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Skill Gap Analysis of Indian Horticulture Sector

AGRICULTURE SKILL COUNCIL OF INDIA (ASCI)
GURUGRAM, HARYANA

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H: 5 M
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H
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Soil Erosion
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Water Stress

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AGRICULTURE SKILL COUNCIL OF INDIA (ASCI)

Agriculture Skill Council of India (ASCI) is the Sector Skill Council for Agriculture and Allied Sectors working under the aegis of Ministry of Skill Development & Entrepreneurship (MSDE). It also works closely with two line ministries, Ministry of Fisheries, Animal Husbandry and Dairying and Ministry of Agriculture and Farmers' Welfare, Government of India. ASCI works towards capacity building by bridging gaps and upgrading skills of farmers, wage workers, self-employed & extension workers engaged in organized / unorganized segments of Agriculture & Allied Sectors.

ASCI is contributing to nation building through Skill Development in Agriculture especially at the times when country's agriculture is experiencing stagnant growth, exodus of quality manpower to other sectors, changing climate with increased variability in production parameters and transformations in international agriculture markets that are especially too much subsidized challenging the competitiveness of Indian Agriculture.

ASCI has taken upon itself the responsibility of transforming Indian Agriculture through developing the skills of country's manpower in emerging areas of agriculture. With the development of 186 Qualification Packs, ASCI is covering following segments:

- Animal Husbandry
- Fisheries
- Dairy Farm Management
- Poultry Farm Management
- Post-Harvest Supply Chain Management
- Forestry & Agro Forestry
- Watershed Management
- Amenity Horticulture & Landscaping
- Production Horticulture
- Seeds industry
- Soil Health Management
- Commodity Management
- Agri Entrepreneurship & Rural Enterprises
- Farm Mechanization and Precision Farming
- Agri-information Management
- and other Allied

OBJECTIVES:

- Determining skills/competency standards and qualifications and development of National Occupational Standards (NOS).
- Preparation and maintenance of skill inventory to facilitate individual choices.
- Development of sector specific skill development plans.
- Standardization of affiliation and accreditation process.
- Affiliation, accreditation, assessment and certification of Vocational Institutes/Programmes.
- Plan and execute Training of Trainers (ToT).
- Promotion of academics of excellence.
- Establishment of a well-structured, sector specific, Labour Market information System (LMIS) to assist planning and delivery of training.
- Adoption of global best practices

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ABBREVIATIONS

S.No	Abbreviation	Full Form
1	AI, IOT and ML	Artificial Intelligence, Internet of Things and Machine Learning
2	AICRP	All India Coordinated Research Project (under ICAR)
3	APEDA	Agricultural and processed food export development authority
4	ASI	Annual Survey of Industries
5	ASCI	Agricultural Skill Council of India
6	BIRD	Bankers Institute of Rural Development
4	IARI	Indian Agriculture Research Institute
7	ICAR	Indian Council of Agricultural Research
8	CAGR	Compounded annual growth rate
9	CBBO	Cluster Based Business Organizations
10	CEO	Chief Executive Officer
11	CoE	Centre of Excellence
12	CSR	Corporate Social Responsibility
13	DFR	Directorate of Floricultural Research
14	EDP	Entrepreneurship Development Programme
15	FICCI	Federation of Indian Chambers of Commerce and industry
16	FPO	Farmers Producers Organization
17	GDP	Gross Domestic Product
18	GoI	Government of India
19	GVA	Gross Value Added (GVA)
20	Ha	Hectare
21	IFAD	International Fund for Agricultural Development
22	IIHR	Indian Institute of Horticulture research
23	IIVR	Indian Institute of Vegetable research
24	IISR	Indian Institute of spices research
25	GoI	Government of India
26	KVK	Krishi Vigyan Kendra
27	MIDH	Mission on integrated horticulture development
28	MoFWA	Ministry of Agriculture and Farmers Welfare
29	MT	Metric tonnes
30	NABARD	National Bank for Agriculture and Rural Development

ABBREVIATIONS

S.No	Abbreviation	Full Form
31	NCCD	National Centre for cold chain
32	NHB	National Horticulture Board
33	NHM	National Horticulture Mission
34	NIN	National Institute of Nutrition
35	NSDC	National Skill Council of India
36	PPP	Public Private Partnership
37	PHM	Post-Harvest management
38	PLFS	Periodic Labour Force Survey
39	RKVY	Rastriya Krishi Vikas Yojna
40	SAU	State Agricultural Universities
41	SDC	Skill Development Centre
42	SMAM	Sub-Mission on Agricultural Mechanization
43	sft	Square Feet
44	Sqm	Square Meter
45	ToT	Training of Trainers

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The horticulture sector has emerged as an important player in the Indian economy contributing to around one-fourth of the value of output at constant prices from the total value of agricultural output. Horticulture crops have high export potential also. The sector provides an opportunity for diversification and improvement in return per unit area and farm income in a sustainable manner. It contributes to the immunity of the population as the produce is healthy and nutritious. The rising per capita income, changing food preferences, the opening of trade and also the emergence of new diseases in human beings made them consume more fruits and vegetables. Rapid urbanization and changing lifestyles have created a huge market for landscaping, ornamental gardening and floriculture. Technological improvements, market reforms, and infrastructural developments provide huge and excellent opportunities for opting for horticulture as a livelihood or enterprise.

The total horticulture production in the country is increasing rapidly and its growth rate is higher than the agricultural growth rate. The new technologies, improvement in storage and cold chain, agri start-ups and Farmer Producer Organizations will play a major role in revamping the horticultural value chain. Considering the enhanced demand for horticulture produce and rapidly changing technological innovations, it is the need of the hour to anticipate the changes and prepare the farmers, farm workers and other stakeholders to upgrade their skills and meet the demand for more trained manpower. Further, in order to reap India's demographic advantage skilling is essential in the existing as well as the new workforce. Agricultural labour productivity continues to be dismally low on account of varied levels of technology adoption and output market constraints which results in lower wages for farm workers which necessitates skilling.

The Sub-group of Chief Ministers on Skill Development, NITI Aayog in 2015 emphasised the dire need for skill development through revision and re-orientation of skilling curriculum as per market needs and up-gradation of training infrastructure. In view of these, an attempt has been made by ASCI to estimate the skill gap in the horticulture sector with the following objectives.

- To have an overview of the horticulture sector, prospects for growth of employment and income generation in different segments of the industry
- To analyse the availability of skilled labour across the value chain in the horticulture sector over the time
- To overview the government policies and programmes to augment the skilling ecosystem
- To analyse the existing status of skilling infrastructure in the sector and estimate the skill gap /requirements in the horticulture sector.

