism strains for rapid decomposition technology for sustainable organic production
- Popularization of FYM enrichment technology among the farmers

7. Agricultural Engineering and Renewable Energy

- Development of crop, situation and gender specific manually operated and mechanized farm equipments
- Development of efficient and effective machinery for farm waste incorporation
- Development of product process technology for underutilized crops
- Development of agro voltaic technologies for dual remunerations from field Development of technologies for optimum utilization of non-conventional energy resources
- Development of small scale agricultural equipments and driers based on renewable energy particularly solar energy
- Utilization of surplus agricultural residues for decentralized power generation

8. Post-Harvest Management and Value addition

- Va**lue addition in oilseeds (e.g. castor Ist and IInd generation derivatives and castor oil coated UREA**), seed spices (e.g. cumin, fennel etc.) and medicinal crops (e.g. Linseed, Isabgol , *Ashwagandha*)
- Value addition, processing, improve self-life and reduced post-harvest losses of perishable fruits and vegetables for export and industry purpose
- Development of biodegradable, edible, smart and economical packaging materials
- Preparation of quality beverage from low to medium quality dates
- Involvement of nano packaging techniques to extend shelf-life of perishable products

9. Livestock production and management

- Nutritional intervention in expression of genetic potential in dairy animals
- Technology to supply nutrients rich feeds fodders

- Development of therapeutic milk and milk products from camel/goat milk
- Advancement in livestock nutraceuticals viz., chelated mineral mixture, bypass proteins, herbal growth promoters, probiotics, herbal immuno boosters

10. Fisheries

- Establishment of inland (fresh and brackish water) fisheries/ aquaculture research station and training centre under SDAU jurisdiction
- Establishment of Fisheries College.

11. Food technology

- Development of functional foods using underutilized fruits such as custard apple, *jamun*, *karonda*, *bael*, wood apple etc.
- Development of health beverage from date kernel powder
- Development of novel food products from locally available fruits and vegetables
- Extraction of nutraceuticals from moringa leaves and its utilization for value addition
- Development of nutri-cereal based extruded foods

12. Dairy technology

- Utilization of goat and camel milk for preparation of value added dairy products
- Development of milk products with enhanced bio functional properties
- Development of functional *lassi* using fermented noni juice
- Evaluation of antioxidant potential of lemon grass fortified fermented milk products
- Development of antioxidant rich dairy products using date kernel powder

13. Agricultural Economics and Marketing

- Marketing of agricultural products in domestic and global markets
- Application of soft computation in agriculture economics
- Use of statistics, data mining for forecasting and prediction in agriculture

Top priorities for implementation of above strategies

- Strengthening Tissue culture laboratory for date palm, pomegranate, banana, papaya crops.
- Establishment of a short term germplasm storage facility at SDAU .
- Establishment of nursery for research and large scale production of plantlets for fruit crops , vegetables, medicinal and floriculture.
- Infrastructure facility creation for research on storage of perishable vegetables and fruit crops.
- Establishing speed breeding facilities
- Facilities for Biomolecule Research
- Infrastructure facility for maintaining indigenous breed of Kankrej cow, Mehsani and bunni buffalo, patanwadi and Marwari sheep and Kachchhi goat and camel.
- Strengthening laboratory for large scale production of pro/pre biotic microorganism for nutritional utilization.
- Strengthening research on product specific varietal development at wheat and Potato.
- Strengthening for hybrid wheat and fennel.
- Strengthening vegetable research station and establishment of groundnut, mustard and sesame and Bajra research stations separately at SDAU.
- Establishment of Nano technology laboratory for improving fertilizer and pesticides use efficiency.
- Establishment of units for production for Azola, Vermicompost, Vermi Wash, Jivamrut, Panchgavya, Farm residue decomposition, Bijamrut, Honey bee rearing, Rhizobium bacteria, Trichoderma spp. , Micr rhiza, Azotobacter, clostridium, Azospirillum, Bio agents for multiple resistance to agro chemicals, Amrut pani, Nimastra, Bhramastra, Gauban, Neem seed extract, Agni Shastra and Dah parni extract.
- College of Veterinary Science & Animal Husbandry at Bhuj

- College of Agriculture at Bhuj
- Livestock Research station for Banni Buffalo and kachchhi camel and goat
- Fisheries college at Kothara
- Establishment of poultry research centre
- College of Agricultural Engineering and Technology at Sardarkrushinagar
- Poly tech in Agri. Engineering
- Poly tech in Agri. Processing at Mehsana

❖ **Work Plan for 2021-2022 and 2022-23**

2021-2022

1. Sorting out of befitting agro-technologies to enhance socio-economic status of farmers
2. To create awareness among the farming community regarding benefits of judicious use of technologies for utilizing available natural resources.
3. Identification of constraints faced by the farmers in the adoption of available technologies and steps to overcome them.
4. Identification of ways for fine-tuning of existing un-penetrated technologies among farmers
5. Vocational training programmes to farmers in the area like agribusiness management, agro product processing and value addition in crops

2022-23

1. Demonstrating recent technologies for minimizing cost of production and realization of other benefits to the farmers.
2. Providing training on preparation of natural inputs for maximizing quality produce.
3. Instant solution for farmers' problems viz., crop production, protection, processing, value addition and marketing
4. Imparting hands-on-training for self-reliance in seed, energy and other inputs production for different crops and livestock as well as value addition of agricultural produce to increase farmers' income.

❖ **Policy suggestions**

Strengthening of PPP involving farmers' groups, SHGs, NGOs etc.

Promotion of renewable energy technologies at farmers field

Promotion of on-farm residue management for organic inputs production technologies at farmers field

Establishment of incubation/start-up centres for agriculture technologies

Intervention of government to be made for smooth registration and licensing for selling of foundation/certified / truthful seeds produced by the farmers

Providing cluster wise support measures to agro-processing units and their collectives for production catchments to promote capacity building and strengthening

❖ **Outcome of strategies**

Genetic Resource Management and Crop Improvement

High yielding varieties in cotton, pearl millet, maize, sorghum suitable to problematic soils and aberrant weather conditions be available to the farmers

Approximately 20% of farmer's of North Gujarat become self-reliant in seed production

Conservation and utilization of indigenous and wild germplasm of field, horticultural crops, beneficial microorganisms, insects and livestock of North Gujarat be achieved

Climate resilient crop varieties be developed through introgression of novel genes and traits from wild germplasm

Integration of conventional breeding with genome resource tools for enhancing crop yield and quality of major crops

Genetic stock of field, horticultural crops, beneficial microorganisms, insects and livestock of North Gujarat be identified for biotic and abiotic stresses

Isolation and identification of new strains of Plant Growth Promoting Rhizo-bacteria (PGPRs) and enhancing their efficiency

Establishment of breed's societies for conservation of animal breeds

Consortia be developed for pro/prebiotics for nutrient utilization

Crop Management

Adoption of GAPs will increase crop productivity, conserve agro-ecosystem and produce safer food

Reduction in loss of nutrients by 20% is expected

Export will be enhanced especially in seed spices through adoption of organic farming technology.

Farmers' friendly low cost input technology of bio-agents be available

Crop simulation models, contingent crop planning, alternate land use systems (ALUs) will be used against aberrant anticipated weather situations

Fertilizer and pesticide use efficiency can be improved using IPM modules.

Marketability of agricultural/horticultural/dairy products will be enhanced

Production of pesticide residue free food products by commissioning cow based natural/organic farming

Consumption of pesticides and its residues be decreased

Bio-agents strains having multiple resistance to agro-chemicals be available to the farmers

Integrated Farming systems

Input use efficiency will increase with the use of natural farm organics under constrained agri environment of North Gujarat

Farmers will get regular income through combined components of IFS

Wastelands of Patan and Kachchh districts be utilized for arid fruits cultivation

Different MPT based agroforestry systems will be developed

Organic Farming

Adoption of cow-based natural farming will reduce the cost of cultivation and reduce farmers' dependency on external inputs and facilitate eco-friendly environment

Converting 10% area of each district of SDAU jurisdiction under organic/natural farming is expected for self-reliance in agri inputs.

Reduction in 30% of the pesticide and chemical fertilizers consumption is expected

Soil and water productivity

Improved soil health and water productivity

Problem soils be delineated

Efficient utilization of waste land

Good quality of FYM will be available to the farmers

Agricultural Engineering and Renewable Energy

Development of skilled manpower in the area of renewable energy utilization and conservation

Enhanced local availability of equipments/ implements

Low cost and timely farm operations to realize more profit

Post-Harvest Management and Value addition

Value-addition in crops (e.g. castor), seed spices, arid fruits and vegetables for enhanced employment and income of small & marginal farmers

Livestock production and Management

Local breeds of livestock (e.g. *Kankrej*, *Banni*, *Mehsani*) will be conserved and maintained that will sustain the business of livestock.

Productivity and quality of milk and other animal products will be increased

Genetic drain of precious livestock will be checked.

Fisheries

Enhanced farm income through allied agri-enterprises.

Dedicated fisheries research centre will enhance the income of aquaculture farmers of N. Gujarat.

Food Technology

Nutritional intervention in society will improve human health.

Enhanced shelf life of farm produce to gain additional income by the farmers.

(Overall outcome can be summarized as: Farmer of North and North west Gujarat Agro Climatic Zone will be self reliant by having technologies like: Sufficient and quality seeds, product specific and high yielding varieties, packages for Good Agricultural practices, high yielding local animal breeds, Processing technologies, Energy independency, Safer food production, Pesticide residue free exportable agri-products, and Profitable Agri-business. That can uplift his socio economic status.)

7. Junagadh Agricultural University

Junagadh Agricultural University

Major strategic crops of Saurashtra :

Field crops: Groundnut, Cotton, Sesame, Wheat, Chickpea, Pigeon pea, Pearl millet

Immunity crops: Fortified Cereals (Developed 3 hybrids in pearl millet)

Horticulture crops:

Fruits : Mango, Acid lime, Coconut, Pomegranate, Banana, Papaya, Sapota, Custard apple

Vegetables: Brinjal, Onion, Tomato, Okra, Garlic

Flowers: Marigold, Gaillardia

Spices: Cumin, Coriander, Ajwain

Table:- 1 Major crops in Saurashtra and Gujarat state (2010-17)

Sr. No.	Crop	Saurashtra region			Gujarat state		
		Saurashtra			Gujarat		
		Area	Production	Yield	Area	Production	Yield
		('000 ha)	('000 t)	(kg/ha)	('000 ha)	('000 t)	(kg/ha)
1	Groundnut	1348.87	2476.07	1835.66	1619.63	3013.86	1860.83
2	Bajra	78.71	163.05	2071.62	585.38	1161.31	1983.88
3	Castor	95.14	214.42	2253.88	660.68	1389.30	2102.85
4	Cotton	1763.43	5599.93	539.85	2664.34	8463.34	540.01
5	Gram	73.55	108.22	1471.29	191.06	216.86	1135.03
6	Sesame	116.94	58.65	501.59	184.77	91.66	496.09
7	Pigeonpea	6.36	7.14	1122.38	253.46	282.74	1115.50
8	Wheat	312.92	1169.81	3738.34	1186.55	3513.21	2960.86

9	Cumin	162.42	124.35	765.64	322.08	230.09	714.39
10	Vegetables	116.84	2286.04	19.57	610.30	12253.63	20.08
11	Fruits	84.26	1018.03	12.08	408.43	8653.54	21.19

Table 2:- Decennial rainfall statistics of Saurashtra region and Gujarat state

Sl. No.	Year	Saurashtra	Deviation from normal (%)	Gujarat	Deviation from Normal (%)
	Normal*	713.69		912.66	
1	2010-11	1189.02	66.60	1011.85	10.86
2	2011-12	810.43	13.56	929.62	1.85
3	2012-13	349.71	-51.00	649.46	-28.83
4	2013-14	1011.27	41.70	1253.30	37.32
5	2014-15	668.36	-6.35	807.45	-11.52
6	2015-16	549.91	-22.95	659.39	-27.75
7	2016-17	647.73	-9.24	787.18	-13.74
8	2017-18	776.55	8.81	943.15	3.34
9	2018-19	646.27	-9.45	831.21	-8.92
10	2019-20	1062.06	48.81	1068.89	17.12

Current Issue :

Economical

- Market prices of farm produce are so volatile and unrealistic.
- Terms of trade for farmers with respect to that of non-farmers are often so low.
- The price spread of a commodity is highly skewed in favour of middlemen or intermediaries over the farmers.
- Escalating cost of cultivation and low productivity.
- Inadequate farm credit matching the requirements of the farmers and credit disbursal often not farmer friendly.
- Cumbersome procedure for farm product exports, processing and organic certification.
- Limited cooperative and dairy sector in this region.

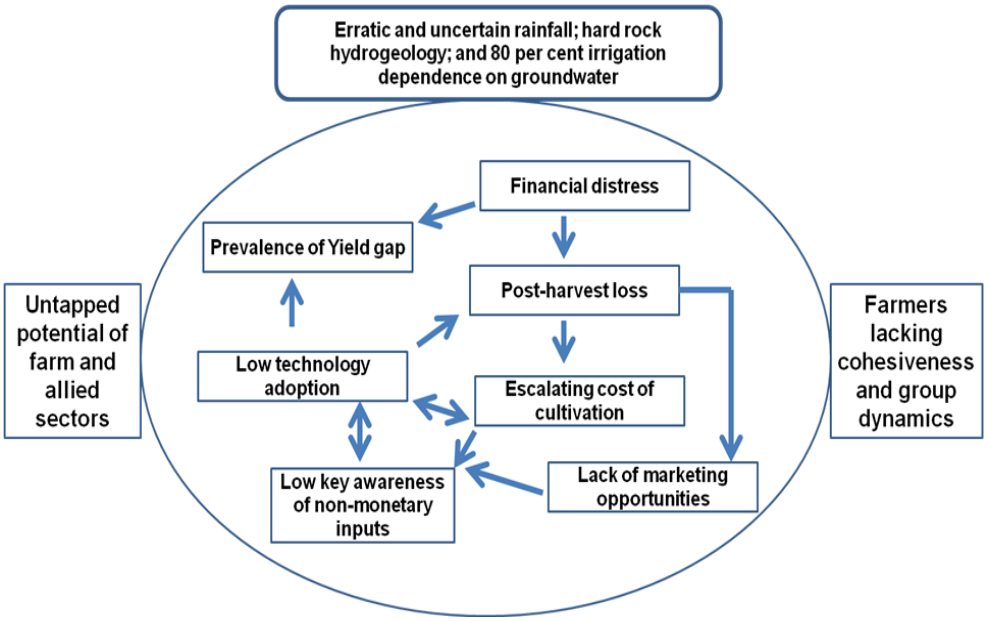
Infrastructural

- Severe shortage of agricultural labourers.
- Insufficient irrigation facilities.
- Inadequate electricity and unsuitable timing for agricultural operations. Inadequate and poor quality rural roads and transportation facilities.
- Large scale availability of spurious inputs on seeds, pesticides, growth regulators, fertilizers and other agro-chemicals.
- Flooding of the market with unstandardized and unscientific organic inputs. Lack of processing and value addition at community/village level.
- Insufficient storage facilities for seed and farm produce at local levels.

Natural and Technological

- Serious problem of vertebrate pests.
- Outbreak of new pests, diseases and weeds.
- Deteriorating level and quality of groundwater.
- Salinity ingress in coastal areas.
- Contamination of soil and water due to industrial pollutants.
- Depletion of soil organic carbon
- Increasing farm risks due to climate change.
- Continuous decrease in farm-holding size making them untenable for investments.

Key challenges in improving farmers' income :



ROAD MAP

Suggested Strategy

1. Crop Improvement
2. Horticulture
3. Natural Resource Management
4. Plant Protection
5. Agricultural Finance and Marketing
6. Agricultural Engineering

Crop Improvement

- Seed entrepreneurship and start-ups
- Seed bank and seed vault
- Seed priming
- Seed quality assurance and testing
- Amendment in Seed Bill 2004
- Seed rolling plan
- Cold storage facility
- Diversification of varietal development
- Conservation of medicinal and aromatic plants
- Organic seed production
- Biofortification

Crop Improvement

Work plan	Outcome
Strategy: (1) Seed entrepreneurship and start-ups	
▪ Establishment of "Seed Entrepreneurship Development Centre " atCentre" at different ICAR	✔ Development of skill and confidence for seed entrepreneurship to

institutes and SAUs. ▪ Training by GCSR and EDII agencies. ▪ Start-up for farmers seed enterprises. ▪ Maintenance of seed quality standards of different crops.	unemployed UG and PG students to take advantage of "Start-up India" ✔ Self-sufficiency of farmers in seed production and marketing.

Work plan	Outcome
Strategy: (2) Seed bank and seed vault	
▪ Strengthening of established seed bank for maintenance of foundation and certified seeds to avail the seeds at the time of natural calamity. ▪ Establishment of community seed banks for ITK. ▪ Establishment of seed vault in Himalayan regions.	✔ Availability of quality seeds for specific regions under natural calamities at an affordable rate.
Strategy: (3) Seed priming	
▪ Strengthening of seed priming seed pelleting and seed coating.	✔ Quick and uniform seed germination and protection against biotic and abiotic stress during early stages. ✔ Reducing cost by

	mechanized sowing.
Strategy: (4) Seed quality assurance and testing	
▪ Upgradation of seed testing protocols up to the International standard. ▪ Adoption of DNA markers to distinguish varieties to supplement grow-out tests. ▪ Development of user-friendly DNA kits for fast and accurate identification of varieties/hybrids. ▪ GMO's detection kits for GM crops.	✔ Easy and fast identification of varieties/hybrids of GM and non-GM crops at affordable rate to avoid spurious seeds. ✔
Strategy: (5) Amendment in Seed Bill 2004	
▪ Amendment for truthful label seeds of private companies. ▪ Compulsory notification for research varieties/ hybrids.certification and notification procedures for varieties/hybrids developed through GMOs.	✔ Farmers get benefit to sow certified and notified varieties/hybrids and claim for compensation under adverse conditions
Strategy: (6) Seed rolling plan	
▪ Identification of region specific landmark varieties.	✔ Availability of quality seeds for biofortified and landmark varieties.

▪ Biofortified varieties in the public distribution system. ▪ Extension of registration validity period of widely adopted varieties/hybrids even after 10 years. ▪ Mechanism of seed traceability by seed bar-coding system.	
Strategy: (7) Cold storage facility	
▪ Provision of region-wise and crop specific cold storage facilities. ▪ APMC takes the lead role in establishment and financial assistance for crop specific cold storage facilities.	✔ Remunerative price of produce as per demand in the market.
Strategy: (8) Diversification of varietal development	
▪ Speed breeding for short-term crop research programme. ▪ Accelerated crop breeding for long-term crop research programme. ▪ Development of pre-breeding materials under greenhouse conditions.	✔ Rapid advancement of breeding materials leads to early release of varieties/ hybrids. ✔
Strategy: (9) Conservation of medicinal and aromatic plants	

▪ Creation of *in-situ* and *ex-situ* conservation facilities for medicinal and aromatic plants. ▪ Establishment of certified nurseries to avail quality planting material. ▪ Strengthening marketing facilities for medicinal and aromatic plants in the APMCs .	✔ Encouraging farmers and communities for cultivation of medicinal and aromatic crops. ✔
Strategy: (10) Organic seed production	
▪ Adoption of NOP Standards. ▪ Strengthening varietal development programme. ▪ Formation of organic seed network. ▪ Climate resilient organic seed production.	✔ Availability of sufficient and certified organic seed.
Strategy: (11) Biofortification	
▪ Strengthening of seed priming seed pelleting and seed coating.	✔ Quick and uniform seed germination and protection against biotic and abiotic stress during early stages. ✔ Reducing cost by

	mechanized sowing.
Strategy: (3) Seed priming	
▪ Strengthening of seed priming seed pelleting and seed coating.	✔ Quick and uniform seed germination and protection against biotic and abiotic stress during early stages. ✔ Reducing cost by mechanized sowing.
Strategy: (3) Seed priming	
▪ Development of biofortified varieties/hybrids in food crops. ▪ Establishment herbal parks. ▪ Implementation of regulatory body for herbal nutraceutical industries.	✔ Improvement in health, longevity and quality of life in rural and urban areas. ✔

Horticulture

- Quality planting material
- Area expansion of forestry and arid fruit crops
- Mechanization in horticulture
- Expansion of domestic horticulture
- Protected cultivation of high valued vegetables and flowers
- Kitchen/terrace gardening

Strategy: (1) Quality planting material

• Promotion of plug nursery. • Start-up through horticultural graduates. • Implementation of Nursery Act. • Provision of subsidy for nursery business. • Accreditation/certification of nursery. • Promotion of nursery business through Self Help Group. • Provision of tissue culture planting materials. • Establishment of vegetable seedling nurseries.	✔ Availability of good quality planting materials.
Strategy: (2) Area expansion of forestry and arid fruit crops	
• Promotion of cultivation of high valued timber crops. • Promotion of cultivation of underutilized fruit crops. • Establishment of “fruit parks” in urban areas. • Relaxation in Forest Act. • Promotion of forest based cottage industries.	✔ Development of climate resiliency and increase in income in arid regions.