The research methodology includes primary as well as secondary research. The primary research includes interviews/discussions which were held with a wide range of stakeholders which include State Horticulture/Agriculture Universities, related ICAR institutes, Training institutes / CoEs, Industry, Development Institutes, Government Departments and skilled trainees. The primary research covered comprehensively the current landscape and ecosystem, current needs and gaps, key drivers of growth and challenges, the role of the institutions in skill development, infrastructure available, key focus areas, emerging trends and upcoming technological developments. The interactions were held (online) and also visited quite a few institutions. The Secondary research has been carried out through a review of available information and literature on various aspects of horticulture, data on the workforce in horticulture production and value chain, etc. The estimated skilling requirement would be equal to the incremental workforce added in various segments of the sector in the initial year. The growth rate as per the trend applied to the initial year's skilling requirement for estimation of skill requirement in subsequent years. Incremental workforce addition and growth rate are derived from the PLFS and ASI workforce data pertaining to various years for various activities. Wherever the workforce growth is negative, it is proposed to consider 1% of the workforce for skilling. Detailed workouts are provided in section 7.3.

Horticulture is a sunrise sector with lots of opportunities. The growth drivers of the sector include its contribution to the national economy at 30% of the agricultural GVA, a major contributor to the workforce (8.6% of the agri workforce in the horticulture sector), ensuring nutritional security, raw material for many industries and have export competitiveness. Further, horticulture crops have a great opportunity for diversification due to the more income generated per unit of land area. It is all the more important for small and marginal farmers as the produce, especially vegetables and local flowers, can be grown year-round and get continuous income. The major challenges faced by the horticulture sector include the declining size of landholding as well as average landholding, lower productivity coupled with little adoption of good agricultural practices, degradation of land and water, the problem of low-quality seeds/spurious seeds and low-quality planting material, indiscriminate use of pesticides & fertilizers, lower penetration of mechanization in horticulture, price-drop due to excess supply in short duration, postharvest losses and lower value addition and monsoon based cultivation in many areas of the country. Various surveys indicate that there is a gradual movement of labour and cultivators from agriculture and horticulture to more lucrative sectors which has pushed up labour costs.

The PLFS survey indicates that about 0.6 % total workforce received vocational/technical training in agriculture and allied sectors. Agricultural households who are accessing technical advice at all India levels during the Kharif season were 48.7% and of these, 89.5 % have followed the advice taken. The States in which the percentage of Agricultural households accessing technical advice is below the national average (48.7%) are Meghalaya, Arunachal Pradesh, Manipur, Assam, Nagaland, Tripura, Uttarakhand, Jharkhand, Bihar, Rajasthan, Gujarat, Chhattisgarh, Madhya Pradesh, West Bengal. The prevailing skilling ecosystem in the country includes various organizations such as ICAR organisations, government departments, horticulture/agriculture universities, KVKs, Centres of Excellence, private players and developmental institutes which are conducting various capacity building programmes i.e awareness, demos, melas, hands-on skilling and advisory during filed days. These organisations design the programmes and have their own content for each programme they are conducting. Quite a few of these organisations are training partners of ASCI and conducting programmes as per the ASCI job roles and QPs. The main skill gap areas identified during the stakeholder discussions were production related aspects and GAP, integrated nutrient, disease and pest management (INM, IPM and IDM), protected cultivation & precision farming, quality seed production along with seed supply chain management, nursery management for quality disease free planting material, post-harvest management (PHM) and value addition.

The Estimated Skill Requirement in Horticulture Sector is Summarised Below:

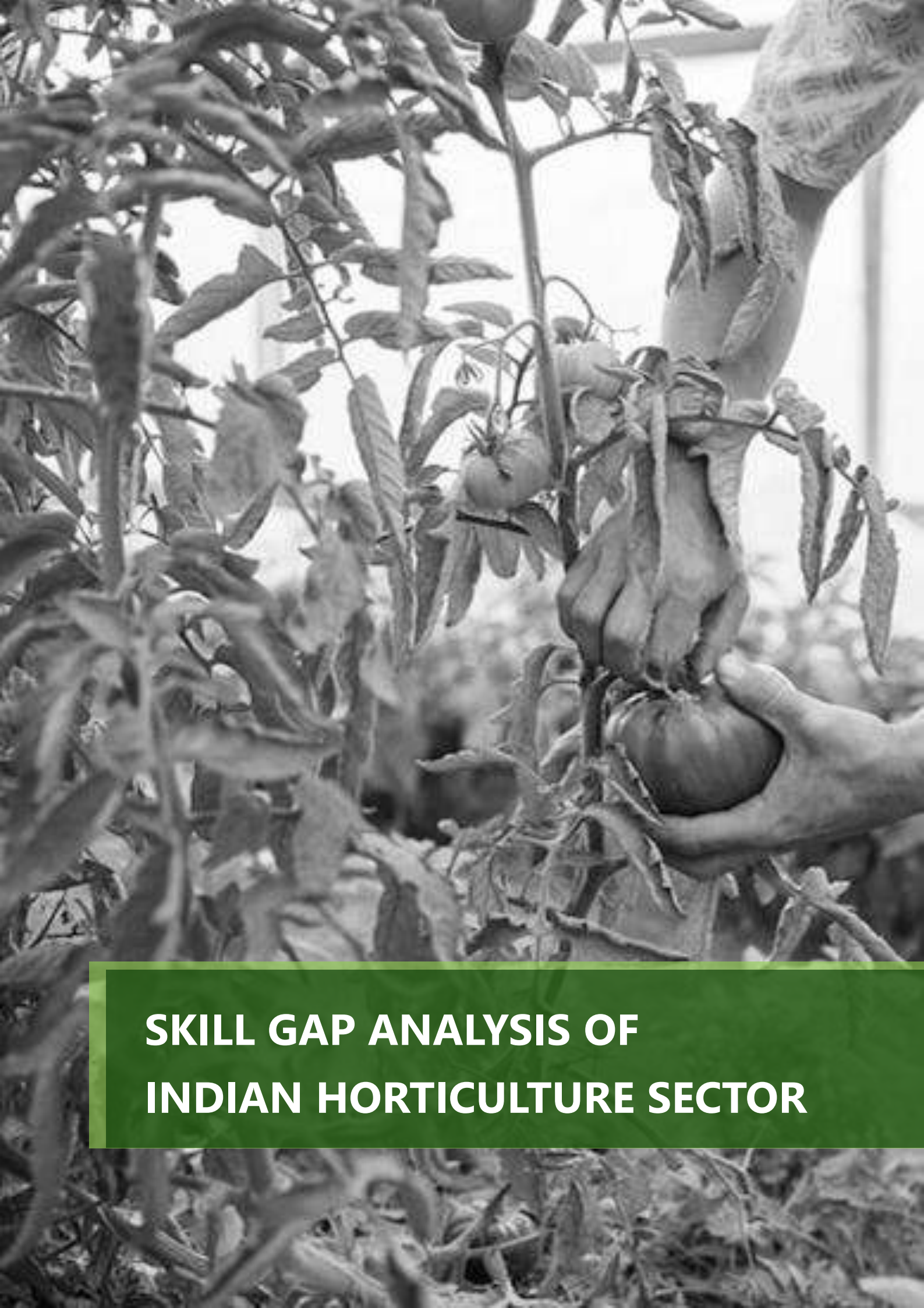
S. No.	Job Role	Workforce in Horticulture to be Skilled in Each Year					
		2022-23	**2023-24**	**2024-25**	**2025-26**	**2026-27**	**2027-28**
i	Growing / production of vegetable crops						
1	Bulb Crop Cultivator	9399	9869	10362	10880	11424	11995
2	Solanaceous Crop Cultivator	9149	9606	10086	10591	11120	11676
3	Chillies Cultivator	2267	2381	2500	2625	2756	2894
4	Tuber Crop Cultivator	26497	27822	29213	30673	32207	33817
5	Vegetable Grower	26196	27505	28881	30325	31841	33433
	Sub-Total	**73507**	**77183**	**81042**	**85094**	**89348**	**93815**
ii	**Production of Flower crops (cut and loose)**						
1	Floriculturist-Open Cultivation and Floriculturist-Protected Cultivation	30000	31500	33075	34729	36465	38288
2	Flower Handler-Packaging & Palletising	30000	31500	33075	34729	36465	38288
3	Florist	10000	10500	11025	11576	12155	12763
	Sub-Total	**70000**	**73500**	**77175**	**81034**	**85085**	**89340**
iii	**Production / growing of fruit crops, nuts, beverage crops, Spice, aromatic, pharma crops**						
1	Vineyard grower and Vineyard Worker	17502	18902	20414	22047	23811	25716
2	Tropical/Sub-tropical Fruit Grower Mango Grower, Banana Farmer	139445	150601	162649	175661	189713	204890
3	Citrus fruit Grower	12984	14023	15145	16356	17665	19078
4	Temperate Fruit Grower	22788	24611	26580	28706	31003	33483
5	Orchard workers	45444	49080	53006	57246	61826	66772
6	Coconut Grower , Friends of Coconut Tree Neera Technician	78378	84648	91420	98734	106632	115163
7	Coffee Plantation Worker and Tea Plantation Worker	39606	42774	46196	49892	53884	58194
8	Spice Crop Cultivator, Coriander Cultivator, Medicinal Plants and Grower Essential Oil Extractor	84795	91579	98905	106817	115363	124592
	Sub-total	**440942**	**476217**	**514315**	**555460**	**599897**	**647888**