• Provision of quality planting materials for forest and minor fruit crops. • Organization of seasonal horticultural crop festivals.	
Strategy: (3) Mechanization in horticulture	
• Availing robotic facilities on subsidized rates. • Establishment of pack houses on cooperative bases. • Provision of low/small capacity equipment on subsidy bases. • Provide big equipment on hire bases.	✔ Reduction in cost of cultivation and post-harvest losses. ✔ Higher market price.
Strategy: (4) Expansion of domestic horticulture	
• Promotion of horti-tourism. • Special horticultural start-ups. • Establishment of spice parks. • Provide training to rural youth. • Establishment of Horti-Clinics at district level.	✔ Horticultural entrepreneurship.

Strategy: (5) Protected cultivation of high valued vegetables and flowers	
• Providing technical support. • Providing market facilities. • Research & Development for low cost protected structures.	✔ More economic return through off seasonal production and higher productivity of the crop.
Strategy: (6) Kitchen/Terrace gardening	
• Availability of quality planting materials. • Promotion of kitchen gardening. • Research & Development for kitchen/terrace garden.	✔ Availability of healthy foods to individual families and opportunity for entrepreneurship.

Natural resource management

- Integrated nutrient management
- Organic farming
- Dry farming technologies
- Integrated weed management
- Management of problem soils
- Integrated farming system
- One District One Crop (ODOC)
- Weather-based agro-advisory services and climate change

Strategy: (1) Integrated nutrient management

• Supplementing deficient nutrients. • Use of manures, biofertilizers, green manuring, crop residues and mulching. • Use of cow-based and botanical bioenhancers. • Biofortification of essential nutrients in food crops. • Remediation technology for waste and polluted waters.	✔ Reduced use of chemical fertilizers. ✔ Recycling of crop residues. ✔ Carbon sequestration. ✔ Improvement in soil health and productivity. ✔ Nutritious food.
Strategy: (2) Organic farming	
• Promotion of organic farming/natural farming in niche areas. • Use of organic manures, biofertilizers, cow-based formulations and botanicals. • Recycling of crop residues/farm waste. • Non-chemical methods of pest, disease and weed management. • Development of microbial consortia enriched organic manures. • Production of organic inputs and cow-based formulations. • Separate MSPs and APMCs for organic produce.	✔ Improvement in quality of farm produce. ✔ Chemical residue free produce. ✔ Reduction in input cost. ✔ Improvement in soil health, carbon sequestration and environment.

Strategy: (3) Dry farming technologies	
• Adoption of crop production technologies for dry farming. • Strengthening of soil and water conservation practices. • Promotion of water harvesting and well recharging. • Maintenance of water harvesting structures. • Promotion of agro-forestry and arid fruits. • Inter/mix/relay cropping. • Use of mulches, polymers, land configuration, tillage etc. • Development of the IFS model for dry farming.	✔ Improved soil and moisture conservation. ✔ Increased water productivity. ✔ Increase in crop production and farm income.
Strategy: (4) Integrated weed management	
• Preventive measures to check weed dispersion. • Incorporating cultural, mechanical, physical and biological methods with chemical methods. • Precision farming based site-specific weed management. • Rotation of herbicides and use of herbicide mixtures. • Management of herbicide residues and phytotoxicity.	✔ Timely and effective weed management. ✔ Reduced herbicide residues in plant and soil. ✔ Tackling farm labour shortage. ✔ Increase in production.

Strategy: (5) Management of problem soils	
• Reclamation/amelioration of contaminated and problem soils. • Recycling and rational usage of different wastes in agricultural soils. • Phyto/bioremediation of contaminated soils. • Screening of crop varieties suitable for problem soils. • Land use according to capability class.	✔ Improved soil health and productivity. ✔ Sustainable crop production ✔ Crop varieties suitable for problem soils. ✔ Delineation of problem soils.
Strategy: (6) Integrated Farming System	
• Horizontal and vertical diversification. • Crop diversification towards high value crops. • Diversified cropping systems with other existing farm enterprises or new/modified enterprises for different land holdings. • Recycling and intermittent use of farm products, by-products, residues and wastes for reducing cost of production. • Development of homestead farming systems. • Development of ecotourism models to supplement farm	✔ Increase in farm production, net income, employment, resource use efficiency, carbon sequestration etc. ✔ Reduction in cost and risk of production. ✔ Sustainable use of resources.

income. • Provision of incentives and insurance for IFS. • Provision of multi-disciplinary advisory service.	
Strategy: (7) One District One Crop (ODOC)	
• Identification of one agriculture or horticulture crop already grown in a district having potential in all parameters like yield potential, suitable climate and capacity to raise income of farmers. • Development of these districts as hubs for particular crops. • Encouraging small food processing units, farmers SHGs, FPOs and cooperatives. • Reaping the benefit of scale in terms of procurement of inputs, availing common services, storage, marketing, value chain development and alignment of support infrastructure.	✔ Reduction in yield gap. ✔ Availability of inputs and infrastructural facilities. ✔ Value chain development. ✔ Increase in incomes and local employment and decline in migration.
Strategy: (8) Weather-based agro-advisory services and climate change	
• National network for medium range weather forecasting linked agro-advisory. • Advisory for crop cultivation practices according to the	✔ Managing vulnerability to climate change. ✔ Preparedness to extreme events.

weather forecast. • Insect-pest forecast on the basis of weather conditions. • Early warning of extreme climatic events. • Decision support system for agro-advisory services to the farmers. • Developing climate-smart agricultural technologies. • Biotic and abiotic stress management • Preparation and dissemination of crop contingency plan.	✔ Mitigation to stress and climate change.

Plant Protection

- Agricultural pesticides
- Surveillance of pests and diseases
- Establishment of plant health clinic
- Biorational management of pests and diseases
- Biofertilizers
- Mushroom cultivation
- Apiculture
- Vertebrate pest management

Strategy: (1) Agricultural pesticides

• Integration of the whole mechanism of pesticides regulation. • Establishment of NABL accredited lab for pesticides residue analysis. • Strengthening mechanism of monitoring of pesticides.	✔ Reduced cost of registration & residue analysis. ✔ Useful to exporters and indirectly farmers ✔ Check spread of spurious and ineffective pesticides.
Strategy: (2) Surveillance of pests and diseases	
• Policies to be fixed for surveillance of pests and diseases. • Monitoring of resistance and resurgence in pests. • Determination of MRLs in food, water and soil.	✔ Forecasting for timely management of the disease-pests. ✔ Use of the pesticides can be optimized. ✔ Minimize the pollution and improve the health of flora and fauna.
Strategy: (3) Establishment of plant health clinic	
• Establish the multi-disciplinary plant health clinic at taluka level.	✔ Timely diagnosis and control of pests and diseases. ✔ To inform the farmers for safe handling of agrochemicals.
Strategy: (4) Biorational management of pests and diseases	
• Encourage use of bio-rationals. • Incentive to start ups for mass productions of bio-rationals. • Establishment of bio-rational	✔ Avoid the injudicious use of the chemical pesticides. ✔ Reduce the dependency on

production units at SAUs/Govt. institutes.	chemical pesticides. ✔ Better management of major pests by conserving biodiversity. ✔ Providing quality bio-rationals to farmers at cheaper rates.
Strategy: (5) Biofertilizers	
• Enhancing production and application of biofertilizers under flagship projects at APMCs and SAUs.	✔ Reduce dependence on chemical fertilizers. ✔ Enhance soil fertility and crop productivity. ✔ The students' entrepreneurship.
Strategy: (6) Mushroom cultivation	
• Encouraging production of spawn. • Development of expertise in mass production and marketing of mushrooms.	✔ Spawn made available locally. ✔ Mushroom growers develop skill and expertise in production and marketing as well as their livelihood increase in rural areas.
Strategy: (7) Apiculture	
• Establishment of apiculture research and training institutes. • Standardisation of protocols of beekeeping.	✔ Proves an important subsidiary occupation to farmers. ✔ Increase in crop yield in cross pollinated crops.
Strategy: (8) Vertebrate pest management	

• Availing physical and biological barriers to manage the vertebrates at local level. • Implementation of user-friendly schemes for farm protection. • Financial assistance for farm protection structures.	✔ Reduce the human-wildlife conflict. ✔ Long term solution to protect the crops and lives.

Agricultural finance and marketing

- Alleviating financial distress
- Focusing on value-chain approach
- Tackling income insecurity
- Leveraging FPOs
- Creating avenues for non-farm rural employment

Strategy: (1) Alleviating financial distress	
• Promoting self-liquidating short-duration marketing loans. • Operationalizing credit linked warehousing facilities at APMC level. • Proliferating pledge financing through rural godown networks. • Availing interest free credit upto 50% of value of produce on accredited warehouse receipts.	✔ Reduction in distress selling of farm produce. ✔ Improvement in farm capital formation. ✔ Better realization of market intelligence services.
Strategy: (2) Focus on value chain approach	
• Using blockchain technology for	✔ Market-led production.

product traceability. • Appointment of accredited quality assessors at every APMC. • Strengthening cold chains, rural godowns and agro-processing centres.	✔ Improvement in produce safety and quality. ✔ Higher net returns.
Strategy: (3) Tackling income insecurity	
• Squeezing prices spread with a lesser number of intermediaries. • Promoting cooperatives for horticultural commodities. • Encouraging group dynamics among farmers. • Operationalizing MSP in tune with the state-wise contributions to the national output.	✔ Improved bargaining capacity of the farmers. ✔ Enhanced net returns.
Strategy: (4) Leveraging FPOs	
• Providing collateral free loans up to Rs. 25 lakh. • Enabling group insurance schemes for members. • Accommodating FPOs at the APMCs by issuing traders' licenses.	✔ Improved adoption of GAPs. ✔ Lesser risks and higher returns.
Strategy: (5) Creating avenues for non-farm rural employment	
• Organizing agro-eco-tourism by using local resources. • Establishing Agro-Technology	✔ Localized employment opportunities.

Parks that may serve as agro-tourism destinations. • Simplifying licensing procedures, laws and regulations for developing small scale enterprises in rural areas. • Identifying avenues for start-ups or incubation hubs in rural areas. • Providing assistance to rural enterprises in terms of information base, availability of technology, technology transfer, improved credit availability, infrastructural support and marketing support.	✔ Additional income opportunities for the farming community. ✔ Improved prospects of processing and value addition at village level.

Agricultural engineering

- Soil conservation
- Water harvesting and groundwater recharge
- Irrigation water management
- Controlling seawater intrusion
- Farm mechanization
- Post harvest management
- Value addition
- Storage and marketing chains
- Energy generation from agricultural wastes
- Enhancing renewable energy sources

Strategy: (1) Soil conservation

• Promotion of soil conservation practices and planning of biofuel producing plants and fuel trees/crops in wastelands.	✔ Increase in cultivated area, ✔ Improvement in crop production.
Strategy: (2) Water harvesting and groundwater recharge	
• Strengthening of Water harvesting and ground water recharge at watershed level in PPP mode • Managing canal water distribution with artificial intelligence and sensors.	✔ Increase in good quality irrigation water ✔ Increase in area under irrigation.
Strategy: (3) Irrigation water management	
• Research focuses on low cost and user friendly smart/automatic irrigation. • Improving surface irrigation efficiency by automation. • Use of sensors. • Promotion of cropping patterns according to water availability. • Establishment of MIS operation and maintenance clinics.	✔ Improving water use efficiency. ✔ Reduce input cost on weeding, labour, fertilizer etc.
Strategy: (4) Controlling seawater intrusion	
• Diverting river flow into the interceptor channel, canal parallel to seacoast.	✔ Improvement in quality of soil and water in coastal areas.

Strategy: (5) Farm mechanization	
• Development of custom hiring centres on PPP mode. • Promotion of contract farming. • Development of low cost improved tools/equipment and machines. • Promotion of resource/residue management equipment. • More funding and promotion of research on artificial intelligence robotics and drones. •	✔ Local availability of equipments/ ✔ implements. ✔ Timely Operation. ✔ Reduce the cost of cultivation.
Strategy: (6) Value addition	
• Raising the level of processing from primary/ secondary to secondary/ tertiary for commodities. • Provide facilities to prepare value added products at local level.	✔ Obtain the higher prices ✔ Employment generation
Strategy: (7) Post Harvest Management	
• Develop on-farm processing and mechanization solutions. • Roll out innovative equipment leasing models to drive process mechanization. • Agro processing centres on a community basis.	✔ Reduce post harvest losses ✔ Obtain higher prices

• Implementation of ARYA project in each taluka	
Strategy: (8) Storage and marketing chains	
• Promote SHGs and FPOs. • Storage facility scheme should be farmer friendly. • Promote integrated agri-logistics systems to enable efficient transfer of produce from farm-gate to end-consumers.	✔ Reduce post harvest losses ✔ Obtain higher prices ✔ Reduce price gap of commodity between producers and consumers.
Strategy: (9) Energy generation from agricultural wastes	
• Promotion of briquetting of crops. • Biogas and biochar production. • Energy plantations on non-arable lands.	✔ Increase in fuel availability. ✔ Additional income from crop by-product. ✔ Environment conservation.
Strategy: (10) Enhancing renewable energy sources	
• To develop concentrated low cost solar photovoltaics. • Harvesting solar energy on farms. • Solar pump with micro irrigation. • Adoption of Agro Voltaic Systems.	✔ Reduce cultivation cost. ✔ Additional crop production. ✔ Eco-friendly environment.

Policy Suggestions: Crop Improvement

Strategy	Policy suggestions

Seed entrepreneurship and start-ups	To establish the start up of "Farmers seed enterprises" for agriculture graduates for production and supply of improved seeds. To establish seed storage at village level under CSR funds.
Seed bank and seed vault	To establish region-wise seed banks for maintenance of foundation and certified seeds of different crops to ensure timely availability.
Seed priming	To provide funds to strengthen the R & D on seed priming/pelleting/coating in SAUs/Govt. agencies.
Seed quality assurance and testing	To frame guidelines of DNA barcoding system for tracking the breeder and subsequent stages of seed production and supply/distribution system.
Seed rolling plan	To demonstrate newly developed variety/hybrid on farmers field on cluster base.
Cold storage facility	To establish region-wise adequate crop specific cold storage facilities with nominal rate.
Organic seed production	To create a seed chain for providing certified organic seed at village level.
Conservation of Medicinal and Aromatic Plants	To set up strategies for production, value addition and marketing of medicinal and aromatic plants

Policy Suggestions: Horticulture

Strategy	Policy suggestions
Quality planting material	To establish certified vegetable seedling nurseries at village level.
Area expansion of forestry and arid fruit crops	To establish social forestry at village level on waste, barren and fellow land by growing high value forest crops. To promote cultivation of arid and minor fruit crops.
Mechanization in horticulture	To provide financial assistance to HDP, rejuvenation, and canopy management. To promote automation and mechanization on a co-operative basis.
Expansion of domestic horticulture	To establish start-ups for high tech horticultural innovations viz., protected cultivation, hydroponics, aeroponics, aquaponics, spices park, kitchen/terrace gardening, horti-tourism, vertical farming. To promote start-ups for flower drying and related products, urban gardening, city landscaping, bio-aesthetic planning etc. in urban areas.
Protected cultivation of high valued vegetables and flowers	To promote off-seasonal cultivation of vegetables and flowers. To establish horti-clinics at district level.

Policy Suggestions: Natural Resource Management

Strategy	Policy suggestions
Organic farming	To encourage start-ups for organic input production involving rural youth. To subsidize organic inputs. To establish infrastructure for input availability, product analysis and market at taluka/district level.
Dry farming technologies	Need scheme for integrated farming system for dry farming/rainfed area.
Management of problem soils	To strengthen the scheme for soil salinity appraisal for monitoring of salt affected areas and poor quality irrigation waters and their reclamation measures. To restrict mining and groundwater exploitation in coastal areas. To create an interceptor canal across the entire seacoast of Gujarat.
Integrated farming systems	To promote crop diversification, new crops, cropping systems etc. To establish a treatment plant for recycling of waste & effluent to agriculture under strict monitoring by Government agencies. To provide financial incentives for establishing bio compost units. To setup multi-disciplinary advisory service cell for IFS farmers
Policy Suggestions: Plant Protection	
Agricultural	To integrate the whole mechanism of pesticides

Pesticides	regulation under one umbrella by creating divisions for registration, bioassay, quality control, residue, biotech, environmental impact and import and export divisions. To establish well-equipped NABL accredited quarantine and pesticide testing laboratories (GLP) in each State/SAUs across the country. To strengthen CIB with agricultural expertise. PGPRs like biofertilizers, bioagents, microbial formulations etc. should be excluded from FCO and CIB.
Surveillance of pests and diseases	To frame the policy or to fix agencies for surveillance of pests and diseases invasion as well as forecasting of disease-pests incidence.
Establishment of plant health clinic	To establish a multi-disciplinary plant health clinic (static/mobile) at taluka level.
Biorational management of pests and diseases	To incentivise Start-Ups for mass production of bio-agents and biofertilizers. To exempt SAUs/Govt. institutes from registration and licensing for mass production and distribution of bio pesticides/biofertilizers.
Mushroom cultivation	To encourage private agencies/ farmers/ NGOs for production and marketing of spawn.
Apiculture	To encourage private agencies/farmers/ NGOs for apiculture.
Vertebrate pest	To extend animal hostels/panjarapole for stray cattle.

management	To provide financial assistance for farmers friendly farm protection structures. Strict monitoring and implementation of policy for vertebrate pests. Financial provision against crop loss, life loss etc.
Policy Suggestions: Finance & Marketing	
Alleviating financial distress	To provide credit linked warehousing facilities at APMC level. To avail interest free credit to accredited warehouses.
Focusing on value-chain approach	To strengthen taluka level cold chains, rural godowns and agro-processing centres. To appoint accredited quality assessors in every APMC.
Tackling income insecurity	To establish robust procurement machinery. To support cooperatives for promoting horticultural produce with institutional incentives and extension mechanisms.
Leveraging FPOs	To exempt FPOs from APMC cess. To provide collateral free loans to the FPOs. To establish group insurance schemes for members of FPOs. To accommodate FPOs at the APMCs by issuing traders' licenses.
Creating avenues for non-farm rural employment	To simplify licensing procedures, laws and regulations for developing small scale enterprises in rural areas.

	To provide appropriate assistance to the small scale sector in rural areas.
Policy Suggestions: Agricultural Engineering	
Soil conservation	To provide financial assistance for conservation and reclamation of problematic soil.
Irrigation water management	To give equal subsidy for all farmers irrespective of categories based on caste, land holding size etc. To authorize Agricultural Engineering graduates for the MIS operation and maintenance service centres.
Farm mechanization	To establish a separate Directorate of Agricultural Engineering to execute / monitor and disseminate various farm mechanization, watershed management, irrigation and command area development programmes, agro processing, renewable energy and protected cultivation etc. To establish more farm machinery and implement testing centres to accelerate the services to machinery manufacturers.
Post-harvest management	To make provision of license waving and incentive for on farm processors.
Value addition	To establish agro processing units on a co-operative basis at taluka/district level.
Enhancing renewable energy sources	More flexibility for loans for PV installations for small and medium enterprises and residential consumers. To increase the purchasing price of net electricity generation from solar plants.

8. Gujarat Organic Agricultural University

Krishi is sobriquet India's development and self-reliance whereas the farmer is the backbone of the krishi. For better performance the body needs a strong backbone similarly for atma nirbhar krishi need of an hour is to make the farmer stronger and adaptable to changing situations. The current scenario is challenging to the farmers as the land is getting fragmented, climate uncertainties, and vicious cycle of debt lead to increase in suicide and migration of farmers towards cities, consequently the agriculture area is also shrinking. Despite a decline in the agriculture sector's contribution to GDP, food grain production and productivity has risen. This credit must be given to the scientist, students and farmers who constantly work hard in research, education and on field, respectively.

1. Current Situation of GOAU:

Organic farming is at its inception stage in India. About 2.30 million hectare is a cultivated area in the country, this is almost two percent of the 140.1 million hectare net sown area in the country. The top three state states: Madhya Pradesh, Rajasthan and Maharashtra account for about half the area under organic cultivation. The top 10 states account for about 80 per cent of the total area under organic cultivation. Gujarat area under organic certification process is 95207 Hectare. India has exported 689.20 million USD organic products (2019-20).

Under the organic policy of Gujarat state, Gujarat Organic Agricultural University was established in the state by Act No. 16 in the year 2017 with the aim to provide quality education, scientific recommendations and dissemination of important and beneficial information and advisories to farmers in organic farming and allied sectors.

The 23 ha. Land has been allotted to the university at Halol village of panchmahal district of the Gujarat state. The first vice-chancellor of the university was appointed in august, 2019.

The skilled manpower is needed in organic farming and considering the need, the university had organized 30 days training of Master level agriculture students of AAU, Anand and many webinars were conducted during 2020. This has brought a change in mindset of farmers and students that organic farming done with scientific approach may give benefit.

Taking into consideration the pressing need from students, the university has developed two unique courses (1) M.Sc. Agri(Agronomy) with specialization in organic farming and (2) M.Sc (Horticulture) with specialization in organic farming. Four and two students were given admission in M.Sc (agronomy) with specialization in organic farming and M.Sc (horticulture) with specialization in organic farming, respectively. Thus, six students enrolled in the current academic year. We have written to ICAr for recognition of these courses.

2. Current issues in Organic Farming:

Organic agriculture is a holistic production management system which promotes and improves health of the agro ecosystem including biodiversity, biological cycles, and soil biological activity. Insect pest management in organic agriculture involves the adoption of scientifically based and ecologically sound strategies as specified by the international and national organic production standards. These include a ban on synthetic insecticides and, more recently, on growing curbs on genetically modified organisms (GMOs).

Since the inception of the idea about organic farming during the green revolution period has raised lots of issues at scientific and research, Farmers level and other issues surmounted the concept of organic farming. The issues are discussed as below:

Research & Scientific issues:

1. **Dedicated Scientist and men power:** In agricultural university it is mostly observed that a particular scientist gets known for a particular crop or a technology but if we look at organic farming there are very few scientists who are engrossed in organic farming research and education. Need a

technical manpower and scientist who shall be dedicated towards organic farming research.

2. **Yield Experiments in organically grown crops:** This is a very important issue for the scientific community to ponder on. We are conducting research on various input aspects but yield related research has never been a focused area in organic farming which has resulted in poor availability of organic seeds and also helped many to peddle the myth regarding the yield in the organic system.
3. **Integration between various departments/ institutes/ universities:** There is very less coordination and integration in organic farming sectors and thus the query remains unaddressed.
4. **Lacking best bet in organic farming:** There is no accurate technology or methods available in organic farming which provides sustainable and effective measures to farmers and organic system as a whole which results in less profit or no profit to the farmers.
5. **Management of soil health, fertility, weed, Insect and Diseases:** In conventional farming there is specific solution and recommendations are available for management of insect- pest, diseases and soil health but in organic farming no or limited recommendation and solutions are available.
6. **Nutritional Benefits of Organically grown food:** No documented proof is available to scientists regarding the nutritional aspects of organically grown food, just mouth to mouth wording is being done that organically grown food is sweeter and healthier but needs to be investigated scientifically.
7. **GMO Impact and alternative:** International Federation for organic agricultural movement as well as many other institutes working in organic farming have given a recommendation that GMO cannot be used in an organic farming system but none of them has solid reason why GMO cannot be used in organic farming. If we look scientifically no chemicals are permitted in organic farming while GMO developed for biotic stress has an edge advantage that it minimizes the spray of chemical pesticides

and thus allows the system to develop naturally. We need to search alternative to GMO like molecular breeding and speed breeding which gives a specific condition solution at precise and in sustainable manner like in rice a variety developed through QTLs has multi genes which confer the resistance against the biotic stress as well as provide tolerance towards abiotic stress or allow GMO which does not breach the integrity of organic farming.

8. **Biodiversity in small landholding:** Majority of the farmers small and marginal in India. The land holding may range from 0.5 ha. To 2.0 ha. The organic farming principle of ecology narrates that without biodiversity we cannot do organic farming, therefore need to address this issue seriously.
9. **Livestock Health:** Many scientific institutes do not have a protocol of organic livestock production and its management. This should be addressed at earliest.

Farmers' issues:

1. **Package of Practices and standard procedure for specific situations**: Farmers do not have PoPs like in conventional farming they have with them. This needs to develop at research institute/ universities level.
2. **Input availability**: Input for fertility management or biotic stress management are available in the market for organic farming but the quality of such inputs have not been validated through scientific research or does not have a statement of compliance of the product.
3. **Quality Seeds**: Seed is a primary input needed in agriculture, As of now no organically developed certified seed is available in organic farming but the standards say that from second year onwards farmers who are in the certification process have to use seeds grown through the organic system of farmers. In India only the PDKV akola is having a programme in organic seed development in cotton.
4. **Availability of Livestock**: The organic farming depends on the animals and their dung, urine and horns are used in making different formulations in organic farming. It is observed that small and marginal farmers do not

have the animals, thus they have to purchase them from outside. This increases the burden on farmers.

5. **Labour**: In Gujarat the problem is getting labour at a reasonable rate and at specific time which is a major problem in farming and specifically for different operations in organic farming requires lots of labour.
6. **Timely Advisory**: No recommendation is available to the farmers in case of any infestation or adverse effect observed on their organic field. It is essential to address this issue immediately in such a way that it would increase the interest of farmers in organic farming.
7. **Documentation of Certification**: The certification is a bonus point to organic farmers for fetching a remunerative price for their organic products but the documentation process is cumbersome and confusing, due to which farmers get disappointed and do not prefer the certification. It is needed to be resolved by automation or by creating assistance centres.
8. **Lower Yield**: Till date only few recommendations and POPs are available to farmers which cannot bridge the gap for yield. The system of organic farming is not well established and has to work in coordination with nature. Need a high yielding varieties and hybrid under organic farming system.
9. **Complications and Confusions, Training in Organic Farming**: The farmers feel that doing organic farming is complicated and confusing as making of formulations are different in different methods of organic farming. The farmer is still confused which method is good or which gives results. The scientific information regarding the parameters and method need to be addressed. The lack of training has been observed by farmers.
10. **Markets**: The farmers sell their produce in the common market as there is no systematic channel of marketing available to organic farmers. The selling takes place at market rate or below it.

Other issues

1. **Dedicated Market, Price Realization, Space at APMCS, Regulations of markets and Trade Channel:** Across the globe , the demand of organic produce has been increasing and it is observed that during lockdown the

demand for organic products has jump in between 25 to 75 per cent but there is no specialized and dedicated market. Consumers get products via mouth publicity or through e-commerce sites. This may lead to fraud and consumers may get conventional food products in the name of organic. Many a time the consumer has to pay double or triple the time of conventional produce, which is not affordable by everyone. A space at APMCs is not available to farmers and price fixation mechanism is also not seen in the system for organic produce. Trade Channel is not visible for organic.

2. **Storage:** Recently global alert has been issued for isabgol and cumin for ethylene oxide contamination. The farmers have grown these crops in an organic system but at storage their produce gets contaminated due to fumigation. A separate protocol and space is needed for storage of organic produce.
3. **Biomass availability:** In organic farming tons of manure is required and making of such manure requires the biomass which is not readily available to farmers as well as institutes. This needs to be addressed at earliest.
4. **Certification and fees:** The certification procedure and its fees are complex and high. The farmers get trapped by certifying bodies in standards which farmers even do not know and to get certificate farmers have to pay a huge amount of money. Therefore, the small and marginal farmer does not go for certification.
5. **Processing Units:** There is minimal separate unit for processing of organic produce, as certification of organic produce requires a separate unit to provide contamination free processed food.
6. **Network of Farmers:** It is observed that farmers do organic farming in scattered areas and there is no network of farmers, the farmers sell their produce individually and during infestation they control by applying ITKs developed by them at their farms. They do not have a mechanism to share their development with other farmers.

7. **Lack of Awareness:** The consumer does not know what is organic and the farmer does not know the standards of organic. Need to develop awareness among both sides.
8. **Export:** The farmers do not have certificates and those who have certificates do not have quantities to export. The farmers are cultivating the crops according to local needs but they need to recognize the export demand and revenue.
9. **Lack of financial support:** Most farmers who are doing organic farming do not get any incentives or subsidies or financial support.
10. **Extension worker interest and knowledge:** It is extremely worrisome that the extension functionaries do not have interest in organic farming as compared to conventional farming. However, they try to work but due to paucity of knowledge they hesitate to recommend farmers regarding the organic farming practices.

3. Strategies and Outcomes:

On the basis of assessing the issues this university has chalked out the strategies and their outcomes which are as below:

Build network of Departments/ Institutes/ Universities :

It is observed that various institutes/universities are working on research aspects in organic farming but it is clearly seen that no network has been set up to bring the work on one platform. The work done by this institute remains at their disposal only and farmers seated far away from this institute do not get benefitted the technologies they have developed. By building up this network we shall have following outcomes:

- Easily design experiments and common sharing of knowledge leads to overcoming various levels of problems.
- Latest technologies can be easily deployed which shall help in development of novel inputs and testing in cost effective manner.

- Package of practices for crops under different situations shall be available to farmers.
- Refinement of ITKS available at nook & Corner of world could be done easily.

Centre of Incubations at different Agro-climatic conditions:

This university shall establish the Centre of incubation in agro climatic zones of the state. These centers shall nestle the budding ideas and provide the platform for innovations based on the needs of the peoples and farmers. This centers shall provide following outcomes:

- Novel and Sustainable practices for farmers according to local needs. It shall also cater the mission- Vocal for local.
- It facilitate in formation of FPOs and assists in marketing by developing e-market tools or linking existing markets by using Artificial Intelligence
- New tools for farm mechanization through innovations. Also address residue burning by developing machines and technologies like Happy Seeder and Waste Decomposer.
- Value addition procedure and protocols shall be available to farmers.
- These centers shall assist in making new policies.

Build Skill and Demonstration Centers

The farmers, consumers and extension workers are not confident and lacking skills in organic farming, considering this issues this centers shall be created and this center will cater the following needs:

- It shall provide the master trainers and trained manpower.
- It shall provide quality publications.
- Hand on training.
- Timely Advisories.
- Demonstration of time and need for specific equipment and technologies.
- Leads to coordination between different sectors and departments.
- Use of ICT helps in dissemination of information rapidly.

- This center shall assist the farmer in the certification and documentation process.
- This center shall assist in filing the notion of One District, One Product along with Brand India.

Develop skilled manpower

Skilled and dedicated men power is a measure step for achieving success in any sector. This University shall provide the Post Graduate studies, Vocational Courses, Diploma Courses to give strength to research, education and extension in the field of organic farming.

Seed Bank and Conservation Technologies

The quality seed is like a chip in a computer which has all the programmes that need to be run by the user. There is a dearth of quality seeds which have resistance and tolerance towards biotic as well as abiotic stress respectively. This seed bank and technologies shall facilitate:

- The conservation and production of indigenous seeds which are tolerant to abiotic stress and resistant to biotic stress.
- Good germplasm shall be available to scientists.

Cluster based approach for seed Production

Bulk requirement shall increase in near future for organic seeds. To leverage the demand we need to adopt the cluster base production strategy and prior to this cluster for seed production approach, it will be collaborated with GOPCA for certification of these clusters. This clusters shall cater the following outcomes:

- It shall provide good quality seed at village level at a reasonable rate.
- Quality testing shall be available at cluster level.

Resource conservation technologies

Organic Farming has a principle to build the ecology too along with production. This university shall take into account the technologies which will have sustainable solutions for conservation of ecology.

Risk Management Measures

The management of risk is a crucial and important aspect in organic farming. This university in coming years shall try to come up with certain measures to tackle emergency situations in collaboration with other institutes worldwide.

Development of Sustainable tools, Multilayer Farming systems along with Models for weather vagaries

To improve the livelihood and nutritional aspects of the farming community and the society as a whole, we need tools to bring the system in uniformity with the environment. On a single piece of land how farmers harvest the maximum benefits to be addressed. The following outcome may be expected:

- It helps farmers to harvest maximum benefits from available pieces of land and can generate a handsome amount of money with limited resources.
- It confers sustainable and economical solutions to farmers against weather vagaries. Promote minor millet cultivation under organic farming regimen which provide nutritional food to society and assure income to farmers.
- The protected cultivation shall take shape by the availability of organic tools which shall assure round the year income to the farmers.
- It provides an entire livelihood, bio fortified crops and increases water use efficiency.

Identification of Potential areas

The university shall identify the potential areas where organic farming can be adopted at ease and these potential areas shall be the model for other farmers. The outcome of this approach shall be as follows:

- It shall facilitate the development of local need based research activities, which shall make farmers confident in adverse conditions.
- The small farmers shall be able to form clusters which shall help them in easy access to research, training and market facilities which reduce the transaction cost for small and marginal farmers.
- Medicinal Plantation areas shall be demarcated and developed as Medicinal Plantation Zones in organic Farming. The essential oil fetches high prices to the farmers and thus, farmers become ATMA NIRBHAR by doing medicinal plantations using technologies developed by the university.

Development of Research and Research base Infrastructures

Quality of organic products are prerequisite for sustainable and profitable organic farming. Lot of spurious material is given to farmers and minimal facilities are available which test the inputs for their quality. Need to develop such infrastructure and facilities which shall provide following outcomes:

- It shall facilitate the laboratories for testing of inputs, development of new protocols and quality inputs.
- It shall help to decipher the complex attributes that exist in nature.
- It shall provide climate resilient products for organic farming.
- It shall create needed base solutions.

Set up of separate Organic Farming Cell by Government and Organic Agriculture Economy Zones (OAEZ)

At policy level government need to take some of the decision such as set of organic cell and organic agriculture economy zones which shall give following outcomes:

- The cell shall formulate the Policies and coordinate with the departments/institutes/ Universities working in organic farming

research, extension and education aspects, respectively. Budget allocation demand shall be through cell.

- OAEZ may delineate a single point solution to policy makers, farmers, consumers and businessmen.
- OAEZ are specialized zones which would be crop centric value chains and provide safety nets based on automated weather based advisories.
- Bridge the gap between farmers and markets.

4. Action Plans of the University for the year 2021-22 and 2022-2-23

In 2021-22 the university shall design new Short term and PG courses, the place shall be identified for the center of Incubations and training and webinars shall be conducted whereas in 2022-23 the courses which were designed shall be started and global classroom concept shall be executed through international universities tie up.

5. Requirements for executing Action Plans:

Staff:

- At least a staff strength of 250 is needed in the university, currently only the vice-chancellor has been appointed.

Land:

- Requires at least 50 ha. of land at different agro climatic conditions for establishment of center of incubation, demonstration and research farms.

Infrastructure:

- The university shall require the laboratories, classrooms, buildings, vehicles, equipment for implementation of strategies.

Recognition:

- The university has started two courses from the academic year-2020. University has written to ICAR for recognition of courses. In

near future universities shall also approach the UGC for recognition.

9. Navsari Agricultural University

(Note to be requested)

10. Kamdhenu University

Status and strategy for indigenous cow and buffalo rearing, embryo breeding and cross breeding. Strategy for improving milk yields of non-descript cows, with focus on tribal areas of Gujarat :

- Development of high producing indigenous animals and minimizing cross breeding with foreign breeds.
- Increase AI coverage in indigenous and non-descript cattle and buffaloes using frozen semen from high genetic merit bulls after genomic selection.
- Provide high genetic merit bulls where AI infrastructure is lacking and also for migratory herds of traditional and non-descript breeds.
- Only certified semen should be used for A.I; where certification of semen is not possible, bulls may be used for breeding.
- Female stock is needed for herd replacement, accurate selection of sires assumes greater importance. But a feasible cost effective and proven method for general adoption in the country is also to emerge. Any programme for genetic improvement needs an organization/set-up that goes beyond the individual/herd.
- Expansion of Information Network for Animal Productivity and Health (INAPH) Network of NDDB. • Knowledge systems and homestead animal husbandry, dairy and fisheries in tribal areas.
- Strengthening extension services for scientific management of animals.

Strategy to organise FPO/cooperative for animal holders where dairy cooperatives are yet to be organised :

- Provide support for the promotion of such FPOs by qualified and experienced Resource Institutions by creating a coalition of partners by the concerned promoter body, involving civil society institutions, research organisations,

consultants, private sector players and any other entity which can contribute to the development of strong and viable producer organizations.

- Encouraging formation of groups of farmers and cooperatives / producers' companies of small and marginal farmers / livestock owners.
- The diagnostic study can be conducted to assess the preliminary situation of the farmers and level of agriculture in the area. The study will help in identifying the potential interventions required and understand the specific project implementation contexts.
- Formulation of policy to support small dairy farming and marketing.
- Increasing and strengthening Cooperative Dairy network. • Animal Waste Management on lines of Swachhta Abhiyan.
- Gauchar land development and fodder seed bank.
- Mini instrumentation bank for dairying and milking at village clusters under cooperatives.
- Setting FPOs for sheep, goat, camel, horse, poultry etc. and feed for these animals.
- Promotion of marketing of organic manure, nutrition and plant protection from cow dung and urine and research into its actual outcome.

Vaccination for all livestock and research to identify new virus and vaccine for the same, in collaboration with NDDB :

- 100% Vaccination and deworming drive.
- Categorize vaccines for diseases that cause economic losses, diseases controlled by the government, and those for neglected animal diseases.
- Urgent need to develop vaccines for diseases of zoonotic importance like, avian influenza, swine fever, Q fever etc.
- Urgent need to develop preventive measures for parasitic diseases of production animals.
- Promoting activities to control and prevent animal diseases, environmental pollution, promoting efforts towards food safety and quality, and supply of quality hides and skins through timely recovery of carcasses.

Animal shelter and research in cattle feed as per climate change and advisory on climate related services :

- Establishing community-based shelters for heat/cyclone resilience
- Ensure steady incomes of small and marginal farmers by enhancing their bovine stock to at least 5 per household. • Increasing availability of fodder and feed to substantially reduce the demand – supply gap through measures which include more area coverage under quality fodder seeds, technology promotion, extension, post-harvest management and processing in consonance with diverse agro-climatic conditions.
- Accelerating production of quality fodder and fodder seeds through effective seed production chain (Nucleus-Breeder-Foundation-Certified- Truthfully labelled, etc.) with active involvement of farmers and in collaboration with the dairy / farmers cooperatives, seed corporations, and private sector enterprises.
- Establishing convergence and synergy among ongoing Plan programmes and stakeholders for sustainable livestock development.
- Promoting applied research in prioritized areas of concern in animal nutrition and livestock production. • Underground storage tanks created for harvesting roof top water and also ponds dug to store rain water as complementary intervention in area surrounding the shed
- Ensure social safety net for small and marginalized households dependent on climate resilient indigenous cattle breeds within project boundary
- Regulations for quality of animal feed.
- Nutri-sensitive animal husbandry, dairy and fisheries resources and innovations.
- Climate smart villages.
- Web and mobile advisory services.
- Providing infrastructure and linkage for marketing, processing and value addition, as forward linkage for the farmer's enterprises.

Human resource development :

- Looking at the economic importance of the animal husbandry, dairy and fisheries sector to the national economy, it is very important to oversee the human capital situation required to support it.
- For Animal Husbandry, Dairy and Fisheries using PPP and cooperative models.
- According to livestock census 2019, India is having a very large animal population; however, per capita production and health levels are concern hence well trained skilled
- Manpower is needed to improve the health status of the animals and help in improving the genetic makeup of animals.
- The role of veterinarians and animal scientists is becoming more and more challenging owing to diversification in the livestock sector; higher expectations of industry, farmers and entrepreneurs; diminishing land under fodder production and for pasture, besides the challenges posed by climate change threat. In the present scenario, we need to produce more with fewer resources. It is a hard fact that in order to be sustainable in agriculture; livestock sector is considered to be the most dependable avocation for rural households. This sector needs to expand exponentially so that it is better equipped to share the burden in societal built up through veterinary and animal husbandry enterprise and practices. Creation of more institutions with modern infrastructure facilities matching global standards to expeditiously produce competent human capital with appropriate knowledge, skill and attitude to effectively manage different activities is the need of the time. Human capital is the most crucial component of growth and thus requires appropriate strategies for human resource development (HRD) and human resource management (HRM) programs. Similar situation exists in the dairy and fisheries sector which needs to be improved.
- Utilize the existing manpower and graduates in veterinary, dairy and fisheries by creating new posts and filling up vacant posts.
- Increase technical trained manpower in animal husbandry, dairy and fisheries.