iv	**Nurseries and Plant Propagation**						
1	Gardener cum Nursery Raiser	2625	2888	3176	3494	3843	4227
2	Nursery Worker	2625	2888	3176	3494	3843	4227
	Sub-total	**5250**	**5775**	**6353**	**6988**	**7687**	**8454**
v	**Landscape care and maintenance service activities**						
1	Horticulture Supervisor	2404	2645	2909	3200	3520	3872
2	Gardener	4808	5289	5818	6400	7040	7744
3	Assistant Gardener	9616	10578	11636	12799	14079	15487
4	Rooftop Gardener	4808	5289	5818	6400	7040	7744
5	Interior Landscaper	4808	5289	5818	6400	7040	7744
6	Assistant Interior Landscaper	9616	10578	11636	12799	14079	15487
7	Assistant Grounds keeper	9616	10578	11636	12799	14079	15487
8	Heritage Gardener	2404	2645	2909	3200	3520	3872
	Sub-Total	**48082**	**52890**	**58179**	**63997**	**70397**	**77437**
vi	**Protected cultivation**						
1	Horticulturist-Protected Cultivation	30000	33000	36300	39930	43923	48315
2	Floriculturist – Protected cultivation	6720	7392	8131	8944	9839	10823
3	Hydroponics Technician	700	770	847	932	1025	1127
4	Protected cultivation worker	56000	61600	67760	74536	81990	90189
	Sub-Total	**93420**	**102762**	**113038**	**124342**	**136776**	**150454**
vii	**Post-harvest management**						
1	Cold Store Technician	4500	4725	4961	5209	5470	6017
2	Cold Storage Manager	4500	4725	4961	5209	5470	6017
3	Cold Storage Supervisor	9000	9450	9923	10419	10940	12034
4	Cold Store Keeper	13500	14175	14884	15628	16409	18050
5	Packhouse Worker/supervisor	40000	42000	44100	46305	48620	53482
6	Ripening Chamber Operator	800	840	882	926	972	1069
7	Supply Chain Field Assistant	5000	5250	5513	5788	6078	6686
8	Onion storage for farmers	5000	5250	5513	5788	6078	6686
	Sub-Total	**82300**	**86415**	**90736**	**95273**	**100036**	**110040**
viii	**Other activities under horticulture**						
1	Bee keeper	10000	10500	11025	11576	12155	13371
2	Mushroom grower	1500	1575	1654	1736	1823	2005
3	Vermi-compost Producer	10000	10500	11025	11576	12155	13371
4	Plant Tissue Culture Technician	200	210	221	232	243	267
5	Makhana Grower cum Processor	1000	1050	1103	1158	1216	1338
	Sub-Total	**22700**	**23835**	**25027**	**26278**	**27592**	**30351**

ix	Upcoming fields and advanced technologies						
1	FPO management	2500	2500	2500	2500	2500	2500
2	Organic/Natural farming under horticulture	3500	3500	3500	3500	3500	3500
3	Drones	1400	1400	1400	1400	1400	1400
	Sub-total	**7400**	**7400**	**7400**	**7400**	**7400**	**7400**
x	**Horticulture processing**						
1	Plant manager and Sr. Plant manager	360	389	420	453	490	529
2	Personnel looking after Sourcing, Production (Line in-charges/supervisors of various products, Quality analysts) & marketing	800	864	933	1008	1088	1175
3	Plant worker (for Loader and Unloader, Helper, Cleaning and pre-processing)	1520	1596	1676	1760	1848	1940
4	Supervisor	160	168	176	185	194	204
5	Packaging operator	720	756	794	833	875	919
6	Machine operator	200	210	221	232	243	255
	Sub-total	**3760**	**3983**	**4220**	**4471**	**4738**	**5022**
xi	**Academia and officials**						
1	Students	2000	2000	2000	2000	2000	2000
2	Faculty	200	200	200	200	200	200
3	Officials	500	500	500	500	500	500
	Sub-total	**2700**	**2700**	**2700**	**2700**	**2700**	**2700**
xii	**Grand total**	**850061**	**912660**	**980185**	**1053037**	**1131656**	**1222901**