Skill development of farmers :

- Need based – Nutrition, Scientific Management. • Capacity building of state functionaries and livestock owners through strengthened extension machinery to provide quality extension service to farmers.
- Indian conditions are more diverse than other nations and require different approaches for nutrition and feed policy.
- Promoting skill based training and dissemination of technologies for reducing cost of production, and improving production of livestock, dairy and fisheries sector
- Promoting initiatives for conservation and genetic upgradation of indigenous breeds of livestock and fisheries in collaboration with farmers / farmers‟ groups / cooperatives, etc.
- Skill of animal handling, housing, and production models of farmers plays an important role and has a direct impact on production gain and gaining socio-economic status of the farmers. Therefore, models which offer constant improvement and polishing skill sets of animal and fish farmers are needed.
- Walk in walk out mode with flexibility in training schedule.
- Attracting rural youth in the animal husbandry and fisheries sector.
- Development of programs like, national skill qualification framework, skill training, value addition and technology Incubation Centres in animal husbandry, dairy and fisheries.

Status of cattle farms, sheep and fodder farms, horse farm, camel rearing center and poultry development including vaccinations :

- Improving farmer’s income from farm and non-farm sources.
- Enhancing efficiency in the use of resources.
- Minimizing expenditures on non-renewable inputs and remunerative prices to farmers at 50% higher than the minimum support price.

11. Gujarat Organic Products Certification Agency (GOPCA)

About GOPCA:

- Gujarat Organic Products Certification Agency (GOPCA) is a body of the Government of Gujarat functional since 2009. It functions as an autonomous body, registered under Societies Registration Act, 1860.
- GOPCA is most preferred by Gujarat state farmers for organic product certification. Presently Gujarat is rapidly increasing its organic crop production.

Office Address: GOPCA. Opposite Gokul House, Nr. Shyamal Cross Road, Satellite, Ahmedabad-380015, Gujarat state.

Accreditation:

- GOPCA is accredited by APEDA according to the National Program for Organic Product (NPOP) 2005 as (NPOP/NAB/0028) in20, Jun, 2014.
- The general criteria and principles of accreditation shall be based on ISO Guide 65 / ISO / IEC17065.

Organogram: Hierarchy wise sanctioned posts include:

- Chairman (Hon. Secretary, Agri)
- Director (Deputation)
- Quality Manager- 3 (Deputation)
- Evaluator /Reviewer - 4 (Deputation)
- Inspector - 14 (Deputation)
- Clerical Staff - 2 (Outsourced)
- Data Entry Operator- 3 (Outsourced)
- Peon/multi-tasking staff - 3 (Outsourced)

Standards: GOPCA, is the only Gujarat State's Government Certification Body that carries out impartial third-party inspection & certification of organic production and

handling under NPOP standards; equivalent to EU standards (European Union standards).

Aim: GOPCA takes note of the increasing demand for organic certification and therefore opportunity to strengthen the hands of farmers on two fronts.

- Affordable price and timely access to certification and
- Thereby help capture larger volumes and newer markets across the world.

These will also enhance their economic adaptive abilities as part of India's dynamic ATMA NIRBHAR approach.

- The Agency works for non-profit certification programs developed in response to the changing market requirements and regulatory nature of organic certification.
- The aim of GOPCA is to provide reliable and efficient inspection & certification services to the smallest of operators/farmers in a cost-efficient way and thus promote organic farming in the State.
- GOPCA charges the lowest registration fees and inspection fees in comparison to other CBs.
- GOPCA provides at source subsidies for overall certifications charges @75% of the total to the Gujarat State's operators. Hence, it's a government agency, through which farmers get benefit of various government schemes under its Organic Policy-2015.

Organic Holding:

- Right now, GOPCA has 181 active operators, covering 526.372 hectare of Organic production land.
- The GOPCA registered operators are growing Cereal crops, Pulses, vegetables and fruit crops in an organic way.

Strategy and Outcome:

Recruitment of regular staff:

- GOPCA needs to work on standards prescribed by APEDA for maintaining organic integrity. As of now the staff pattern is as below :
  - Director
  - Quality Manager- 3 (Only 1 post is filled by Deputation)
  - Evaluator /Reviewer - 4 (Only 1 post is filled by Deputation)
  - Inspector - 14 (6 post is filled by Deputation and 4 by outsource)
  - Clerical Staff - 2 (1 is Out sourced)
  - Data Entry Operator- 3 (1 is Out sourced)
  - Peon/multi-tasking staff - 3 (1 is Out sourced)

- GOPCA in coming time try to fill this post through recruitment in order to smoothly do certification work. The certification work requires 100 % attention which could be delivered only through permanent staff.
- The area would increase which shall facilitate the farmers to earn premium price for their organic produce. Thus, farmer income improves and shall become ATMANIRBHAR.

Identification of Potential areas

- GOPCA shall try to identify the areas where group organic farming can be possible. It would result in the formation of an Internal Control System. More ICS –More the organic products and less the breach of standards.
- Group Organic Certification shall reduce the burden of fee on individual farmers and promote the small and marginal farmers to have certification. This shall give an opportunity to the group to have their organic produce in bulk, which they can sell and earn a good amount of money. Thus, this shall improve the livelihood of farmers as well as consumers, simultaneously it shall also reduce the pollution

and degradation of environment which shall help the Government to meet Sustainable Development Goals (SDGs).

Certification of whole chain

- Presently the certification is done for farmers and crop production. GOPCA shall cover the whole channel from producer to consumer. The GOPCA in future shall carry out the certification for food processing which leads to availability of 100% organic products to end consumers.
- The food processing certification shall promote the activities of FPOs and they shall supply the processed certified food products to market with their brand name, which shall strengthen the rural economy by providing the jobs at local level to local people. This shall also fulfill the mission -Vocal for Local and ATMANIRBHAR Village.

Increase the area of Gujarat State under Organic Certification:

- The area for organic certification in Gujarat is more which is already under Organic farming.
- The area needs to be expanded as a large number of farmers have shown interest in organic farming certification.

Promote Grower groups in the State for organic certification

- The certification cost is comparatively higher for small and marginal farmers.
- Considering this aspect, a cluster approach shall be adopted and groups of certified farmers shall be formed and assisted with reasonable rates.

Acquire International Standards like NOP, JAS, SWIS (BIOS) etc beside NPOP.

- Currently, the GOPCA can give NPOP certification to farmers which only has validity in India and EUROPEAN UNION. The farmer cannot sell their produce to the USA and any other nation using this certificate. GOPCA therefore aims to

relate to such other standards as NOP, SWISS etc to help farmers expand their markets.

Increase organic production in Gujarat and promote farmers to export organic products from Gujarat State to all parts of the world.

Expand certification domains for Crop production, Wild Harvest, Livestock, Poultry and Products, Apiculture, Aquaculture Production, Food Processing & Handling etc.

- GOPCA currently has only crop production certification thrust.
- It accordingly recognizes the larger potential across all agro-climatic circumstances of the State and the possibility to cover production in coastal systems and aquatic organic certification.
- The forest area of the State has various agricultural food items that are easy to certify. This shall be tapped by GOPCA.

The food processing market is growing rapidly aligned with increasing demand for processed organic food. The GOPCA shall respond to this opportunity in a comprehensive manner to further consolidate its niche.

12. Gujarat Green Revolution Company Limited (GGRC)

Introduction :

Micro irrigation technology is a modern method of irrigation having multiple benefits of water, fertilizer, energy and labour saving coupled with increase in crop productivity. . Realizing this fact, the State and Central Governments are encouraging farmers to adopt micro irrigation technologies in agriculture by providing financial assistance to farmers under flagship scheme Pradhan Mantri Krishi Sinchai Yojna- Per Drop More Crop (Micro Irrigation).

Institutional Background :

As a major initiative, Government of Gujarat during the closing ceremony of the Vibrant Gujarat Mahotsav-2004 announced formation of Gujarat Green Revolution Company Limited (GGRC), a Special Purpose Vehicle (SPV) promoted by Gujarat State Fertilizers & Chemicals Limited (GSFC), Gujarat Narmada Valley Fertilizers Company Limited (GNFC) and Gujarat Agro Industries Corporation Limited (GAIC) as the Implementing Agency appointed for implementation of Micro Irrigation Scheme in the State of Gujarat and in this regard Government of Gujarat issued Govt. Resolution (GR No. PRCH-102005-497-N, dated 09.05.2005).

Purposes and Priorities :

GGRC is formed with following objectives:

- To implement Micro Irrigation Scheme with uniform modality in the State of Gujarat.
- To remove all the inequalities and anomalies available under different scheme and sub scheme heads are utilized efficiently and benefits are extended to more and more farmers of the state effectively.

Prevailing Subsidy Norms :

Sr. No	Category of Farmer	Non Dark Zone area	Dark Zone area for 57 talukas
1	General Farmer: Small and Marginal farmer (Landholders of less than 2 ha)	Upto 70% of MIS Unit Cost or Rs. 80,000/- per hectares, whichever is less	Upto 80% of MIS Unit Cost or Rs. 80,000/- per hectares, whichever is less
2	General Farmer: (Land holders of 2 ha and more than)	Upto 70% of MIS Unit Cost or Rs. 70,000/- per hectares, whichever is less	
3	SC/ST Farmers (Tribal Farmers)	Upto 85% of MIS Unit Cost or Rs. 1,00,000/- per hectares, whichever is less	Upto 90% of MIS Unit Cost or Rs. 1,00,000/- per hectares, whichever is less

Operational Procedure Evolved :

The unique feature of the Scheme is its flexibility, wherein the farmer has the discretion to choose the extent of area to be covered under the micro irrigation technology, kind of Micro Irrigation System to be installed, viz a system design compatible with his cropping pattern and also the MIS Supplier who would install the system on his farm. All Micro Irrigation components of the System are uniformly priced under the Scheme, which ensures that the MIS Suppliers adhere to uniform quality standards and System costs.

The Scheme is being implemented with assistance of registered MIS Suppliers appointed by GGRC. At present there are 54 MIS Suppliers who take biometrics data viz., applicant photograph, digital signature and left/right hand thumb impression of the

applicant and register the application, undertake Geo Positioning System (GPS) based survey of the field and prepare design, supply and install the MI Systems on the farmers' field. After installing the System, the MIS Supplier(s) are responsible for rendering maintenance services for a period of five years. A provision has been made under the Scheme for insuring the Micro Irrigation System as well as the farmer for a period of one year. To ensure strict adherence to quality standards in the use of MIS Components, GGRC has made it mandatory for MIS suppliers to use only those components which conform to BI Standards. Third party inspections are conducted periodically by technical agencies such as Central Institute of Plastics Engineering and Technology (CIPET), and Gujarat Industrial Research and Development Agency (GIRDA) at the factory site of the MIS Supplier(s). Furthermore, GGRC has also put in place a regimen of third party inspections, wherein Third Party Inspection Agencies (TPIAs) have been appointed to conduct inspections of every farmers system to verify that Micro Irrigation System installed is as per the quotation and is operational. TPIA Inspectors are equipped with android based QR Coded "E-Capture Solutions" which enables the Inspection Agency to capture and upload photographs of the MIS installation, at site, along with GPS coordinates, on a mobile phone for subsequent monitoring of the site on Google map.

High level of transparency is a forte of the Scheme. To achieve the status, GGRC has established systems and developed processes in a corporate mode for processing MIS applications with the use of state-of-art information technology. The applications are processed centrally through a dedicated software which is web-based and user friendly. A state-of-art IT infrastructure has been put in place for implementation of the Micro Irrigation Scheme with an in house data centre.

Strategies adopted for bringing the transformation and positive impact of the scheme:

- To make Processing of Farmers Application and the Subsidy Disbursement System transparent, simple and fast:
    - **Standardisation of procedure:** The operational procedures right from

registration of beneficiary farmers application to issuance of technical sanction, design, supply and commissioning of micro irrigation system on farmers field and disbursement of subsidy to farmers are standardized, made IT enabled and known to all concerned stakeholders through dedicated online portal.

- **Fast Decision Making Process & Participatory Approach:** GGRC as an autonomous organization has full control over decision making for implementation of MIS Scheme. Due to the corporate style of implementation of the Scheme and authority to the Company Management and the Board of Directors to make decisions, the decision making process is very fast.
- **Transparency & flexibility of MI Scheme:** The implementation Scheme is transparent and information is accessible to all stakeholders and the public through GGRC website. Flexibility has been given to farmers to select a MIS supplier of his/her choice and design the system as per his requirement. No cash transactions are carried out at any stage of the application processing. Receipt of farmer's share and release of payment to MIS Suppliers are through electronic mode only.
- **Use of IT in implementation of Micro Irrigation Scheme.** The entire processing of farmers application has been carried out through a dedicated software module developed in-house; The software module with required checks and balances takes care of precise processing of MIS Applications, monitoring and verification of installation of MI System on farmer's field, disbursement of subsidy, accounting and Management Information System. In order to have more & more participation of stakeholders, registration of MIS applications has also been done by remote registration facility at the offices of MIS suppliers as well as from the farm sites of the farmer so that processing can be made as fast as possible. Dedicated Khedut Portal is made operative wherein farmers can register his/her application under the Scheme simply by sending SMS through his mobile or through the web. The website with URL

www.ggrc.co.in provides application forms, procedures, policies, unit cost, price list, insurance guidelines and package of practices. The website also provides the opportunity to the public & stakeholders to access the online progress information of MI Applications. GGRC has incorporated Geo-fencing based Cost and Design Preparation linked with the Google Map so as to authenticate the survey number of the farmland and get the exact field design in synchrony with the actual field condition. It also prevents duplication of cases. To ensure authenticity of the installation of the Micro Irrigation system on a beneficiary's farm, the installation site is being Geotagged at the time of trial run and handing over the system to the farmers. Use of QR Code GPS based mobile application for MIS Installation verification to ensure the asset (MIS) transfer to the beneficiaries. Toll free helpline telephone number has been arranged to provide information to farmers at free of cost.

- **To ensure quality of MIS Components:** To ensure the quality of MIS Components, quality checks are kept, at the manufacturing site of MIS suppliers by Technical Agencies such as Central Institute of Plastics Engineering and Technology (CIPET) and Gujarat Industrial Research and Development Agency (GIRDA). It is mandatory to supply MIS components with BIS quality to farmers by MIS Suppliers. Specifications of each component are laid down and made known to MIS suppliers so that they manufacture and Supply MIS components as per the tech. specifications. At field level, Third Party Inspection Agencies do physical verification of materials as well as BIS marking of the MIS Components and take a trial run of the MI System to judge the performance of the system in the field as per the specifications.
- **For scaling up – Strategic approach:** To increase the existing scope of Micro Irrigation under Pradhan Mantri Krushi Sinchai Yojana – Per Drop More Crop (Micro Irrigation), the Scheme is converged with other Departmental Scheme or major irrigation projects which are as under:
    - Agricultural Electricity Connection has been provided by Gujarat Urja Vikas Nigam Limited (GUVNL) on an overriding priority basis to those

farmers who adopt MIS, (more than 80,000 connections have been released).

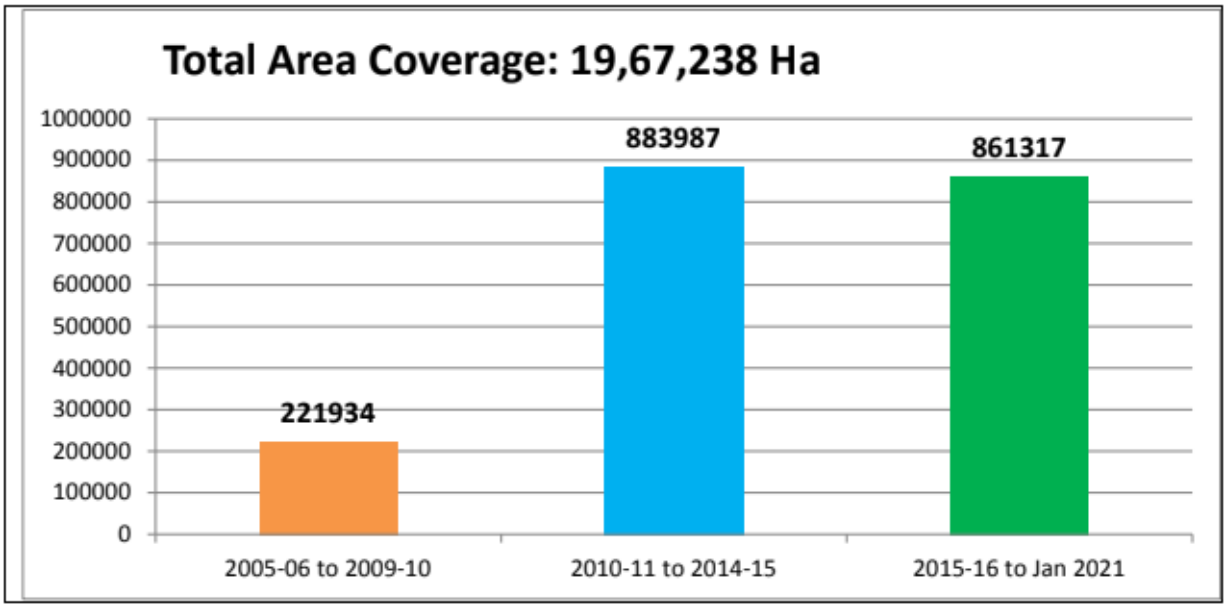
- To encourage more and more farmers to adopt the Micro Irrigation, MIS Partner Model is developed wherein, NGOs, APMCs, Sugar Factories, Corporate bodies, District Watershed Agencies etc. can act as MIS Partner and provide additional financial assistance to the farmers under their jurisdiction to discharge their Corporate Social Responsibilities (CSR).

- **Capacity Building of Stakeholders:**
  - Various District Level Training & Workshop are being organized for Village level workers, Gram Sevak & other officers of District Administrations.
  - Agronomical services with MIS maintenance training are compulsorily provided to beneficiary farmers by MIS suppliers.

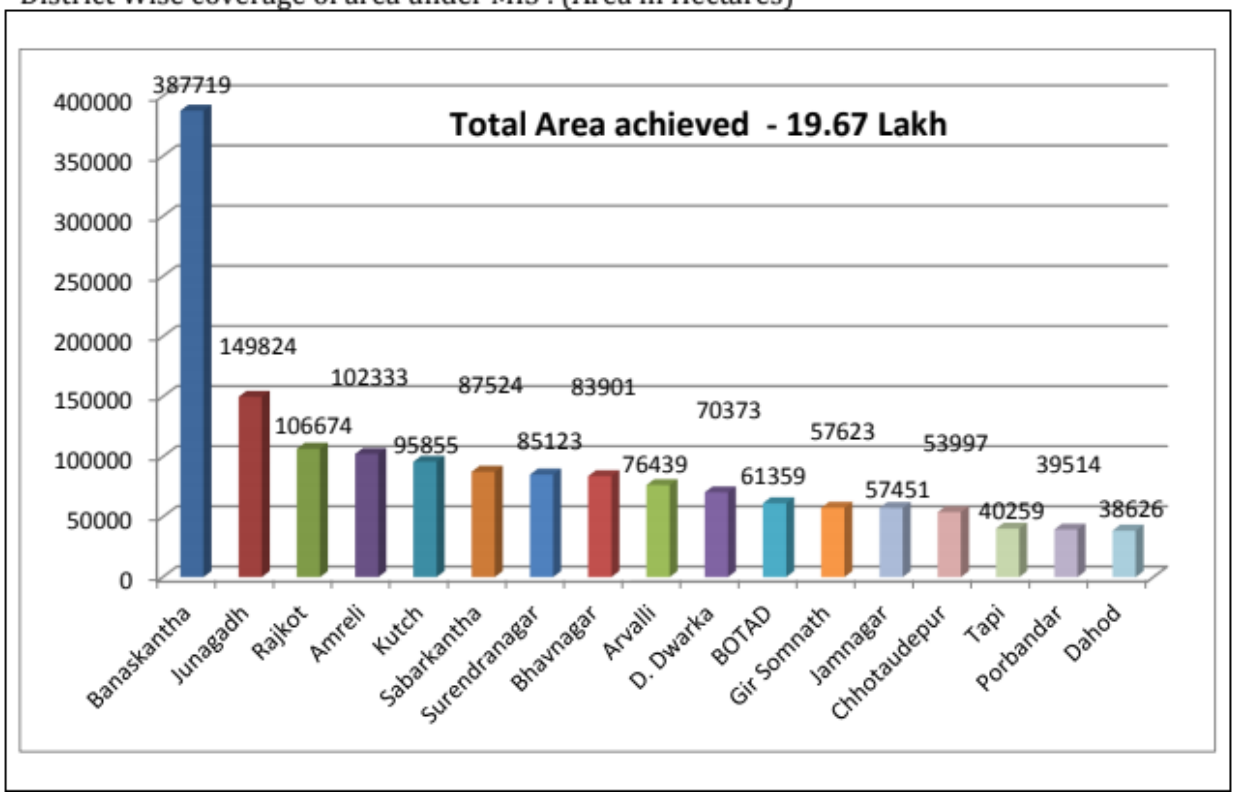
Achievement : Progressive status :

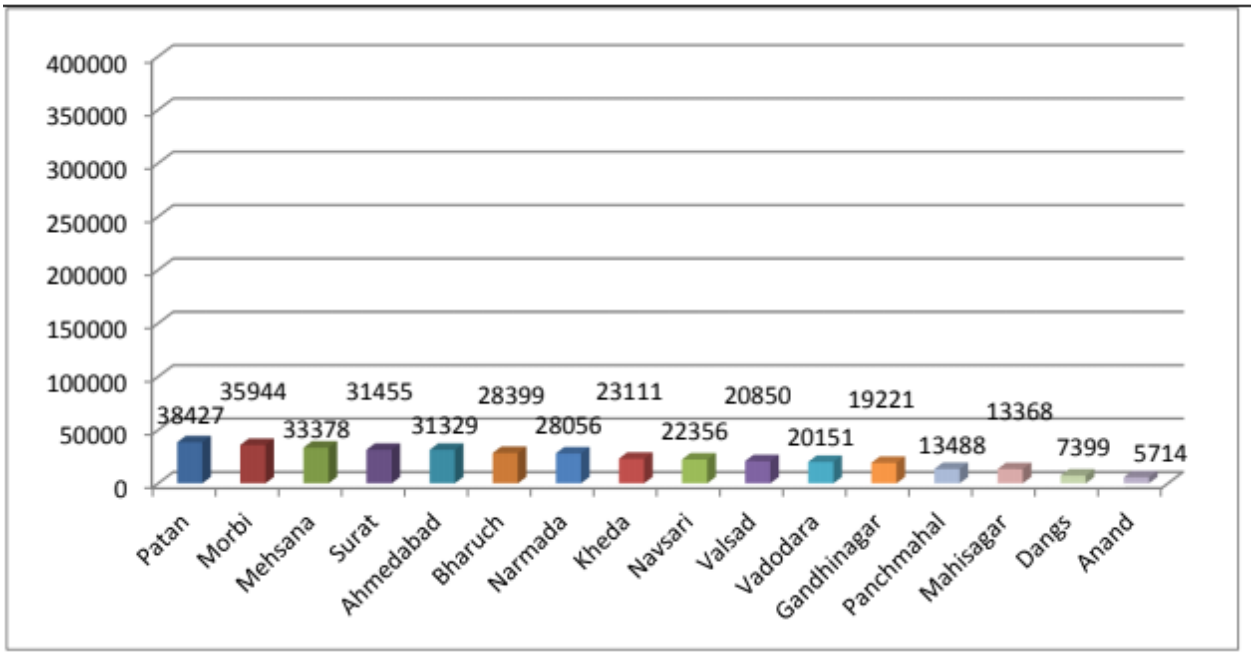
At the inception of Scheme implementation, the prime focus was continuous extension and promotional activities regarding Micro Irrigation scheme and technology using audio visual media as well as farmers meeting/shibir coupled with farmer education and training. The farming community simply believes in “seeing is believing” and considering that, along with village level awareness meetings, live demonstrations were arranged. In the first year (2005-06) of implementation by GGRC, there were just 7217 farmers who benefited covering 15892 hectares under Micro Irrigation. It took 4 years (from 2005-06 to 2008-09) to achieve the cumulative coverage of 1.5 lakh hectares. However the total coverage from 2005 to January-2021 is 19,67,238 hectares of agricultural land benefitting 12,28,669 farmers with an annual average achievement of approximately 1.25 lakh hectares / year.

Year Wise coverage of area under MIS: (Area in Hectares)



District Wise coverage of area under MIS : (Area in Hectares)

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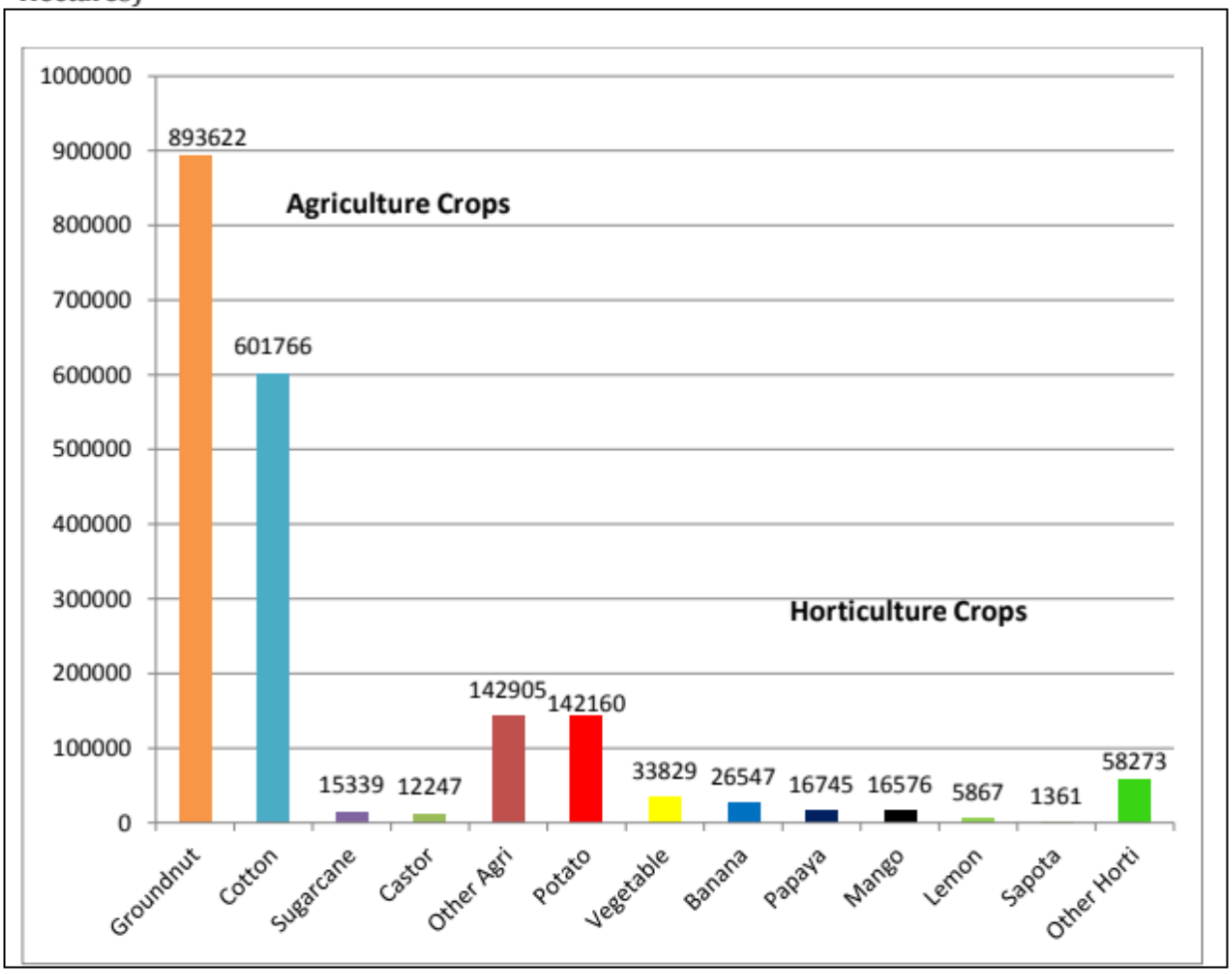
Crop Wise coverage of area under MIS: Agriculture Crop – Horticulture Crop (Area in Hectares)



Socio economic impact and concurrent monitoring and evaluation of the scheme

GGRC has put in place an elaborated monitoring and evaluation system for the Micro Irrigation Scheme. At regular intervals, the socio economic evaluation of the scheme is being carried out by various organizations Centre for Innovation Incubation and Entrepreneurship (CIIE) - Indian Institute of Management (IIM), Ahmedabad, Agricultural Finance Corporation (AFC) India Ltd., State Agricultural Universities, NGOs.

On the basis of findings of various studies, following benefits are reported due to adoption of Micro Irrigation by the farmers under the scheme.

Sr. No.	Details	Result (%)

1	Saving in Water	33-50%
2	Saving in Fertilizers	21-25%
3	Saving in Energy	69-3030kWhr/Ha
4	Saving in Labour Cost	35%
5	Increase in Crop Yield	25-30%
6	Increase in net income / hectare due to micro irrigation (Based on annualized cost)	Rs. 15487/-

As above table indicates that over and above saving of Water, Fertilizers, Energy, Labour cost and increase in crop yield, the increase in net income per hectare to the beneficiary farmer is Rs. 15487/- In addition to above mentioned reported benefits, Micro Irrigation technology also offers advantages of irrigating undulating land, prevent soil erosion, reduce incidents of crop diseases and pest, uniform distribution of water in the crop root zone and improvement in quality of crop produce.

Way Forward- Vision 2020-30 : It is envisioned to achieve the installation of Micro Irrigation in an additional area of 15 Lakh hectares by 2030 (within next 10 years – targeting 1.5 Lakh hectare area per year under Micro Irrigation) from the balance Irrigated Area. Out of total 48.38 Lakh hectare irrigated area (that includes 11.39 Lakh hectare area in Canal Command, and 36.99 Lakh hectare area irrigated through farmers own source of water tubewell/dug well and tanks) 19.67 Lakh hectare has been brought under Micro Irrigation within the span of 15 years. Micro irrigation system for its operation needs pressurized water flow in the pipe network. The prerequisite of operation of micro irrigation is water source with pumping facility. Hence, the farmers who have individual water sources as well as facilities of lifting and pumping water are taking benefit under the scheme.

To achieve the vision, following options are being explored :

- **Targeting available irrigated area as well as newly created individual water sources :** At present, farmers with secure water source (i.e. Well, Tubewell) and water lifting facility (i.e. Electric motor, Diesel engine) are the one adopting Micro Irrigation in their farm. Farmers with newly created water sources by themselves or by government departments are also encouraged and being targeted for adoption of Micro irrigation.
- **Micro Irrigation in Canal Command area:** There is huge scope of scaling up of area to bring under micro irrigation in canal command of Kadana, Ukai and SSP over and above other medium dam commands. Since the irrigation in canal command is designed with gravity flow, to unleash the potential of adoption of micro irrigation in canal command, it needs to create additional infrastructure in terms of pipe network, water storage facility and pumping facility to harness the full benefit of micro irrigation technology in canal command. Public Private Partnership (PPP) Model could be the probable solution. Area under canal or medium and minor dam based lift irrigation scheme under implementation by the Government will be the potential area for micro irrigation.
- **Adoption of Drip Irrigation in water guzzling crops like Sugarcane, banana and paddy :** There is a scope of Micro Irrigation in water guzzling crops which effectively multiplies the benefits of water saving, electricity saving and enhancement in crop productivity. A focused approach and efforts are being made to create awareness among farmers who are growing water guzzling crops like Sugarcane, Banana, Paddy. Growers of Paddy are not able to use Micro Irrigation due to crop unsuitability reasons; however trials/research for Micro Irrigation adoption in Paddy crop is under way at State Agriculture University level as well as at the level of farmers with innovative approaches. Success may lead to bringing this area under micro irrigation .

Impact on Water Savings:

As per the study conducted by the Centre for Innovation Incubation &

Entrepreneurship, Indian Institute of Management, Ahmedabad (CIIE-IIM, Ahmedabad), it is reported that the savings are estimated to be more in high-water-consuming crops like banana and sugarcane. Compared to traditional irrigation practice, Drip Irrigation saves 50% (1099mm/ha) water in Banana and 41% (893mm/ha) in Sugarcane crop. It is also stated that the water saving percentage can be raised up to 64% with proper guidance and precise usage.

As evident from above figures, Drip Irrigation technology saves huge amounts of water, it is possible to double the area under irrigation with the same amount of water available. In general, it can be estimated that by covering around 2.0 Lakh ha under Micro Irrigation systems in Canal command it would save around 1786 Mm3 to 2198 Mm3 with water guzzling crops like Sugarcane and Banana respectively.

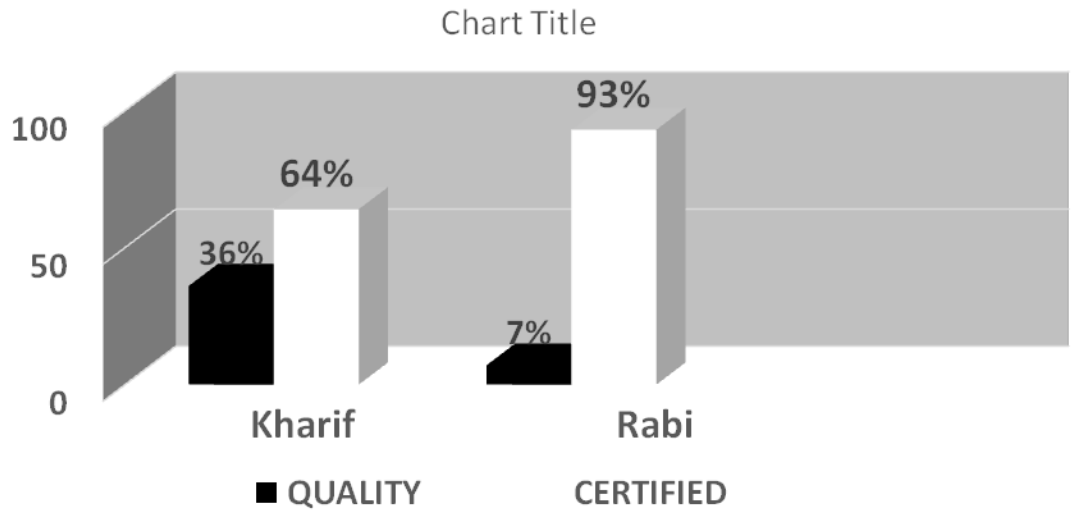
Looking to the huge potential and enormous water savings possibilities, Government of Gujarat, over and above the ongoing individual beneficiary oriented Micro Irrigation scheme, may plan to implement the Integrated Micro Irrigation in Canal command area either on PPP model or through convergence of Scheme to optimize water use efficiency and increase area under MIS in the State.

13. Gujarat State Seed Certification Agency (GSSCA)

(A) Current Situation		
• The objective of seed certification is to maintain and make availability of seed to the public, through certification of high quality seeds and propagating materials of notified varieties. so grown and distributed as to ensure genetic identity and genetic purity. Seed certification is also designed to achieve prescribed standards		
• GSSCA is notified under section 8 of the seed Act, 1966 and certified seed of only those varieties which are notified under section 5 of seed Act, 1666 and follow all minimum standards of seed certification, so GSSCA is not having any target oriented work.		
CROPS UNDER CERTIFICATION		
Cereal crop	Wheat, Paddy, Jowaretc.	
Oilseed crop	Groundnut, Sesamum, Castor, Mustard, Soyabeanetc.	
Pulses crop	Gram, Green gram,Black gram, Pigeon pea, Cowpea etc.	
Fiber crop	Cotton, Deshi cotton, Jute etc.	
Fodder crop	Maize, Jowar, Clusterbean, Lucerne, Oat etc	
Vegetable crop	Cluster bean, Okra, Cowpea, Onion, Fenugreek etc.	
Spices and condiment crop	Cumin, Funnel	
Seed Production Programme taken by different Main Producers		
Government sector	Gujarat State Seed Corporation, Gandhinagar, National Seed Corporation	
Cooperative Sector	GUJCOMASOL, Ahmedabad	
State Agricultural University	Anand Agricultural University, Navsari Agricultural University, Junagadh Agricultural , University, SardarkrushinagarDantiwada, Agricultural University	
State Farm/NGO	More than 20	
Private Sector	More than 250	

Activities of GSSCA conduct in main 6 Phases like……

- Receipt and scrutiny of application
- Verification of seed source, class and other requirements of the seed used for raising the seed crops
- Field inspection to verify conformity to the prescribed field standards
- Supervision at post-harvest stages including processing and packing, Seed sampling and analysis, including genetic purity test and/or seed health test, if any, in order to verify conformity to the prescribed standards; and
- Grant of certificate and certification tags, tagging and sealing
- In 2019-20, state total seed requirement and availability (Including Kharif and rabi) is 14.71 lakh qtl and 16.89 lakh qtl respectively on the basis of SRR. Among that total quality seed, the contribution of certified seed is 64% and 93% in kharif and rabi season respectively.



Achievement of last three years

Year	Season	Area Certified (Ha.)	Quantity certified (Qtl.)
2017-18	Kharif	29343	367510
	Rabi	35508	760576
	Summer	2826	20110

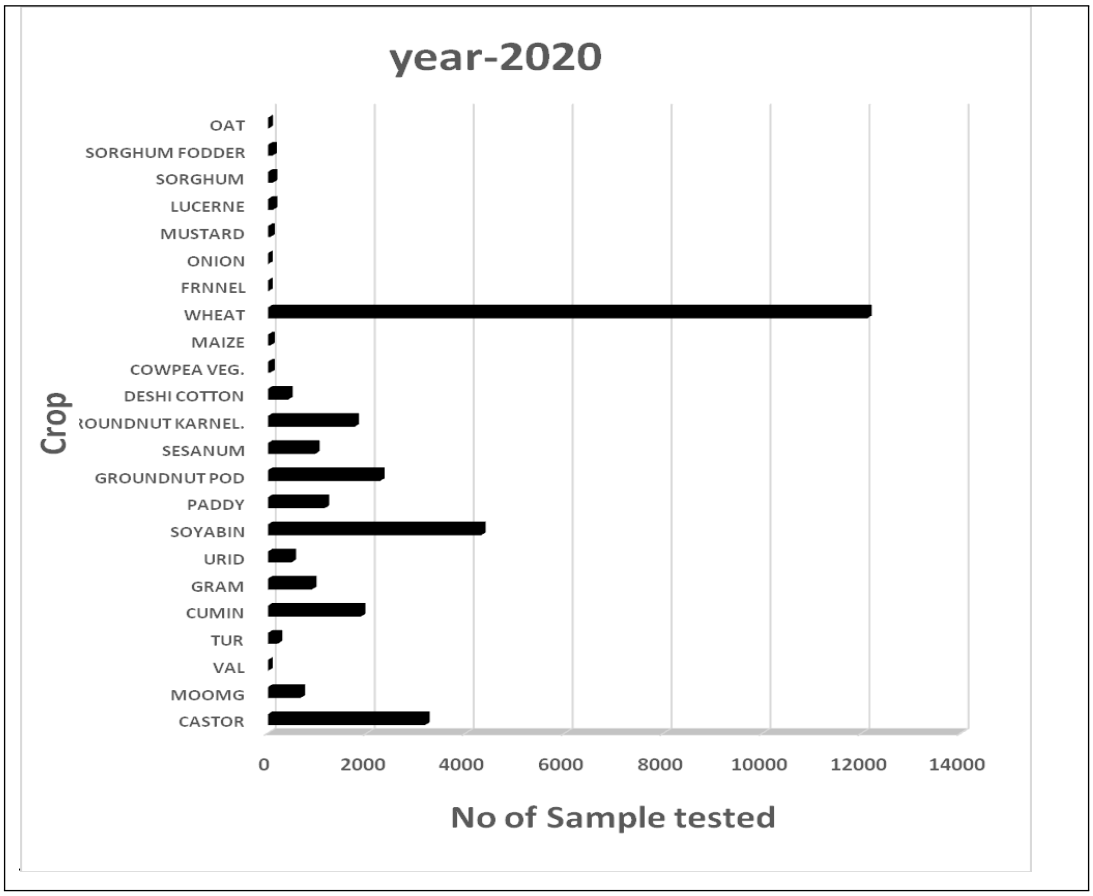
	Total	**67677**	**1148196**
2018-19	Kharif	29330	337444
	Rabi	32697	686637
	Summer	2923	18419
	Total	**64950**	**1042500**
2019-20	Kharif	32462	431393
	Rabi	41605	892882
	Summer	6395	69272
	Total	**80462**	**1393545**

- In a current year, GSSCA carried out “Grow out Test” (GOT) of 18000 samples of different crops like castor, wheat, pulses and paddy at field level (especially wheat tested at Bangalore)

Detail of GOT (last Three Years)

Sr no.	**Crop**	**Year**			**Remarks**
		2017-18	**2018-19**	**2019-20**	
1	Castor	6427	5291	2451	At own farm (Dehgam, Dist:Gandhinagar), (Nadiad)
2	Wheat	11718	12467	12008	At KSSCA farm (Banglore)
3	Pulsed (F/S stage)	187	162	136	At Mangrol Junagadhdist
4	Paddy (F/S stage)	316	316	300	At vedachi, Suratdist
	Total	**18648**	**18236**	**14895**	

- In the current year, GSSCA tested 30000 samples at laboratory level for various parameters like physical purity, germination percentage, other crop/weed seed, inert matter etc.