Trainees at HTI

Protected Cultivation Structures



SKILL GAP ANALYSIS OF INDIAN HORTICULTURE SECTOR

1. Introduction and Objectives

The horticulture sector in India has evolved as one of the major growth engines of agriculture over the years. The sector plays a critical role in Indian agriculture in order to diversify and improve farm income in a sustainable manner and also provide healthy and nutritious food. The varied nature of the horticulture segment covering fruits, and vegetables including root/tuber crops, flowers, aromatics and medicinal crops, honey, mushrooms, spices and plantation crops provides better returns per unit of area. It is a labour-intensive sector and has the potential to create employment opportunities for wide sections of the population. It also forms an integral part of food and an immunity booster. The horticulture sector has emerged as an important player in the Indian economy contributing to around one-fourth of the value of output at constant prices from the total value of agricultural output in the last 5 years (NAS, 2022). Horticulture crops also have high export potential.

There is a greater demand for fruits and vegetables with rising per capita income, changing food preferences, the opening of trade and also the emergence of new diseases in human beings made them consume more fruits and vegetables. Rapid urbanization and changing lifestyles have created a huge market for landscaping, ornamental gardening and floriculture. This is the sector which gives the young generation of educated farmers and unemployed rural youth an opportunity to become entrepreneurs. Technological improvements, market reforms, and infrastructural developments provide excellent opportunities for opting for horticulture as a livelihood/enterprise.

The total horticulture production in the country has surpassed the total foodgrains production a decade back and achieving a higher production every year. in the coming years, new technologies, improvements in storage and cold chain, agri start-ups and Farmer Producer Organizations will play a major role in revamping the horticultural value chain. Considering the enhanced demand for horticulture produce and rapidly changing technological innovations, it is the need of the hour to anticipate the changes and prepare the farmers, farm workers and other stakeholders to upgrade their skills and meet the demand for more trained manpower. India has the demographic advantage (around 54% of the population is below 25 years of age, old-age dependency ratio of 12.5) compared to other countries for another 25-30 years. However, the share of skilled to total labour force as per HDR 2020 is at 21.2% only in comparison to developed countries where the share is more than 70%.

Thus, India's ability to leverage demographic advantage is at the lower levels due to deficient skills in the existing as well as the new workforce. Twelve million people enter the Labour force in India every year who need to be skilled. Agricultural labour productivity continues to be dismally low on account of varied levels of technology adoption and output market constraints which results in lower wages for farm workers. It is, therefore, not surprising that young people are disinterested to perform low-paying and hard farm work. One of the strategies is to accelerate productivity-enhancing investment in agriculture in conjunction with the movement of workers off the farm elsewhere (non-farm sector). Agricultural production is required to be increased with a few farm workers to facilitate the movement of workers off the farm. This would reduce the disparity between the wages of farm and non-farm workers.

The Sub-group of Chief Ministers on Skill Development constituted by NITI Aayog in 2015 noted that "most of the training received by the current workforce is "traditionally transmitted" and there is a dire need of skill development through revision and re-orientation of skilling curriculum as per market needs and up-gradation of training infrastructure". Thus, the development of skilled human resources is necessary for reduction in production costs, better management, higher productivity and profit maximization which would ultimately help in dragging millions of farmers out of poverty. Keeping in view the constant high growth rate in horticulture, rapidly changing technologies coupled with upcoming innovations, it is necessary to upgrade the skills and meet the demand for a skilled workforce.

Therefore, a study on Skill Gap Analysis in the Indian Horticulture Sector has been taken up with the following objectives:

- To have an overview of the horticulture sector, prospects for growth of employment and income generation in different segments of the industry
- To analyse the availability of skilled labour across the value chain in the horticulture sector over the time
- To overview the government policies and programmes to augment the skilling ecosystem
- To analyze the existing status of skilling infrastructure in the sector and estimate the skill gap /requirements in the horticulture sector

2. Methodology

The research methodology includes primary research through discussions and field visits to stakeholders who include government departments, agriculture universities, ICAR institutes, industries, Centre's of excellence and farmers and secondary research through review of available literature and secondary data on various aspects of horticulture, its markets, workforce and employment and skilling needs in various segments of horticulture.

2.1 Primary Research

The primary research methods include mainly field visits and discussions with the stakeholders across the horticulture ecosystem. Discussions were held with a wide range of stakeholders including Central and State Government Departments, Horticulture Universities, ICAR institutes related to horticulture, Industry, Development Institutes, Centre's of Excellence on horticulture and farmers. The primary research comprehensively covers the current landscape and ecosystem of horticulture, current technological changes, skilling needs and gaps, key drivers of growth and challenges, the role of the institutions in skill development, infrastructure available, key focus areas, emerging trends and upcoming developments. Overall, the interactions were held with 79 stakeholders across 8 different categories as given below **(Exhibit.1).** About 50 skilled trainees were also covered internally by ASCI to estimate the effectiveness of skill programmes under horticulture.

Exhibit.1. Broad Categories of Stakeholders Participated in Discussions

S. No.	Category	Number Participated in Discussion
1	ICAR and its Institutes	6
2	State Horticulture / Agricultural Universities (SAU)	8
3	Krishi Vigyan Kendra's (KVKs)	2
4	Government department	2
5	Industry (Tissue culture, protected cultivation, nurseries, gardening)	5
6	Training Centre's / CoEs	4
7	Development Organizations	2
8	Skilled Trainees	50
9	Total	79

2.2 Secondary Research

Secondary research has been carried out through review of available information and literature on various horticulture aspects, skill gaps and needs, workforce in horticulture segment-wise, existing technologies, new emerging areas and technologies. The following important resources were referred and the data utilized for conducting the Skill Gap Analysis on Horticulture.

- Annual Report, 2021-22, Department of Agriculture, Cooperation and Farmer Welfare, GoI
- Economic Survey 2021-22, Ministry of Finance, GoI
- Market Vulnerabilities and Potential of Horticulture Crop in India, V. Kumar, A.Tiwari and S.B.Afroz, APRIL - MAY 2021 ISSUE XXXV Rural Pulse, NABARD
- NITI Aayog report Demand & Supply Projections towards 2033-Crops, Livestock, Fisheries and Agricultural Inputs -The working Group Report Feb 2018)
- National Sectoral Paper on Horticulture, NABARD, 2018.
- Share of fruits and vegetables in tackling CVDs and NCDs, 2019, *https://www.nin.res.in/brief/Fruits_and_Vegetables.pdf*
- Dietary guidelines for Indians, National Institute of Nutrition-A Manual, 2011, Hyderabad, *https://www.nin.res.in/downloads/DietaryGuidelinesforNINwebsite.pdf*
- FICCI and Yes bank report, 2021 on India Beyond 75: Envisioning Smart & Sustainable Agriculture
- Evaluation of Centrally Sponsored Schemes in Agriculture, Animal Husbandry and Fisheries Sector, Volume 2 – Agriculture, NITI Aayog and Development monitoring and evaluation Office, August 2020, Report 2020/UCSS01/2
- PLFS surveys of various years, MoSPI, GoI
- Annual Survey of industries of various years, MoSPI, GoI

The broad methodology for estimation of the skill gap includes analysis/usage of statistical data from major official data sources and inputs received from sectoral experts and stakeholders. The analysis carried out on the availability of skilled labour in different segments of the horticulture sector, skill gaps among the workforce, gender differences, trends in employment creation and labour absorption, availability of skilled labour, projections for labour requirements in the new and emerging areas of the sector. The availability of skilled labour is given both in absolute terms as well as a proportion of total labour engaged in the sector as a whole.

The major activities considered in the horticulture sector are ranging from production aspects of crops right from soil preparation to harvesting; post-harvest management; cold chain management; protected cultivation and other new areas. In horticulture, as well as in other sectors of agriculture, a large section of the workforce acquires skills and knowledge through traditional and informal ways i.e hereditary, self-learning, learning on the job, and other informal ways. Separate data on the labour skilled through different methods, both formal and informal methods are provided in this document.

The secondary data has been used to estimate employment generation and skilled labour availability in broad segments of the sector. Secondary data, published in different reports are useful in getting an overview and aggregate picture of the trends and patterns of the labour force indicators. To get a disaggregated picture, more detailed data on labour absorption in different occupations and sub-sectors in the sector was analysed to gain a deeper understanding of the future course and also for planning and policy formulations. Further, the horticulture sector, like any other sub-sectors of agriculture, has witnessed some transformational changes in the use of technology, organisation of production and manpower, composition and relative importance of different segments in the total output of the sector which have a far-reaching impact on the employment and livelihood potential. The ASCI study team has held intense discussions with horticulture experts of ICAR institutions, universities, industry experts and incorporated their inputs.

The secondary data for the skill gap analysis study has been collected from various issues of the Horticultural statistics, MoAFW, Annual Periodic Labour Force Survey (PLFS) and Annual Survey of Industries (ASI) of various years.

The brief details of Data sources (secondary research) used for analysis in this report are as under:

1. **Horticulture Statistics at a glance, 2018 and Annual report of MOAFW 2021-22:**

   Horticulture Statistics at a Glance, 2018 is a publication of the Department of Agriculture, Cooperation and Farmers Welfare, MoAFW, GoI. The publication contains production related data such as the area under cultivation, production/yield, the productivity of various horticulture crops, prices, market arrivals, inputs, imports and exports, cold chain and packhouses and area under micro-irrigation. The production data is used for future projections and the associated demand for skilled labour in the sector. The horticulture production and area data is collected from the annual report of MoAFW also for recent years.

2. **Situation Assessment of Agricultural Households and Land and Livestock Holdings of Households in Rural India, 2019 (NSS 77th Round)**

   Situation Assessment of Agricultural Households and Land and Livestock Holdings of Households in Rural India, 2019 (NSS 77th Round) of Ministry of Statistics and Programme Implementation is used to collect data on the source of technical advice by farmers and adoption of technical advice taken by farmers.

3. Periodic Labour Force Survey (PLFS):

The employment and unemployment surveys undertaken by the National Sample Survey Office (NSSO) had been conducted at regular intervals up to 2011-12 (NSS 68th round). Later, since 2017-18, NSSO has replaced employment and unemployment surveys with the Periodic Labour Force Survey (PLFS). The PLFS follows a rotational survey design to collect information about the involvement of the labour force in different activities including agriculture and allied activities. The data on horticulture segment-wise from this survey is used to analyse trends related to the labour force in the country and the availability of skilled labour (workers who have received vocational education and training (VET).

4. Annual Survey of Industries:

Annual Survey of Industries is an annual publication of the Central Statistical Organisation (CSO) which surveys registered manufacturing units across India. It collects data on operational aspects of the units including employment of workforce/manpower. The recent rounds of these datasets have been used to study recent employment trends in the processing sector horticulture-related product in registered manufacturing units.

STATUS OF HORTICULTURE IN INDIA

3. STATUS OF HORTICULTURE IN INDIA

3.1 Contribution of Horticulture Sector to Economy

The horticulture sector in India is one of the major growth engines of agriculture over the years. It is a labour-intensive sector and has the potential to create employment opportunities for wide sections of the population. It also forms an integral part of food and nutritional security and boosts immunity leading to good health. Horticulture crops also have high export potential. With rising per capita income, changing food preferences, and opening of trade, there is a greater demand for fruits and vegetables. Rapid urbanization and changing lifestyles have created a huge market for landscaping, rooftop gardening, vertical gardening, ornamental floriculture, etc. This is the sector which gives the young generation of educated farmers and unemployed rural youth an opportunity to become entrepreneurs. Technological improvements, market reforms, and infrastructural developments provide ideal opportunities for opting for horticulture as an enterprise. The horticulture sector has emerged as an important player in the Indian economy contributing to around 21 % of the value of output at constant prices from the total agricultural output (Exhibit.2 and NAS, 2022).

India has the 10th largest arable land resources in the world with 20 agro-climatic regions and all 15 major climates in the world exist in India. The country also possesses 46 of the 60 soil types of the world. Thus, it's suitable for a wide variety of cereal crops, pulses, oil seeds, sugarcane, and cotton as well as a variety of horticulture crops right from temperate to tropical horticultural crops. The major subtropical fruits like citrus, pineapple and banana and many temperate fruits like apple, peach, plum, strawberry, passion fruit and kiwifruit are grown in different regions of India.