Result of Lab+ GOT (during last three years)

Year	Total Sample Tested (Lab+GOT)	Rejected
2017-18	32221	5917
2018-19	32701	4315
2019-20	25888	3003

Registration of Main seed producer, seed growers and Seed processing plant: last three years

Year	Main Producer	Seed Growers	Processing plant
2017-18	285	35054	310
2018-19	273	29276	320
2019-20	301	33580	326

(B) Current issues

- Shortage of staff. There were 285 technical posts sanctioned at the time the Agency established (area of certification program was 20000 ha.) Today total regular technical staff is only 05 and 82 outsourcing staff against a total 95 sanctioned posts (area of certification program is 80000ha.)

Sr. no.	Year	No.of technical post filled up	Sr. no.	Year	No of technical post filled up
1	1981	285	20	2002	162
2	1984	250	21	2003	152
3	1985	250	22	2004	147
4	1986	241	23	2005	147
5	1987	234	24	2006	146
6	1988	234	25	2007	146
7	1989	222	26	2008	139
8	1990	222	27	2009	136
9	1991	222	28	2010	134
10	1992	203	29	2011	119
11	1993	200	30	2012	114
12	1994	199	31	2013	114
13	1995	193	32	2014	101
14	1996	189	33	2015	83
15	1997	189	34	2016	60
16	1998	212	35	2017	50
17	1999	169	36	2018	30
18	2000	166	37	2019	5
19	2001	164	38	2020	5

- Capacity building for Grow Out testing and Laboratory testing
- Modernization of laboratory
- Lack of software programme for producer

- Self reliable
- Rate of registration and other fees are very less compared to other state

(C) Suggested Strategies

- Correspondence with government for recruitment is in progress (Also proposal made for new recruitment rules, revised service rules etc)
- Fill up all vacant post of Agency within short period of time
- Proposal made for Laboratory instrument & GOT updation under SMSP scheme
- Initiative taken and work is in progress to develop new software programme under guidance of GIL

(D) Work Plan 2021 & 2022-23

Area registered of certified seed production and quantity certified seed produced

season	Year 2019-20 (Actual)		Year 2021-22 (Targeted)		Year 2022-23 (Targeted)	
	Area Registered in Hect.	Quantity certified in Qtls.	Area Registered in Hect.	Quantity certified in Qtls.	Area Registered in Hect.	Quantity certified in Qtls.
Kharif	32462	431393	41800	543400	44980	597740
Rabi	41605	892881	44110	990168	46521	1089184
Summer	6395	69271	2858	17480	3144	19228

(E) Policy Suggestions-if any

- Special incentives to farmers/FPOs for certified seed production and processing unit
- Subsidy up to 75 % in certified seed distribution for SMF.
- To avail seed storage and processing facility at village level
- Strengthening R & D at SAU level
- Special incentives to institutes/companies for seed production and processing units in backward areas.

(F) Outcome of Strategy

- Increase in area of registration of certified seed production will resulted in increase in income of farmers as well as productivity and production

- Increase SRR, increase small and large scale seed processing and packing unit (generate employment)

14. Gujarat State Seeds Corporation Limited (GSSCL)

GSSCL-Gandhinagar – Establishment, Main Objective and Activity.

✔ Gujarat State Seeds Corporation Ltd., established in April 1975 popularly known by its brand name "GURABINI" is serving in the larger interest of farmers from more than three decades with farmer's faith brand loyalty, quality assurance, dedicated service and sustainable contribution for upliftment of farmers with glorious achievements.

Objective: 1. To supply Good quality seeds at a reasonable rate.

2. To ascertain adequate supply of quality seeds of low value-high volume crops
viz; Groundnut, Wheat, paddy, Gram etc.

3. To promote, establish, improve, develop, administer and to help the growth
and modernization of the seed industry.

✔ GURABINI is primarily engaged in production, processing and marketing of seeds of more than 25 crops and 96 varieties and hybrids in almost all categories i.e. Cereals, Pulse, Oilseeds, Fiber Crops, Fodder, and Green Manuring Crops.

✔ GURABINI has its Head Office at Gandhinagar and 14 branches across Gujarat and one Sales Depot.

✔ The authorized share capital of Corporation as on is Rs. 4 Crores divided into equal shares of Rs. 100 each. As against that, the paid up share capital is Rs. 3.93 Crores. The shares have been held by following categories of shareholders:

Government of Gujarat: 95.00% shares

Government of India : 5.00% shares

- ✔ Marketed under the popular brand name of “GURABINI”, GSSCL seeds have become a symbol of quality. GURABINI seeds are produced in diverse agro-climatic regions under the supervision of experienced technical workforce. From sowing to harvesting and processing, packing to storage, the seeds are scientifically monitored to achieve and maintain uniform high quality. GSSCL produces high quality certified, foundation and truthful seeds of assured genetic and physical purity with high germination and assured vigour.
- ✔ Standards of quality are maintained at every stage Viz. production, processing, storage and marketing through scientific approach and strict surveillance. During the seed production programme, rigorous concurrent inspection is done by GSSCL’s Field Officer. Apart from that independent and strict inspections are also taken by Seed Certification Agencies officers. A technical guideline is consistently provided to the seed growers to maintain quality standards of seed production. Any kind of impurity found gets plugged during the inspection and genetic purity levels are maintained thoroughly. The seed which passes the basic parameters are taken for processing. The processed seed is further tested in a grow -out test for evaluation of the genetic purity.
- ✔ GSSCL provides good quality seeds to the farmers of the state in a timely manner by carrying out seeds certification process with Gujarat state seeds certification Agency as well as in house processing-packing also done and this seed quantity produced by the reputed and progressive farmers of the respective area of the state.

Seed production capacity and Target: -

- ✔ Seed is the basic, crucial and critical and most vital single input that plays a key role in boosting agriculture productivity. Hence, the Corporation is committed to the green revolution by introducing high yielding varieties/hybrids of seeds and by bringing more areas under improved seed cultivation. Corporation is aiming not only to provide timely supply of adequate quantities of quality seeds to farmers but also to achieve varietal diversity to suit various agro-climatic zones. Corporation is well known for the highest standards of quality and productivity it has maintained over the years and has been awarded the National Productivity Council for 5 times till date.
- ✔ GSSCL has recognized the fast changing scenario and dynamics of seed production and has evolved strategies to take up seed production with adequate product mix of hybrids and improved varieties considering the requirements of all segments of the farming community. The social objectives of providing quality certified seed to the cultivators has never been taken up to promote high value low volume crop seeds to take care of the profitability of the company.
- ✔ In a year 2020-21, GSSCL produce average 2.37 lacs qtl. Good quality seed of different crops and varieties by taking seed production programmes through their reputed and progressive seed producer farmers.
- ✔ GSSCL has a target to achieve 3.01 lacs qtl. Quality Seed production up to year-2024-25 on yearly basis and it will be targeted to reach 3.51 lacs qtl. up to year – 2029-30 on yearly basis. This targeted seed production will increase 27% and 48% respectively than the current average seed production capacity of the corporation.
- ✔ GSSCL produces and distributes high quality seeds of more than 25 crops consisting of approx. 96 varieties in which 82 varieties and 14 hybrids as per detail given below.
- ✔ Good varieties of vegetables and B.T. Cotton which is available with SAU, should be taken into the production and distribution chain. Selection of

promising vegetables and B.T. Cotton varieties should be done in consensus with SAU and farmers.

Sr. No.	Crop	Varietal	Hybrids
1.	Paddy	Gurjari, GAR-13, Mahisagar, GR-11, GR-3, Masuri, Jaya,IR-28, NAUR-1, GNR-3, GNR-6,GAR-14	-
2.	Moong	G.M-4, GAM-5,GM-6,GM-7	-
3.	Urid	Guj-1, T-9,Guj-3	-
4.	Maize	GM-6	GAYMH-1
5.	Arhar	BSMR-853 (Vaishali), AGT-2, BDN-2, GJP-1 ,GT-104	-
6.	Soyabean	JS-335, NRC-37	-
7.	Groundnut	GG-20, GJG-7, GJG-9, GJG-22, TG-38, TG-37A, TG-51, TLG-45, GJG-17, GJG-31, GG-2, GG-5, TAG-24, GG-11, GAUG-10, GJG-32,TG-39	-
8.	Sesamum	Guj-2, Guj-3, Guj-4, Guj-5	-
9.	Hy.Castor	-	GCH-2, GCH-4, GCH-7, GCH-8, GCH-9, GNCH-1
10.	Hy.Cotton	-	G.Cot.H-6 (BG-II), G.Cot.H-8 (BG-II), G.Cot.H-10 (BG-II), G.Cot.H-12 (BG-II), GTHH.49 (BG-II)
11.	Cow Pea	AVCP-1	-
12.	Fennel	Guj-2, Guj-11, Guj-12	-
13.	Guar (Fodder)	Guj-1, Guj-2	-
14.	Guar (Veg)	PNB	-
15.	Wheat	GW-496, Lok-1, GW-503, GW-173,	-

		GW-273, GW-11, GDW-1255, GW-451	
16.	Gram	Guj-1, Guj-2, Guj-3, Guj-5, Guj-6	-
17.	Mustard	Guj-1, Guj-2, GDM-4, NRCHB-101,PDZ-31	-
18.	Cumin	Guj-4	-
19.	Oat	Kent, OL-1802	-
20.	Coriander	GDLC-2	-
21.	Lucerne	GAUL-1 (Anand-2), Anand-3	-
22.	Isabgol	Guj-2,Guj-3	-
23.	Jowar (Fodder)	-	CSH-24-MF
24.	Bajara(Fodder)	-	BAIF-1
25.	Maize (Fodder)	African Tall	-

✔ GSSCL already decreases the seed production of old varieties year by year and simultaneously increases the seed production of newly recommended varieties developed by SAU. As per below given table, data itself indicate that seed production of old varieties decreases year by year and increase the seed production of new varieties. i.e. From year – 2017-18 to 2020-21, the production of old varieties decreased from 74 % to 57 %, while other side production of new varieties increased from 26 % to 43 %.

Year	Total Production (Qtl.)	Old Variety		New Variety	
		Production (Qtl.)	%	Production (Qtl.)	%
2017-18	2,55,705	1,88,350	74	67,355	26
2020-21 (Approx.)	2,56,714	1,46,140	57	1,10,575	43

- ✔ GSSCL already reduced the gestation period of the new variety because GSSCL took the seed production of newly developed variety/hybrids as a labelled seed production before the notification of that variety. E.g. in Maize Crop new Variety GAYMH-1 seed production taking from 2014-15 as labelled seed production and In Moong crop new variety GAM-5 seed production taking from the year 2015-16 as labelled seed production and it is notified in the year 2016 and 2018 respectively. I.e. reducing the 3-year gestation period of a new promising variety.

- ✔ In Horticulture crop GSSCL took seed production programme of Cumin, Isabgul, fennel, cowpea, cluster bean and coriander.
- ✔ Other horticulture crops mainly propagated through graft, tissue, or sapling.
- ✔ Guar gum is registered in seed certification as Guar fodder for seed production programme. So, the Guar fodder mentioned in the production sheet is Guar gum. GSSCL produced Guar gum in sufficient quantity as per the demand of farmers.
- ✔ GSSCL produces Guar fodder as a seed purpose for farmers. But whatever production comes from the sowing of seed by farmers that can be utilized as an fodder/industrial purpose as per need of the individual.
- ✔ According to the Marketing department requirement, the production department arranged seed production programmes of particular crops/varieties with 10 % high to fulfil the demand and overcome the gap that will be addressed by natural climatic conditions.

Seed storage capacity and target: -

✔ GSSCL has constructed its own total 51 godowns for scientific storage of various types of seeds. The storage capacity of GSSCL own godowns is 231000 quintals per season.

Sr. No.	Location	No of Godown	Storage Capacity
1	Nadiad	10	71000
2	Mehsana	2	7000
3	Himmatnagar	1	2000
4	Godhara	5	19000
5	Vyara	4	9000
6	Shihor	1	2000
7	Amreli	8	30000
8	Junagadh	4	16000
9	Rajkot	8	27000
10	Gandhinagar	8	48000
	Total	51	231000

✔ GSSCL has a total 24 processing machines and installed capacity 424032 quintals. The high capacity plants are located at Gandhinagar, Nadiad, Godhara, Vyara, Amreli, Rajkot, Junagadh and Mehsana.

Sr. No.	**Location**	**No of Plant**	**Working Processing Capacity**

			(in Qtl) In Active Present Days
1	Charedi, Gandhinagar (including G.nut Grading Machine)	3	51,744
2	Mahesana	2	53,760
3	Nadiad	3	63,168
4	Godhara	3	60,480
5	Vyara	2	40,320
6	Rajkot (including G.nut Grading Machine)	4	49,728
7	Junagadh (including G.nut Grading Machine)	3	51,744
8	Amreli (including G.nut Grading Machine)	4	53,088
	Total	**24**	**4,24,032**

- ❖ Looking at the seasonality discipline of diff. varieties & hybrids, the active days for seed processing will be kharif, Rabi and summer season – Total – 96 days

✔ GSSCL has a wide range of contemporary processing machinery and equipment suited for seed separation based on different criteria like size, shape, weight, texture etcThe plants are equipped with the latest machinery of different types like Seed Cleaner & Grader, Gravity Separators, Seed Treaters, Automatic Thiram packing machine, Automatic Weighing and packing machine.

✔ GSSCL has a need of godown having storage capacity of 2.50 lacs qtl. as per current situation of year – 2020-21. In relation to this GSSCL having its own godown with storage capacity of 2.31 lacs qtl, while other godowns are to be kept on rent for storage purpose by GSSCL.

✔ If GSSCL targeted to produce 3.0 lacs qtl. yearly seed production upto year – 2024-25, then seed storage capacity of the corporation must be increased upto 0.70 lacs qtl. than the current storage capacity. In relation to this GSSCL has a need of godown which requires 0.90 lacs sq. ft area.

Sr. No	**District**	**Place**	**Seed Godowns in metric ton.**
1	Ahmedabad	Miroli	1000
2	Gandhinagar	Dhamasana	5000
3	Anand	Borsad	1000
4	Panchmahal	Halol	2000
5	Junagadh	Vanthali	2000
Total			**11000 (1.10 lacs qtl.)**

✔ GSSCL has planned to construct 11000 MT. Godown capacity under phase-1 of RIDF project (NABARD funded) which is expected to be ready by march 2023. Locations and storage capacity of this project details are as follows:

✔ Moreover, the under phase-2 of this project contains construction of 9000 MT. Godown capacity. Locations and storage capacity of this project details are as follows:

Sr. No	**District**	**Place**	**Seed Godowns in metric ton.**
1	Porbandar	Kutiana	2000

2	Surendranagar	Kherali	2000
3	Vadodara	Khanpur	2000
4	Rajkot	Bhunava	2000
5	Dahod	Kharedi	1000
Total			**9000 (0.9 lacs qtl.)**

Seed selling capacity and target: -

- ✔ GSSCL is marketing its seeds with the brand name “GURABINI”, which has been quite popular among the farmers for the last 3 decades. Since its inception, GSSCL has been in a very consistent manner making available the seeds of hybrids and improved cultivars at reasonable prices in time and maintained its status as market leader in seed business in Gujarat.

- ✔ GSSCL caters to the extent of 35% demand of seed in Gujarat mainly in the crops like Soyabean, Wheat, Paddy, Moong, Urid, Groundnut, Arhar, Sesamum, Gram, Castor and Maize.

- ✔ GSSCL is handling mainly seeds of high volume and low value crops like Cereals, Oilseeds & Pulses to cater to the needs of farmers as a part of social mandate.

- ✔ Whatever gap of in-house production of certified seed in groundnut (pod)crops and intended to market seeds will be addressed by procurement of certified seeds pods/kernel from NSC/State seeds corporations/GUJCOMASOL by proper procurement process to fulfil the requirement of farmers. In a year – 2020-21, GSSCL supplied Total – 1, 10,340 qtl. G.nut, among which GSSCL having its own production 72,475 qtl. G.nut (Pod) + Purchasing G.nut Pod & (Kernel) from NSC 7,589 qtl. + Purchasing G.nut (kernel) by tender 30,276 qtl.
- ✔ Apart from having an all pervasive and dominant presence in Gujarat, GSSCL has ventured to make inroads in several other neighbouring states like Rajasthan, Madhya Pradesh, and Maharashtra.

- ✔ GSSCL distributes an average 2.55 lacs qtl. good quality seed as per current year situation 2020-21 through 1501 active dealer network in state among which co-operative dealer's are 528 and Pvt. dealer's are 973. The dealer network will be increased upto 10 % upto 2024-25 and 15% upto year – 2029-30.
- ✔ GSSCL targeted to distribute good quality seed 3.04 lacs qtl. (yearly basis) upto 2024-25 and it will also be targeted to reach upto 3.62 lacs qtl. (yearly basis) upto year – 2029-30. This targeted seed distribution will be increased 19 % and 42 % respectively than the current average seed distribution

capacity of the corporation. Whatever the gap will be addressed by procurement from national/state seeds Corporations.

- ✔ For major crops sowing area of the state considering seed replacement rate (SRR) at current year 2020-21, GSSCL contribution of providing good quality seed of different crops and varieties is 19.74%. It will be targeted to reach 24 % upto 2024-25 and 29 % upto year – 2029-30.
- ✔ Introduction of bar-coding is a good idea/suggestion for precision and traceability but it requires proper programming and it traces out only the purchase place of seed. But tracing the cultivation area for a particular crop/variety is not possible because farmers purchase seed from dealers of GSSCL. Dealer scans the bar-coding and GSSCL multiplying variety/hybrid developed by universities and certified it from GSSCA on prevailing rules. So, it is supported by mandatory rules also.
- ✔ GSSCL is already analysing the demand of variety/hybrid by our branch office collected from Dealers before production. But sowing of crops depends upon the environment factor and farmers can change the cropping pattern according to season and market value.
- ✔ GSSCL only multiplies the varieties which are developed by the scientist of SAU, whatever varieties right now in the chain it will be not highly acceptable and promising as compared to Pvt. Sector varieties of vegetables. Vegetable seed production is a time consuming and tedious job and also more technical manpower is required for hybrid seed production because of small tiny flowers. GSSCL already sells the vegetable seeds by procuring from NSC.
- ✔ GSSCL-Marketing department given 10 % high production programme plan to GSSCL-production department well in advance a year as per branch ground root demand and last three-year average seed sale report of particular crop and varieties.
- ✔ GSSCL does not have R & D Activities for developing new varieties but whatever the new varieties launched by SAU scientist, GSSCL put in well advance for multiplication of particular varieties before notification. Due to

this performance of the varieties in field level can be traced out and according to it future production planning can be done.e.g. GSSCL done advance production for GAYMH-1 of Hy.Maize variety and also Moong GAM-5 Variety before notification.

- ✔ Good varieties of vegetables and B.T. Cotton which is available with SAU, should be taken into the production and distribution chain. Selection of promising vegetables and B.T. Cotton varieties should be done in consensus with SAU and farmers.
- ✔ GSSCL has done extension activities with the help of ATMA staff (wall slogan), Reliance foundation and also given advertisement in a newspaper (3) three times in a year (season wise).

GSSCL STAFF STRENGTH DETAIL: -

- ✔ As GSSCL deals with technical and scientific work for seed production, storage, packing-processing and marketing work, there will be a need for technical manpower for this work.
- ✔ GSSCL having total 204 approved technical and non-technical staff strength. Looking at the present staff strength is only 101 staff. There are 103 posts vacant against the total staff strength of GSSCL.
- ✔ In the upcoming year's GSSCL processed for filled 87 vacant posts for different work of GSSCL.
- ✔ Considering this fact, Staff shortage for different technical and non-technical work is a great hurdle for GSSCL to achieve the above mentioned target in upcoming years. so, it will be a force for GSSCL to fill vacant posts as early as possible for their qualitative and quantitative work.
- ✔ Looking at the production and processing target set for upcoming years, GSSCL should be strengthened for human resource needs.

- ✔ If GSSCL opens Regional office, Area office and Branch office, it must be fully occupied with permanent technical and non-technical staff for achieving the target set.