The total food grain production in the country was estimated to be 308.65 million tonnes (Economic Survey 2021-22) with 139.3 million hectares (42.4% of geographical area) of the net sown area and with a cropping intensity of 141.60 % (Annual report, Dept. of Agriculture, MoAFW 2021-22). Indian Agriculture sector accounted for approximately 18.8 per cent of the country's Gross Value Addition (GVA) for the year 21-22). The workforce in agriculture was 51.52% of the total workforce in 2010 which decreased to 42.5% in 2018-19 and later increased to 46.5 % in 2020-21 (PLFS survey 2021). The years 2019 to 2021 coincide with COVID-19. With respect to horticulture (Exhibit.1) the area under cultivation, production and productivity are increasing over the last 5 years. The area under horticulture is expanding as also the production, which indicates the interest of farmers in horticulture. The production of horticulture crops has surpassed the food grain production in the country in 2015.

Further, the value of output **(Exhibit.2)** from food grains and fruits & vegetables are more or less equal (18% and 17%, respectively of total agri output value) in 2019-20 whereas, in the year 2011-12, the output from food grains is more than that of fruits and vegetables. There is an increased value of output (@5% per annum except in covid year in fruits and vegetables segment. A similar trend observed in the last decade which indicates diversification of farming from food grains to others such as horticulture.

Exhibit.2. Area, Production and Yield of Major Crops

Crops	Area (Lakh Hectares)					Production (Million Tonnes)					Yield (kg/Hectare)				
	2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21
Food Grains	1292.30	1275.20	1247.77	1269.95	1293.43	275.10	285.00	285.21	297.50	308.65	2129	2235	2286	2343	2386
Oil Seeds	261.80	245.10	247.94	271.39	287.88	31.30	31.50	31.52	33.22	36.10	1195	1284	1271	1224	1254
Sugarcane	44.40	47.40	50.61	46.03	48.57	306.10	379.90	405.42	370.50	399.25	69001	80198	80105	80497	82205
Cotton	108.30	125.90	126.14	134.77	130.04	32.60	32.80	28.04	36.07	35.38	512	443	378	455	462
Jute and Mesta	7.60	7.40	7.05	6.73	6.63	10.90	10.00	9.82	9.88	9.56	2585	2435	2508	2641	2595
Horticulture	248.50	252.40	257.40	264.80	275.90	300.64	310.67	311.05	320.47	329.86	12100	12310	12090	12100	12000

Note : *2021 figures are estimates*
Source : *Annual Report, 2021-22, Department of Agriculture, Cooperation and Farmer Welfare, GoI*

Exhibit.3. India Value of Output from Agriculture and Horticulture

S. No.	Item	2011-12		2016-17		2017-18		2018-19		2019-20	
		Output-Value	% To Total Agri Output	Output-Value	% To Total Agri Output	Output-Value	% To Total Agri Output	Output-Value	% To Total Agri Output	Output-value	% To Total Agri Output
1	Cereals	33635938	15.71	34723307	15.72	35677356	15.37	36326907	15.28	37760539	15.15
2	Pulses	5215060	2.37	7025619	3.18	7612422	3.28	6695740	2.82	7030296	2.82
3	Oilseeds	10665446	4.49	10609000	4.80	10882195	4.69	10645739	4.48	11648099	4.67
4	Tea, Coffee, Cocoa, Saffron, Etc.	3847744	2.10	4220417	1.91	4381303	1.89	3521639	1.48	3678369	1.48
5	Condiments & Spices	4639990	2.49	5690157	2.58	6260194	2.70	6927963	2.91	7669363	3.08
6	Fruits & Vegetables	28742654	16.18	35286938	15.97	36952776	15.92	37363709	15.71	38332165	15.38
7	Rubber	1716422	0.50	1257318	0.57	1273986	0.55	1284918	0.54	1268289	0.51
8	Guar Seed	2229639	1.38	1902842	0.86	1671550	0.72	1397278	0.59	1637230	0.66
9	Total Output From Agriculture And Allied Activities	190808753		220914397		232077737		237801284		249205267	
10	% Horticulture Output (4+5+6+7) To Total Agri Output		21.58		21.89		21.78		21.24		21.10

Source : Data from state-wise Output value, NAS 2022 and analysis by ASCI

Note : Fruits and vegetables account for nearly 77-78% of total horticulture output value in the country

3.2 Important Milestones of Horticulture in India

Quite a lot of varieties of fruits, vegetables and spices have grown in India since ancient days, which have the reference in Vedas i.e turmeric, pepper, lemon, etc. There was a trade in spices from India to Europe and other countries. Mughal Emperors practised horticulture in the country in a big way. Then, Rev William Carey, an English Baptist Missionary, founded the Agri-Horticultural Society in India in 1820 for the promotion and development of it in the country. The society has introduced a wide variety of better strains of vegetables and fruits.

After India attained independence, National Horticulture Board (NHB) was set up by the Government of India in April 1984 on the basis of recommendations of the "Group on Perishable Agricultural Commodities", headed by Dr M. S. Swaminathan, the then Member (Agriculture), Planning Commission, Government of India. The NHB focuses on hi-tech horticulture and post-harvest management infrastructure, including cold storage and reefer vans. Apart from NHB, there are various boards, various missions, and Centres of Excellence as given below:

- National Mission on Oilseeds and Oil Palm, which includes the promotion of oil palm cultivation in select areas.

- "Centres of Excellence (CoE)" for identified crops across different regions established to promote hi-tech horticulture enterprises through demonstration, training & capacity building, technology transfer and handholding support. CoEs are existing in Punjab, Haryana, Rajasthan, Gujarat, Tamil Nadu, etc. on various fruits and vegetables. There are about 44 CoEs in 17 states under Indo-Israel (37) & Indo-Dutch Cooperation (7).

- Various commodity boards like Tea Board, Coffee Board, Rubber Board, Spices Board, National Bee Board, APEDA, National Medicinal Plants Board (NMPB), etc. are working on promotions of respective crops with incentives and promotional schemes. They are also providing capacity building.

- In research, the Indian Institute of Horticultural Research (IIHR) under ICAR is an autonomous organization acting as a nodal agency for basic, strategic, anticipatory, and applied research on various aspects of horticulture such as fruits, vegetables, ornamental, medicinal and aromatic plants and mushrooms in India. There are other research Institutes under ICAR i.e Central Institute for Arid Horticulture, Bikaner; Central Institute for Subtropical Horticulture, Lucknow; Central Institute for Temperate Horticulture, J&K; Central Institute of Post-harvest Engineering & Technology, IIVR and IISR.

- In 2004-05 Government of India (GoI) started implementing National Horticulture Mission. Over a period GoI has supported the sector with the following schemes and horticulture is a component of these schemes.