GSSCL Dealer Network in Gujarat

District wise Dealers.					
SR. NO.	Concerned Branch	DISTRICT	CATEGORY WISE NO. OF DEALERS		
			CO-OPERATIVE	PRIVATE	TOTAL
1	Gandhinagar	Ahmedabad	25	33	58
		Gandhinagar	52	26	78
2	Nadiad	Kheda	10	18	28
		Anand	10	16	26
3	Vadodara	Vadodara	11	28	39
		Bharuch	10	20	30
		Narmada	7	7	14
		Chotaudepur	5	16	21
4	Godhara	Panchmahal	11	26	37
		Dahod	13	39	52
		Mahisagar	6	26	32
5	Vyara	Surat	21	9	30
		Tapi	16	10	26
		Navsari	6	12	18
		Valsad	5	10	15
		Dang	10	2	12
6	Himmatnagar	Sabarkantha	45	25	70
		Aravalli	20	17	37
7	Mahesana	Mahesana	29	38	67
		Patan	15	55	70
8	Palanpur	Banaskantha	59	118	177
9	Surendranagar	Surendranagar	17	57	74
10	Rajkot	Rajkot	10	52	62

		Morbi	11	25	36
11	Jamnagar/	Jamnagar	7	37	44
	Rajkot	Devbhumi Dwarka	0	30	30
12	Junagadh	Junagadh	19	52	71
		Porbandar	15	21	36
		Gir-Somnath	14	19	33
13	Amreli	Amreli	11	27	38
14	Shihor	Bhavnagar	9	29	38
		Botad	11	17	28
15	Bhuj	Kutch	18	56	74
Total			**528**	**973**	**1501**

15. Gujarat Agricultural Produce Market Committees (APMCs)

Performance Overview :

Agriculture and allied sectors in Gujarat contribute to around 16% of Gross state value added and is growing at a healthy rate of 9.56%. Gujarat contributes to 7% in national agricultural GVA.

Agriculture production in Gujarat is valued between INR1,40,000 crore to INR1,50,000 crore. APMC has recorded transactions around INR 37,000 crore that are sold through open auction. APMC transaction value as percentage of agricultural output value is just around one fourth at 26.42%. wherever produce is brought to APMC and open auctions are conducted farmers are getting fair prices and being benefited.

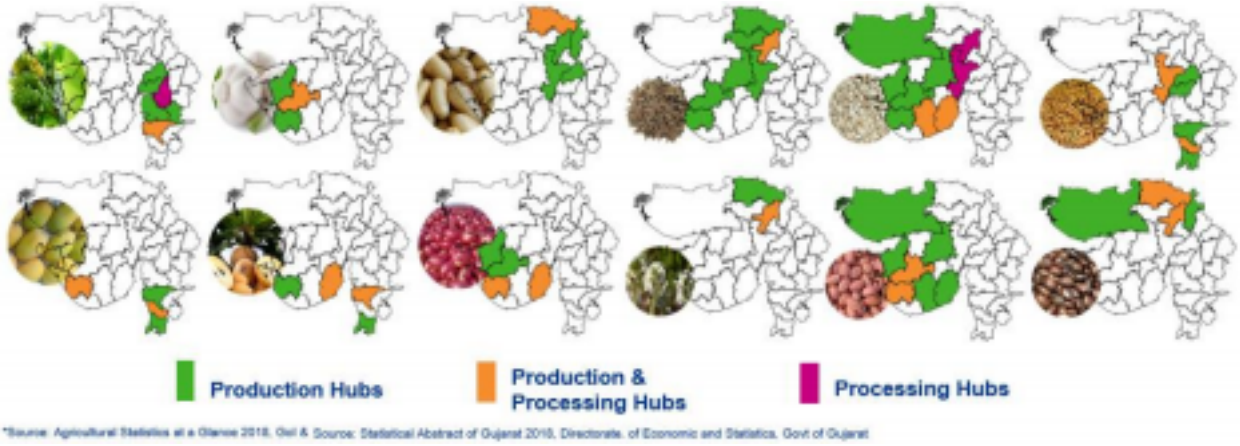
Gujarat is a leading producer and processor of many crops in India. Gujarat plays a crucial role in Indian agriculture not only from crop production but also from production of Milk and dairy products.

Crop	Production estimate in '000 tons
Grains	7131.45
Oilseeds	5947.32

Pulses	1706.66
Spices	659.38

Sugarcane	13621.22
Cotton	1266.1
Potato	3896.69
Onion	1487.65
Garlic	98.35
Tobacco	394.28
Guar seed	75.68
Isabgul	8.87

Gujarat has natural production clusters of various important crops and accordingly the state has developed processing clusters that makes Gujarat as one of the important states not only from production front but also from processing perspective. Below image clearly shows the production and processing cluster of Gujarat for important crops.



*Source: Agricultural Statistics at a Glance 2018, Oil & Source: Statistical Abstract of Gujarat 2018, Directorate, of Economic and Statistics, Govt of Gujarat

Current Situation :

- **Crop wise cumulative APMC arrivals :** APMCs are active in many commodities and are known to provide remunerative prices to farmers. Spices and onions have recorded maximum arrivals as percentage of production across all commodity groups in Gujarat. The success of Onion and Spices can be attributed to the infrastructure available at a few APMCs and services farmers are getting at these APMCs. These APMCs could attract farmers to bring their produce to APMCs as the realization is better at APMC.

Commodity group wise production and arrivals at APMC in quantity terms

Crop	Production in '000 tons	Arrivals in '000 tons	% of production
Cotton	8616.00	1372.30	15.93%
Grains	8500.48	1978.10	23.27%
Groundnut	4645.48	641.90	13.82%
Potato	3578.24	947.70	26.49%

Other Oilseeds	2008.14	1159.50	57.74%
Onion	1416.31	1105.30	78.04%
Pulses	1057.56	252.50	23.88%
Spices	924.58	731.80	79.15%
Total	**30746.79**	**8189.10**	**26.63%**

Though we have covered a great ground in attracting farmers to APMC, arrivals as Percentage of production standing at around 26% highlights the scope for the betterment.

Gujarat state has 224 functional APMC spread across the state.

- **Recent APMC Act Amendment :** State government of Gujarat is proactive towards bringing in required amendments in state APMC act to carry on business.
    - Accommodate private trade
    - Undertaking processing of purchased produce
    - Undertaking contract farming and sale of the same
    - Establishment of private APMCs
    - Allowing e-trading in commodities

  This year Gujarat APMC act has been amended as the Gujarat agricultural produce marketing (promotion and facilitation) act 1963. In this amended act many provisions like e-trading platform, market sab yard, Market yard of national importance, unified single market area, are included for the benefit of farmers. Increased representation of agriculturists from 8 agriculturists representatives to 10 agriculturists in the amended act to ensure interest of farmers are protected.

APMCs Infrastructure Overview :

Gujarat has 224 APMCs and 176 sub Yards making a total market yards to 400, where farmers can bring their produce and sell.

Majority of these APMCs and sub yards have required infrastructure to facilitate trade of agricultural produce. Following table shows the infrastructure across all APMCs in Gujarat.

Facility	Numbers	Average per market yard
Auction sheds	1,746	4.37
Office Building	284	0.71
Shop cum Godown	19,701	49.25
Electronic weigh bridge	246	0.62
Farmer's rest house	140	0.35
Canteen	123	0.31
Soil testing laboratory	54	0.14
Cleaning and Grading facility	55	0.14
Exhibition center	89	0.22
Cold storage	20	0.05

Basic infrastructure like auction sheds, shops cum godowns are available at almost all the market yards, distribution may be skewed though. But the status of supporting infrastructure is not encouraging as 14% of market yards have a Cleaning & grading facility, Soil testing lab is just 14% that means one in seven market yards have these facilities. Other supporting infrastructure like exhibition center, Canteen, Farmer's rest

house is also present at less than 35% of market yards.

This shows scope for improvement across APMCs, however there are few very progressive APMCs as well in Gujarat, that have developed infrastructure to meet requirements of farmers and attract maximum farmer participation. Best practices of all the successful APMCs can be used as reference best practices for developing or planning to develop other APMCs.

Current total storage capacity of Gujarat is around 12 Lakh MT, with mandate of erecting new storage capacity with pace of 50,000 MT annually for next one decade.

Proactive APMCs :

There are some leading APMCs which can act as an example of progress by way of installing and utilizing modern infrastructure.

APMC Name	Unique feature
Surat	Pulping unit for Mango and Tomato, Waste disposal plant
Unjha	Mandi Infrastructure, Grading facilities
Ahmedabad	Testing Lab, Grading facilities
Baroda	Waste disposal plant
Mahua	Onion dehydration plant

APMCs that are struggling

- There are around 35 APMCs in Gujarat that do not have any transaction at Mandi premise.
- Among these 35 APMCs, 23 APMCs have a physical market yard to facilitate sale, but no arrivals at mandi.
- 12 APMC does not even have a physical market yard.
- These 35 APMCs require support in the current scenario to become self-reliant.

Roadmap to make APMCs self-sustainable and profitable :

Comparison of production with APMC arrivals gives a significant scope of improvement at that front, which is the most critical element to make APMCs more self-sustainable as well as profitable. Same can be achieved by:

- Bringing more farmers to sell their produce in APMCs
- Bringing more buyers/traders to buy their requirement from APMCs

In order to bring more farmers and buyers on APMCs platform our approach will be holistic which will address both aspects of infrastructure:

- Physical Infrastructure
- Digital Infrastructure

Road Map for Physical Infrastructure :

- **Warehousing Capacity:**To address the gap of warehousing capacity requirement and availability APMCs are the best institution. The Government of Gujarat has allocated INR100 crores to support the development of warehouses at identified APMCs. Currently 39 APMCs have submitted their proposals which will augment the capacity by around 2.27 Lakh MT in the coming recent time. Director of APMC along with GSAMB is working on developing warehousing infrastructure in APMCs through ISAM and AMIF schemes. Current total storage capacity of Gujarat is around 12 Lakh MT, with mandate of erecting new storage capacity with pace of 50,000 MT annually for next one decade i.e. additional 500,000 MT of warehousing space during that period.
- **Development of supporting infrastructure :** As highlighted in the previous section, supporting infrastructure at APMCs in Gujarat have good scope of improvement, which can be addressed by development of supporting infrastructure across APMCs. Recent announcement of including APMCs as eligible entities for availing benefit under AIF is a welcome step. Director APMC

has planned to organize district level awareness camps for all APMCs to utilize the scheme in developing required infrastructure at APMC. The focus would be on trade support infrastructure like:

- Cleaning, Grading and Packing
- Quality testing infrastructure
- Soil and Water testing Laboratory
- Farmer Training centers
- Farmer Rest Houses

In the mandated next 10 years all APMCs will be first assessed for required infrastructure and in follow that facilities of required capacity and efficiency will be installed.

- **Developing PACS as the extended arms of APMCs :** This approach will be focused for certain APMCs where farmer foot fall is minimal or nil. One possible option director APMC would like to explore in these cases is:
  - Making PACS present in the APMC jurisdiction as the extended arms of APMC and to act as aggregation point or collection center.
  - These PACS will be supported in developing required farm gate infrastructure that is required to facilitate farmer produce sale using the benefits provided under AIF scheme.

Road Map for Digital Infrastructure :

- **Development of customized e-trading platform -** Gujarat state agricultural Marketing board has been designated as nodal agency to develop e-trading platform to facilitate produce sale at farm gate or at primary aggregation point and protect farmers interest in terms of timely payment. This e-trading platform will be made available to all the farmers who wish to sell their produce through this platform. APMCs and PACS can act as physical aggregation points and also will support farmers who wish to use the e-trading platform. Aggregation points are required to attract a greater number of buyers as these aggregation points help in optimizing logistic expenses of buyers.In order to maximize the reach of

this platform every possible touch point will be connected, like:

- Main Yard
- Sub Yard
- Market Sub Yard
- Warehouses Dry as well as Cold
- Silos

- **Agricultural market intelligence system -** There is a need to develop a real time agricultural market intelligence system that ensures timely collection and dissemination of production, availability and price information across the state.
  - This will help farmers in Gujarat to know the price prevailing and decide whether to sell the produce or to hold and avail credit.
  - This will help buyers in planning their purchase based on availability at various locations.
  - This will enable buyers from outside Gujarat also to participate.
  - This system should be made available in Gujarati, Hindi and English.

Summary : Directorate of APMC aims to focus on assessing the gap of required infrastructure for respective APMC and build over that, with a clear objective to bring maximum farmer and buyers to them in order to make them self-sustainable as well as profitable. Objectives will be achieved with a dual approach of augmenting physical as well as digital infrastructure. The objective is to attain a 10 years period with defined ascending timelines.

16. NABARD

Present Role of NABARD and Vision for 2030 for Gujarat

NABARD (National Bank for Agriculture and Rural Development) came into existence on 12 July 1982 by an Act of Parliament, with a mission to promote sustainable and equitable agriculture and rural prosperity through effective credit support, related services, institutional development and other innovative initiatives. NABARD has touched almost all socio-economic activities in the realm of agriculture and rural development, being the apex institution in this field and performs multiple activities and roles including that of being a refinancing agency, a development agency, an institution supporting creation of rural infrastructure and a planning and policy making body.

***Our Vision**: Development Bank of the Nation for Fostering Rural Prosperity*

***Our Mission**: Promote sustainable and equitable agriculture and rural development through participative financial and non-financial interventions, innovations, technology and institutional development for securing prosperity.*

A. Initiatives of NABARD in Gujarat

In Gujarat, NABARD has extended financial assistance to the tune of Rs.80,000 crore during the last five years, towards loans, refinance and for various developmental initiatives under farm/off-farm sectors, enterprise development and institution building, infrastructure development, etc.

I. Promotional and Developmental Interventions

The support extended by NABARD, Gujarat RO for developmental and promotional interventions under farm and off-farm sector, development of self-help groups and micro-enterprises, institution development and financial inclusion are enumerated below.

1. Farm Sector Development

- NABARD has been supporting formation and nurturing of Farmer Producers Organisations (FPOs), which are legal entities formed by primary producers, i.e., farmers, for collectivisation of various activities related to production, value addition and marketing, thereby enhancing their income. As on 31 March 2020, NABARD has promoted 204 FPOs in Gujarat. The total membership under these FPOs stands at 50,586 and collectively an equity of Rs.9.89 crore has been raised. The major activities undertaken by the FPOs include input supply, aggregation, marketing and processing related to spices, groundnut, cotton, fruits and vegetables, etc.

- NABARD has been promoting farmers' collectives since inception through the Farmers' Club Programme. Out of about 800 digitised Farmers' Clubs in Gujarat, around 87 have graduated to form 15 FPOs.

- With a view to enhancing farmers' accessibility to multiple markets and buyers digitally and to bring transparency in price discovery mechanism and price realization based on quality of produce, Government of India has launched the Electronic National Agriculture Market (e-NAM), a pan-India online trading portal for agricultural commodities. In order to overcome the supply-chain disruptions during the pandemic, NABARD has supported the marketing concerns of farmers by assisting 50 FPOs of the state to on-board to on the e-NAM.

- NABARD has been supporting various farm interventions related to Natural Resource Management (NRM), climate change and innovative projects in the farm sector. As the National Implementing Entity (NIE) for National Adaptation Fund for Climate Change (NAFCC), NABARD is implementing a project for Climate Change Adaptation for Natural Resource Dependent Communities of Kachchh District. The project aims to enhance the resilience of 2170 people belonging to vulnerable

communities (farmers, fishermen, and pastoralists) through water and livelihood security and ecosystem restoration in 03 talukas covering 32 villages at a total grant assistance of Rs.21.35 crore over 04 years (2017 to 2021). Under Natural Resource Management five projects have been supported covering Chhota Udepur, Sabarkantha, Kheda, Dahod and Gir Somnath districts.

- With a view to encouraging innovations in farm sector, NABARD has supported various innovative projects for promotion of climate smart agricultural technologies, ICT and IOT based solutions for farmers, value-chain development, organic farming, improvement of tribal livelihoods, use of structured water devices and demonstration of advanced breeding technology in livestock, covering twelve districts, *viz.,* Bharuch, Gir Somnath, Valsad, Vadodar, Chhota Udepur, Surat, Tapi, Banaskantha, Bhavnagar, Amreli & Patan, etc.

- The treatment of rainfed areas through soil and water conservation activities is being supported by NABARD under Watershed Development Fund. Till date, around 56418 ha has been treated, covering 36928 families, with NABARD support. In addition to this, an area of 37,587 ha has been covered in six districts over a ten-year period since 2007 under the Indo German Watershed Development Programme.

- In the context of GoI's vision for doubling of farmers' income by 2022, NABARD has been implementing a pilot project viz., "Krishak Samriddhi Yojana", in 15 villages of Dediapada block of Narmada district in Gujarat State since September 2017, with a TFO of Rs.67.53 crore and NABARD grant of Rs.2.86 crore. It focuses on convergence of Government, Banks, CSR and NABARD support for funding various activities like land development, farm mechanization, creation of storage facility, irrigation through wells and solar pump sets, promotion of allied activities like dairy and agroforestry and training and capacity building programmes in the selected villages.

- With a considerable tribal population in the state, tribal development programmes have been implemented extensively in Gujarat since 2005-06 for holistic development through sustainable livelihoods. Since inception of TDF in Gujarat, a total of 52 Tribal Development Projects have been sanctioned and implemented across 13 districts, covering 43,312 tribal families spread over 42,728 acres of land. The major activities include orchard development (wadi) and support to landless families for various income generating activities. Further, the special refinance scheme for watershed areas and TDF beneficiaries formulated by NABARD is being popularized by us through DDMs, PIAs and Banks through web meetings.

- These projects envisage preservation of ecological balance, livelihood generation and climate proofing interventions in the project areas. In watershed projects, the focus is on soil and water conservation whereas in TDF projects, the major activities include orchard development (wadi) and support to landless families for various income generating activities.

2. Off-farm sector development

- NABARD supports the development of the farm sector in rural areas by supporting rural youth in skill development and by assisting artisans in marketing through formation of Rural Mart, Rural Haat, GI indicators and conduct of exhibitions. Of late, financial assistance is also being extended for formation and nurturing of Off Farm Producers Organisation (OFPO) for collectivisation of off farm sector activities as well as for setting up of Rural Incubation Centres for helping start-ups which in turn would provide gainful employment to rural people.

- During the last five years, RSETIs of the state were supported for imparting skill training to 3526 rural youth through 216 skill development programmes .

- A major OFPO on Embroidery & Patch Work Patan District has also been sanctioned

in 2019-20 benefitting nearly 400 artisans.

- Since 2017, 10 Rural Marts have been supported for enabling producers/artisans/weavers to sell their locally made products. As part of marketing initiatives, NABARD has supported 54 rural artisans & craftsmen for participation in various events Mahalaxmi Saras Mela Mumbai, Surajkund Mela, etc. to develop direct linkages with customers.

- Grant assistance has also been extended to an agency for implementation of an innovative project for creating plastic products from waste plastic in Palara Jail, benefiting 25 jail inmates and 20 women artisans from Kukma village of Kutch district in 2019-20 and 2020-21.

3. Informal credit delivery system – SHG/ JLG

- As on 31 March 2020, In Gujarat, 2.90 lakh SHGs have been savings-linked with a savings of Rs.356.55 crore. Further, 48008 SHGs have been credit linked in the state so far with a bank loan outstanding of Rs.300.24 crore as on 31 March 2020.

- NABARD has provided a grant assistance for conducting more than 600 Micro Entrepreneurship Development Programmes (MEDP) covering about 20,000 members of matured SHGs, wherein skill development training was imparted on activities like handicrafts, fruit processing, jute bags making, garment designing and apparel making.

- In Gujarat, about 10 lakh JLGs have been formed by 31 March 2020 in both farm and non-farm sectors.

- NABARD has been implementing digitization of SHGs under the E-Shakti programme with a view to creating credit history of SHG members, thereby facilitating banks to take informed credit decisions. E-Shakti is being implemented in 16 districts of Gujarat through Gujarat Livelihood Promotion Company (GLPC). As on date, as per

the E-Shakti portal, of the 53,118 SHGs digitized, 15,762 SHGs have been credit linked.

4. Financial Inclusion and banking technology

- The developmental and promotional activities undertaken in the State for achieving greater financial inclusion include capacity building and sensitisation of various stakeholders, creation of infrastructure, enhanced investment in Information and Communication Technology (ICT) solutions, research and transfer of technology and enhancing technological absorption capacity of financial service providers/users. The Financial Inclusion Fund set up in NABARD for the purpose has been utilised for sensitizing the staff of Regional Rural Banks (RRBs) and Rural Cooperative Banks (RCBs), training of business correspondents (BCs) / Business Facilitators (BFs) of banks and supporting banks for setting up Financial Literacy Centres and strengthening RSETIs.
- NABARD, in its role as an advisor and facilitator in the implementation of Core Banking Solution (CBS), has assisted Cooperative Banks to provide technology enabled services like NET, RTGS, Direct Benefit Transfer, Rupay Debit Card and KCC.

5. Institutional Development and Strengthening

- NABARD has been associated with the improvement of the health of rural financial institutions (RFIs) over the past four decades. NABARD has assisted the Rural Cooperative Banks of the State for training of their personnel, infrastructure development in PACS and for undertaking exposure visits.