    - Agri Clinics and AgriBusiness Centers (ACABC),
    - Initiative for Development of Entrepreneurs in Agriculture (IDEA)
    - Rastriya Krishi Vikas Yojana – RAFTAAR (RKVY RAFTAAR)
    - The Venture Capital Assistance Scheme
    - Agro Processing Cluster Scheme
    - Export Development & Promotion of horticulture crops
    - Development of commercial Horticulture through Production and Post-Harvest Management
    - Capital Investment Subsidy for Construction / Modernization Expansion of Cold Storage and Storages for Horticulture Produce
    - Technology Development and Transfer for Promotion of Horticulture

With a view to giving focused attention to horticultural development in the country, the Government of India has launched a Centrally Sponsored Scheme namely Mission for Integrated Development of Horticulture (MIDH) in 2014-15 for the holistic growth of the horticulture sector covering fruits, vegetables, root & tuber crops, mushrooms, spices, flowers, aromatic crops, coconut, cashew, cocoa and bamboo by subsuming programmes which were existing at that time National Horticulture Mission (NHM), Horticulture Mission for North East and Himalayan States (HMNEH), NBM (National Bamboo Mission), NHB (National Horticulture Board), Coconut Development Board (CDB) and Central Institute for Horticulture (CIH), Nagaland). MIDH is considered to be the major development and promotional intervention aimed at the holistic development of the horticulture sector in the country. The MIDH supports skill development and facilitates employment generation opportunities for rural youth in horticulture and post-harvest management. Capacity buildings of farmers and other stakeholders are also provided for adopting improved technologies, and various farming techniques for horticulture crops, mushrooms, floriculture, beekeeping, protected cultivation, micro irrigation, post-harvest processing, etc.

3.3 Area, Production and Productivity of Horticultural Crops

The Horticulture sector of the country is broad-based and multifaceted with fruits, and vegetables including onion, potato and tuber crops, medicinal and aromatic plants, ornamental plants, spices, plantation crops, honey and mushroom. The variety of horticultural crops found in India as per the climate and weather ex. Lichee in northern states, coconut in southern states. As per the data of the Annual report of the Agricultural Department, MoAFW, 2021-22, the area under horticulture is 27.59 million ha and produced 329.86 Million MT of horticulture produce with an increase of about 2.93% over 2019-20.

The horticultural production surpassed the food grain production of 273.38 Million MT in 2015-16. The horticulture production in India has more than doubled in the last 2 decades from 146 Million MT in 2001-02 to 329.86 Million MT in 2020-21 whereas the production of foodgrains increased from 213 Million MT to 308.65 Million MT during the same period. The CAGR growth rate for horticulture production and food grains production in the last two decades was 4.65 % and 2.38 %, respectively (V. Kumar, et.al, 2021). The area, production and productivity for overall horticultural crops in the last decade are as under. The rate of expansion of horticultural crops areas wise (2.4% per annum) is lesser than that of production (3.42% per annum) which can be seen through the improvement in productivity due to the utilization of improved seeds, irrigation and technologies.

According to the advance estimates, India's production of Honey has touched about 133,200 metric tonnes in 2021-22 as against 125000 Million MT in 2020-21. India is in the second spot in the world behind China.

The area, production and productivity under various categories of horticultural crops are given in Exhibit.4 and 5. The area of expansion is very low compared to the production and productivity in the last 15 years. The production of fruits, vegetables, plantation crops and spices doubled in production during this period while there was a multi-fold increase in the production of medicinal and aromatic crops and flowers. A noteworthy change was noticed in agricultural dynamism around 2004-05 through rapid diversification that has occurred in favour of horticultural crops. It was a direct result of the National Horticulture Mission operationalized in 2005-06.

A remarkable improvement in horticultural crops in the expansion of area (47%), production (doubled) and productivity (33%) can be noticed (Exhibit.5) since 2004-05 in a span of 15 years. Fruits and vegetables account for nearly 90% of the total quantity of horticulture production in the country (Horticulture Statistics, MoAFW, 2018).

Exhibit.4. Area, Production and Productivity under Horticulture Crops in Last Decade

Year	Area (million Ha)	Production (Million Tonnes)	Productivity (Tonnes/ Ha)	Growth rate in area (%)	Growth rate in Production (%)	Growth rate in Productivity (%)
2009-10	20.88	223.09	10.69			
2010-11	21.83	240.53	11.02	4.5	7.8	3.1
2011-12	23.24	257.28	11.07	6.5	7.0	0.5
2012-13	23.69	268.85	11.35	1.9	4.5	2.5
2013-14	24.20	277.35	11.46	2.2	3.2	1.0
2014-15	23.41	280.99	12.00	-3.3	1.3	4.7
2015-16	24.47	286.19	11.69	4.5	1.9	-2.6
2016-17	24.85	300.64	12.10	1.6	5.0	3.5
2017-18	25.24	310.67	12.31	1.6	3.3	1.7
2018-19	25.74	311.05	12.09	2.0	0.1	-1.8
2019-20	26.48	320.47	12.10	2.9	3.0	0.1
2020-21	27.59	329.86	12.00	4.2	3.3	-0.8

Note : *2021 figures are estimates*
Source : *Data from Annual Report, 2021-22, Department of Agriculture, Cooperation and Farmer Welfare, GoI and Analysis by ASCI*

Exhibit.5. Area, Production and Yield of Various Categories of Horticultural Crops