6. Infrastructure Development and creation of employment opportunities in rural

areas

- NABARD extends loans to State Governments and state owned corporations to enable them to complete ongoing rural infrastructure projects. Since inception, under Rural Infrastructure Development Fund (RIDF), 60,106 projects have been sanctioned in Gujarat, with a about Rs 30,000 crore and disbursement of about Rs 25,000 cr, accounting for nearly 9% of the all-India levels. Irrigation projects account for the major share of projects under RIDF (74%), followed by Social Sector projects (17%) and Rural Roads (9%).
- Warehouse Infrastructure Fund has been one of the important sources of funds for the State Government to develop critical post-harvest agriculture infrastructure. Under Warehouse Infrastructure Fund (WIF), a cumulative loan of Rs.515.42 crore has been sanctioned to Government of Gujarat in respect of 9 projects for construction of warehouses with total capacity of 8.3 lakh MT. As on date, an additional storage capacity of 5.93 lakh MT (including 2.69 lakh MT at the village levels) has been created in the state with WIF assistance. These warehouses provide an ideal storage location as near as the farmers' doorstep, enabling them to avoid hasty transportation and prevent distress sale
- Under Agri-Marketing Infrastructure Fund (AMIF), subsidised loans are provided to States and Union Territories for 585 APMCs and 10000 GrAMs.
- Government of India has operationalized a Micro-Irrigation Fund (MIF) with a corpus of Rs.5000.00 crore for special & innovative projects. An amount of Rs.764.13 crore has been sanctioned to the State Government under MIF.
- In addition to RIDF and WIF loans for creation of infrastructure, NABARD has also supported three milk unions namely Sabarkantha, Gandhinagar and Kheda with financial accommodation of Rs.394.23 crore under DIDF for expansion and

modernization of processing facilities.

• Food Processing Units under Mega Food Park in Surat – three units have been financed with an amount of Rs.23.4 crore for setting up of food processing units.

• Agriculture Infrastructure Fund / Transformation of PACS as MSC: GoI has launched Rs. 1 lakh crore Agriculture Infrastructure Fund with Gujarat having been allocated Rs. 7282 crore. PACS have been included as one of the eligible institutions for interest subvention under AIF. In Gujarat, 151 PACS have been identified and granted in-principle approval for conversion as MSCs. The DCCBs providing loans to PACS under this scheme are eligible for NABARD refinance at a very concessional rate of interest of 3% and loans are to be made available to PACS at 4% ROI. NABARD,

III. Refinance function and other support to Banks

• NABARD provides refinance for Short Term – Seasonal Agricultural Operations (ST-SAO), Additional ST-SAO and ST (others) to DCCBs through Gujarat State Cooperative Bank (GStCB) and directly to RRBs for production, marketing and procurement activities. NABARD also provides long term refinance to financial institutions for a wide gamut of farm and non-farm activities with tenors of 18 months to more than 5 years to provide impetus to capital formation in rural areas. Since 2015-16, concessional refinance of nearly 25,ooo cr and more than Rs.32,000 cr has been extended under long term and short-term loans, respectively, to Cooperative banks, RRBs and other financial institutions of Gujarat by NABARD.

• NABARD also releases interest subvention on behalf of GoI @2% and @3% to RRBs and Cooperative banks in Gujarat.

• In order to ensure unhindered flow of credit from banks to farmers to carry out their

agricultural operations smoothly, NABARD provided front ended liquidity support of Rs.557.40 crore to GStCB and Rs.30 crore to NBFC under the Special Liquidity Facility (SLF) announced by RBI during the COVID-19 pandemic. Financial assistance is also being extended in the State under Additional Special Liquidity Facility (ASLF) to NBFC-mFIs and smaller NBFCs.

- NABARD has formulated special Refinance Scheme for beneficiaries in Watershed and Wadi areas (3%) promoting Micro Food Processing Enterprises (@4%), and promotion of Water, Sanitation and Hygiene (WASH) related activities to all eligible Banks/FIs to enable banks to accelerate capital formation in micro food processing enterprises, promotion of income generating activities in Watershed/Wadi project areas and also for financing WASH related activities such as construction of toilets, setting up of biogas plants, rainwater harvesting structures, etc.

- Direct refinance assistance to DCCBs – NABARD also extends refinance to eligible DCCBs directly for purposes like marketing activities, financing artisans, etc.

B. Vision 2030 for NABARD in Gujarat

- Being a key partner in implementing various programmes for agricultural and rural development and in directing financial assistance under the packages and schemes announced by the Govt. of India from time to time for the development of these sectors, NABARD would be intensifying its functions and roles. In the coming years, NABARD would boost the availability of timely refinance to banks to ensure unhindered credit flow to farmers, enhance the financial assistance to state governments and corporations for the creation of the much needed rural infrastructure sector and support state-owned corporations for their procurement operations.

- It is envisaged that in the next five years (2020-21 to 2029-30), NABARD will be extending financial assistance by way of refinance of Rs.70,000 crore and Rs.50,000 crore for various investment activities (Long Term) and for short term operations, respectively, to various agencies in Gujarat. The credit linkage of beneficiaries under special refinance schemes will be up-scaled and financial assistance will be provided to Watershed/ Wadi areas and for WASH facilities and micro-food processing activities. The progress under KCC will be reviewed on an ongoing basis and NABARD will facilitate dialogues with milk unions and banks to resolve the issues in credit dispensation for coverage of maximum farmers under KCC. Further, NABARD would also contribute in promoting the Agriculture Infrastructure Fund (AIF) among banks, FPOs and other agencies for good offtake and success of the scheme. Under PACS as MSCs, NABARD plans to contribute to the transformation of about 400-500 PACS as Multi Service Centres in the next five years.

- Creation of infrastructure for agriculture and rural development will continue to be an area of importance for focus by NABARD in the State. Rural infrastructure financing is going to play a critical role in the revival of the economy post COVID-19. RIDF which provides loans to the State Government at concessional ROI will ensure effective utilization of limited resources of the State Government. The projects sanctioned under RIDF have been envisaged to fill the infrastructure gaps in the rural areas which will result in creation of more economic activity resulting in the speedy revival of the economy. An assistance of Rs.25,000 crore is projected for infrastructure financing in the state for the next 10 years.

- Recognising that aggregation and collectivisation of farming and agricultural production activities through formation of Farmer Producer Organisations (FPOs) is an efficient method to ensure sustainable marketing avenues and

better price realisation, thereby, improving farm incomes, emphasis would be laid on development and strengthening of FPOs in the years to come. Being identified as one of the major implementing agencies under the GoI scheme for promoting 10,000 FPOs in 5 years under the GoI's CSS for 'Formation and Promotion of Farmer Producer Organizations (FPOs)', NABARD has been mandated to promote 4,000 FPOs in India. In Gujarat, 150-200 FPOs will be promoted under the programme during the coming five years. Similarly, by 2030, about 400 FPOs are envisaged to be promoted in the State with an average of about 300-500 members per FPO. This will benefit about 2 lakh farmers directly and many more indirectly in the value chain.

- NABARD will be monitoring the FPOs closely so that they evolve as replicable business models. Eventually, NABARD will also be playing a key role to establish these FPOs as successful business entrepreneurs in the field of value addition, processing, branding, certification and marketing of agricultural produce. NABARD will be exploring and funding innovative projects in farm sector for technology adoption, value chain formation, productivity enhancement, climate resilient farming, demonstration of new and innovative technology, model farms with IOT, digitisation of agriculture, enhancing market infrastructure and agri-stacks, which will pave the way for modernisation and innovations in agriculture. By 2030, it is envisioned that at least 100 FPOs of Gujarat will be leading Business Houses and will be taking care of end to end solutions for their FPO members, each of whom would be empowered to be an agri-preneur in his own right.

- These FPOs will be working in product clusters and therefore it is also envisioned that value chains will be developed in the State for different products and the State will be a leading exporter of spices, processed fruits and vegetables, GI tagged commodities, etc. NABARD will join hands with the State Govt to promote infrastructural facilities for these FPOs in graduating to Business Houses with State of the Art facilities for procuring, processing, storing,

processing and marketing of commodities.

- NABARD will be supporting watersheds in hitherto uncovered areas that are vulnerable and need interventions for soil and water conservation. An additional area of about 30,000 hectare is envisaged to be covered in the ensuing 10 years, with around 30 new watershed projects and an assistance of Rs 30 crore, benefitting 20,000 - 30,000 families. Natural resource management activities on a non-watershed basis will also be promoted to cover areas and communities vulnerable to the adverse impacts of climate change.

- Tribal development projects will be encouraged with an emphasis on sustainability of livelihoods created under completed projects with proper hand-holding by the PIAs to ensure that beneficiaries get a continuous income stream. It is envisaged to support about 4 new tribal development projects per annum in the next 10 years covering about 20,000 additional families, with an assistance of approximately Rs.100 crore.

- The initiatives being undertaken for development of the off-farm sector of the State will be upscaled in a sustainable manner with more emphasis on skill upgradation, technology adoption, marketing and employment generation through business incubation centres, with an anticipated financial assistance to the tune of more than 100 cr. The State has excellent scope for Off farm FPOs (OFPOs) as Gujarat is famous for its localised embroidery, handloom work, etc. More OFPOs will be developed and the State will have at least 10 such OFPOs that will lead by example.

- Based on the trends in savings and credit linkage of SHGs, by the end of 2029- 30, around 10 lakh SHGs will be savings-linked and 2 lakh SHGs will be credit linked. Around 20 lakh JLGs will be financed by 2030 by the banking system in Gujarat. In the ensuing 10 years, E-Shakti is envisaged to be expanded to the remaining 17 districts of Gujarat as well in the coming years leading to total digitization SHGs.

- Efforts for more meaningful financial inclusion in the state will be continued in the coming years by covering more and more eligible activities with increased credit flow to the rural entities. Recently, support for extension of Connectivity and Power Infrastructure schemes has been extended to all the districts by NABARD. With such timely interventions, we look forward to implementing a fully digital branch in a special focused district to showcase the benefits that accrue by way of implementation of the diverse activities under FIF. Efforts would be made for the holistic upliftment of the areas served by improving the banking technology and related infrastructure, thereby transforming the remotest areas with modern digital technology to enhance accessibility to and availability of financial services. The anticipated assistance for financial inclusion in the state for the next 10 years is approximately Rs.100 crore.

- Lastly, parametrization of plans and targets i.e. number/percentage of farmers that may be covered in NABARD schemes in the State will be emphasised in its entirety. The aim is to slowly but surely shift the focus from refinance to enhancing credit support to every rural household.

- Extending support to agri-rural start-ups such as incubation business centres, benchmarking a definite number of start-ups to be supported by 2030, will not only enhance the role of NABARD in the rural set-up but also increase the income of farmers, mainly the small and marginal farmers.

- Replicating pilot projects like Krishak Samriddhi Yojana (KSY) wherein the line departments of the State Govt., converge to provide benefits of the schemes being implemented by them to rural households will facilitate in doubling the income of the farmers.

- Encouraging climate finance, micro irrigation finance, solar pump finance etc., are also envisaged in the goal towards increasing the farmer's income.

17. ATMA Directorate and SAMETI

Current Situation: Activities

Sr. No	Activity	2019-20	2020-21
SAMETI		**No of Trainees/Officers**	
1	Training of Extension functionaries	653	397
2	Exposure Visit of Officers	47	0
3	E-Tech Packages (No.)	42	18
Total		**742**	**415**
ATMA		**Beneficiaries**	
1	Training of Farmers	179286	95000

2	Demonstration	36098	35000
3	Exposure Visit of Farmers	77687	70000
4	Exhibition/ Kisan Mela	54088	40000
5	Farmer-Scientist Interaction	5718	5500
6	Field Days/ Kisan Gosthi	62634	40000
7	Farm School	49611	32000
8	No of FIG's/Farmers	3298/43738	751/9993
9	No of Farmers Awards	525	450
Total		**468945**	**318701**

Current Situation: Manpower

Sr. No	Designation	Approved post	Filled	Vacant
SAMETI				
1	Director	1	1	0
2	Deputy Director	8	4	4
3	Accountant/Clerk	1	0	1
4	Computer Programmer	1	0	1
5	Media Consultant	2	1	1
Total		**13**	**6**	**7**
ATMA				
1	Project Director	33	26	7
2	State Coordinator	1	1	0

3	Gender Coordinator	1	0	1
4	Deputy Project Director	66	54	11
5	Block Technology Manager	248	195	55
6	Assistant Technology Manager	744	325	419
7	Accountant/Clerk	33	25	8
8	Computer Programmer	33	15	18
Total		**1159**	**640**	**519**
9	**Farmer Friend**	**9300**	**8500**	**800**

Current Situation: Natural farming

- Under the valuable guidance of Hon'ble Governorshri & Gov. of Guj., ATMA has directed agriculture extension activities on mission mode towards "Prakrutik Krushi" followed by various mega events, seminars, webinars, residential meha trainings, village level trainings etc.
- 21861 master trainers were trained with 7 days residential training by Padma Shri Subhash Palekarji
- With the help of Master Trainer & ATMA Staff 1,72,032 Farmers were trained at village level
- To support the Natural Farming, Government of Gujarat launched two schemes "DESI COW MAINTENANCE SCHEME" & "PRAKRUTIK KRISHI KIT SCHEME" in July-2020-21 under the ATMA Project

Sr. No	Scheme/Activity	Physical		Financial (Cr.)	
		Target	Achievement	Target	Achievement
1	**Desi Cow Maintenance Scheme** Rs.900/Monthly subsidy for the maintenance cost of one indigenous cow to a farming family doing Natural Farming	1,05,000	1,05,000	66.50	48.09

2	**Prakrutik Krushi Kit Scheme** Provision of 75% subsidy or Rs.1350/- to farmers for purchase Natural Farming Kit to prepare Jivamrut	1,00,000	20,000 *(Continue..)*	13.50	0.617

(1) Current Issues:

- Release of fund routine mechanisms from GoI to SAMETI/ATMA have taken too much time, its effect on technical work and also Manpower salary and legal payment.
- The government, private sector, NGOs and others providing agriculture extension services are working in isolated mode with little or no functional coordination at the field level. This leads to restriction of good practices.
- Lack of integration of Agri- preneurs (Agro Processing & Agro Input Industries) with ATMA at State & District Level
- Inadequate infrastructure support to ATMA extension functionaries
- Sometime, ATMA staff assign with other activity at District level which adversely affect the main activity
- Farmer gathering activities in various programme by ATMA staff is increasing
- As per revised guidelines of 2014 & 2018, monthly salary and increment for ATMA employees is not implemented till date, so its reflection on activity.

(2) **Suggested Strategies :**

- **Comprehensive programme** of Capacity building & re-skilling the extension worker as per the current need.
- Enhance the **performance level** of extension set up in various factors.
- SAMETIs will focus on the technology dissemination process.
- Farmer's feedback analysis and strengthening need base activities.

- Technology disseminations analysis to the bottom level and strengthens its outreach.

SAMETI & ATMA

- Weightage of training on Post Harvest Technologies, Marketing and Value additions
- Provide training to extension functionaries for participation of FIG in future trading.
- ATMA activities focus on identified GAP of the region
- Various farmer oriented activities will be carried out in PPP mode.
- Through DAESI (Diploma in Agricultural Extension Services for Input Dealers) programme capacity building of Input dealers will be focused to cover more participation.
- Focus on PGDAEM (Post Graduate Diploma in Agricultural Extension & Management) course for capacity building of officers

Natural Farming

- Create new FIG for Natural Farming
- Create awareness among farmers for visit to Model farm
- Provide open place to sell farmers produce, Ex : Amrut Aahar Mahotsav
- Provide platform to farmers & buyers on mobile app
- Develop one Model Farm of Natural Farming in each Taluka
- One Master Trainer of Natural Farming in each Village
- Distribute the book on “Natural Farming” written by Hon. Governor shri of Gujarat to all Natural Farming scheme applicants.

Strengthening of Kisan Call Center (KCC)

- Training of Farm Tele Advisors (FTA) as per their need, new technologies and schemes of Agriculture & allied sectors

- ❑ Exposure work of FTAs to ATMA functionaries & ATMA functionaries as FTA

Convergence

- ❑ Doing interaction / meeting with Agriculture & line departments, SAUs, KVKs, Door Darshan etc to focus on below topics
- ❑ Managing yield gap
- ❑ Reducing Cost of Cultivation
- ❑ Increasing in Production
- ❑ Leveraging Precision Farming
- ❑ Protected Cultivation
- ❑ Reduce Post Harvest losses
- ❑ Value addition
- ❑ Contract Farming
- ❑ Market linkage etc
- ❑ Avoid duplication of activities

ICT (Information & Communication Technology)

- ❑ Use of ICT, Mass media, printing media to fast adoption of technologies
- ❑ Agricultural Extension is a crucial link between the research system and farmers. There is the need to have an e-platform for pooling, sharing, processing, classifying and disseminating the technologies to the State and District level.
- ❑ Development of advertisement on Marketing, Value addition, Post Harvest Technologies, Natural Farming as an advertisement has lots of power to convince the people for adoption.
- ❑ Natural Farming success stories book publications
- ❑ Development and maintenance of Natural Farming Mobile App to Find Family Farmer (FFF)

- As per suggestion of Sadamate Sir also using ICT platform even though increase its use to reach maximum farmers

(3) Work Plan: 2021-22 & 2022-23

SAMETI Activity 10 year Road Map		**(No of Trainees/Officers)**	
Sr No	**Activity**	**2021-22**	**2022-23**
1	Training of Extension functionaries	800	900
2	Exposure Visit of Officers	110	100
3	E-Tech Packages (No.)	22	26
	Total	**932**	**1026**

ATMA Activity 10 year Road Map		**(No of Beneficiaries)**	
Sr No	**Activity**	**2021-22**	**2022-23**
1	Training of Farmers	800	900
2	Exposure Visit of Officers	110	100
3	E-Tech Packages (No.)	22	26
4	Exhibition/ Kisan Mela	56,700	59,500
5	Farmer-Scientist Interaction	3,000	6,300
6	Field Days/ Kisan Gosthi	65,800	69,000
7	Farm School	52,000	55,000
8	No of Farmers in FIG's	48,000	51,000
9	No of Farmers Awards	560	625
	Total	**5,31,110**	**5,61,925**

ICT-10 year Road Map		**(No's)**	
Sr No	**Activity**	**2021-22**	**2022-23**
1	Kisan Call Center (No of Calls)	1,45,000	1,65,000
2	BISAG Programme	40	42
3	No of Text Message (Portal)	9	10
4	Social Media (FB/Twitter/etc.) No of Post	25	35
5	No of Publications (Book, Leaflets, Handbills Folder)	5	7
	Total	**1,45,079**	**1,65,094**

Sr No	Activity	2021-22	2022-23
Natural Farming -10 year Road Map		**(No of Beneficiaries)**	
1	Rs.900/Monthly subsidy for the maintenance cost of one indigenous cow to a farming family doing Natural Farming	1,93,000	1,93,000

(4) **Policy Suggestions:**

- ❑ The cost norms of most of cafeteria of activities need to be revised
- ❑ Create new post at division level and also recruit more field staff/new post should be open
- ❑ For marketing there should be a separate department and dedicated special staff with qualified education who are looking after sales, quality certification, export etc.
- ❑ To evaluate and monitor ATMA/SAMETI there should be a nominated agency from the Centre.

(5) **Outcomes of Strategies :**

- ❑ ATMA registered 55,811 FIG's and 7,87,187 farmers till January, 2021 and It will be increased by 95,000 FIG's and 12,95,000 farmers till the year 2030. All farmers will rotationally benefit by scheme.
- ❑ The farmers who join ATMA will reduce farming cost, increase quality production and get higher prices by getting training, exposure visits etc.
- ❑ After 10 years approx 4.00 lakh Farmers will adopt scientific cultivation through demonstration practices
- ❑ Farmers will become entrepreneurs of Agriculture & allied sectors & will join eagerly.
- ❑ The extension manpower will have adequate knowledge of the market and new technologies by SAMETI training.

- Analysis of farmer's feedback and technology disseminations will drive extension services in the right direction.

Abbreviations

- AH- Animal Husbandry
- AI- Artificial Insemination
- ELP- Experiential Learning Programmes
- FIG- Farmers Interest Group
- FPO- Farmers Producer Organisations
- GAP- Good Agricultural Practices
- HDP- High Density Plantation
- ICT- Information Communication and Technology
- IFS- Integrated Farming System
- INAPH- Information Network For Animal Productivity and Health
- KVK- Krishi Vigyan Kendra
- MSME- Micro Small and Medium Enterprises
- NDDB- National Dairy Development Board
- OAEZ- Organic Agriculture Economy Zones
- PMKSY- Pradhan Mantri Krishi Sinchai Yojana
- SAU- State Agricultural Universities
- WUE- Water Use Efficiencies
- WUA- Water Users' Association