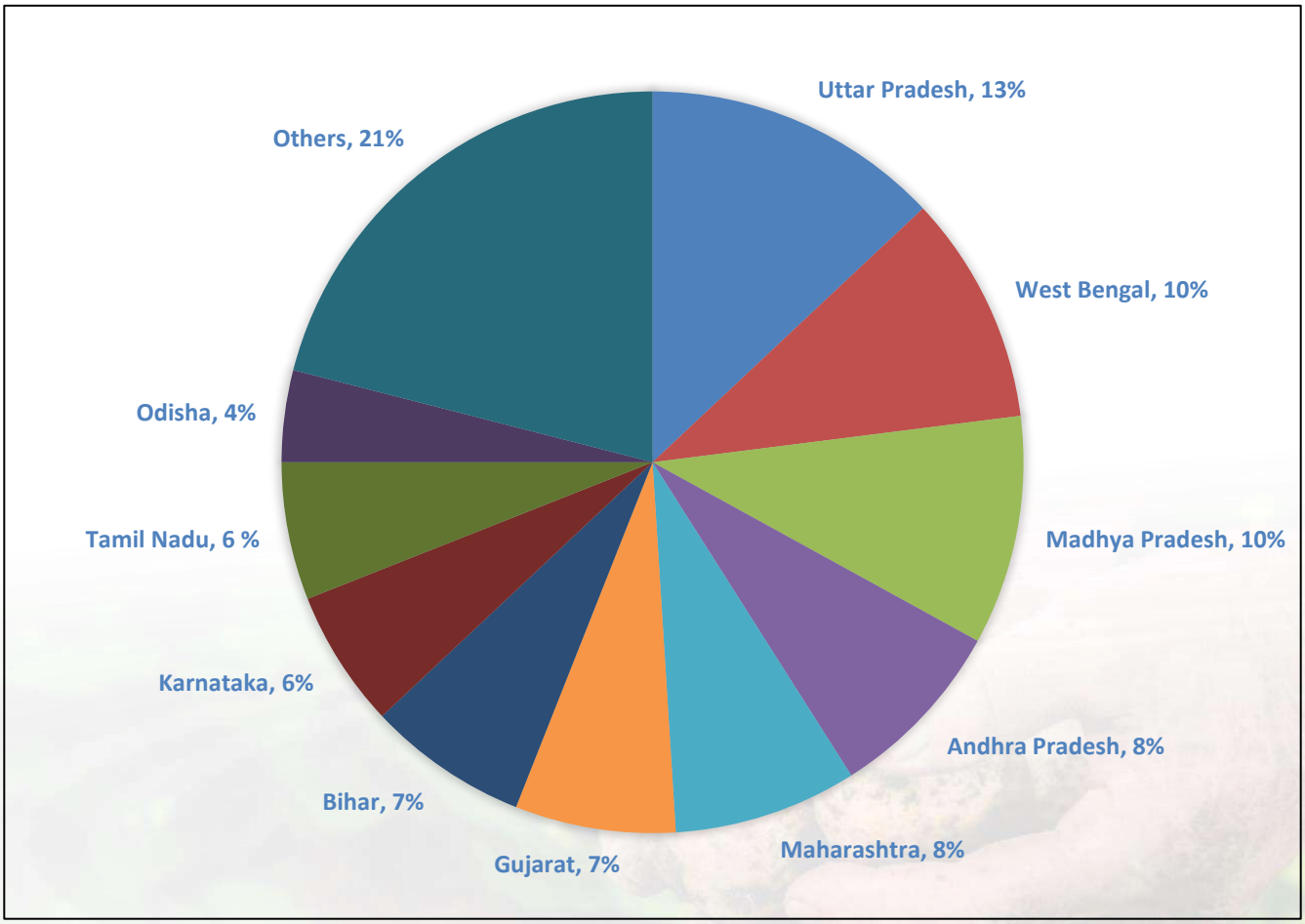
Crops	Area (000' Hectares)				Production (000' MT)				Yield (MT/Hectare)			
	2004-05	2018 -19	2019-20	2020-21	2004-05	2018-19	2019-20	2020-21	2004 -05	2018 -19	2019 -20	2020 -21
Fruits	5049	6597	6774	6806	50867	97967	10280	102764	10.07		15.07	14.90
Vegetables	6744	10073	10310	10803	101246	183170	188284	196268	15.01		18.26	17.99
Medicinal & Aromatic Plants	131	627	641	660	159	795	734	779	1.21		1.15	1.18
Flowers	118	303	323	315	659	2910	3000	2785	5.58		9.29	7.92
Honey						120	120	125				
Plantation Crops	3147	4069	4143	4161	9835	16592	16116	16599	3.13		3.89	3.96
Spices	3150	4067	4291	4487	4001	9500	10137	10536	1.27		2.36	2.36
Total Horticultural Crops	18445	25737	26482	27231	166939	311053	320471	329856	9.05	12.09	12.1	12.0

Note : *2021 figures are estimates*
Source : *Annual Report, 2021-22, Department of Agriculture, Cooperation and Farmer Welfare, GoI*

3.4. Major Horticulture Producing States

The major states with horticultural produce are depicted in Fig.1 below. The state-wise horticulture area and production are provided as Annexure. The state of Uttar Pradesh is producing the highest horticulture produce in the country followed by West Bengal, Madhya Pradesh, Andhra Pradesh, Gujarat, Maharashtra, Bihar, Karnataka, Tamil Nadu and Odisha. About 80% of the horticultural produce comes from these states.

Figure 1. Share of Horticulture produce by different States



Source : *Annual Report, 2021-22, Department of Agriculture, Cooperation and Farmer Welfare, GoI and Analysis by ASCI*

The category-wise major horticulture producing states are given below:

Exhibit.6. Category-Wise Major Horticulture Producing States

Crops	Major States
Fruits	About 80% of fruits are produced in these 10 states i.e. Andhra Pradesh, Uttar Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Karnataka, Tamil Nadu, Bihar, West Bengal and Assam
Vegetables	About 79% of fruits are produced in these 10 states West Bengal, Uttar Pradesh, Madhya Pradesh, Bihar, Gujarat, Maharashtra, Odisha, Haryana, Tamil Nadu and Chhattisgarh
Medicinal and Aromatic Plants	Rajasthan, Uttar Pradesh and Madhya Pradesh.
Flowers	Tamil Nadu, Karnataka, Andhra Pradesh, West Bengal, Maharashtra, Haryana, Uttar Pradesh, Gujarat, Madhya Pradesh, etc. North Eastern states are emerging as major contributors of modern cut flower production, especially for anthuriums, lilies and orchids.
Plantation Crops	States in Himalayan and western ghats
Spices	All the states are producing one or the other spice but leading states are Rajasthan, Andhra Pradesh, Madhya Pradesh, Gujarat and Telangana

Source : *National Sectoral Paper – Plantation and Horticulture, 2018, NABARD*

3.5 Per Capita Availability and Consumption of Fruits and Vegetables

It is estimated that per capita net availability of fruits and vegetables in our country is 141 and 272 gms per day, respectively **(Exhibit.7).** The National Institute of Nutrition (NIN) has recommended, in its dietary guidelines (2011), that every individual should consume at least 300 g of vegetables (Green leafy Vegetables-50 g; Other vegetables-200 g; Roots & Tubers-50 g) in a day. In addition, fresh fruits @100 g/day should be consumed regularly. However, the consumption of vegetables and fruits is far less than the recommendation i.e. per day vegetables consumed at 172 grams in urban areas and 99 (female)-130 (male) grams in rural areas and per day fruits consumed at 45-55 grams in urban areas and 25 grams in rural areas. The consumption of fruits and vegetables is higher in urban areas than in rural areas and males consume more than females (Share of fruits and Vegetables, 2019, NIN).

Exhibit.7. Per Capita Availability of Fruits and Vegetables

Year	Per Capita Availability of Fruits (In grams per day)		Per Capita Availability of Vegetables (In grams per day)	
	Gross	Net	Gross	Net
2011-12	142	100	309	217
2012-13	149	105	327	229
2013-14	156	110	345	242
2014-15	163	115	365	256
2015-16	171	120	386	270
2016-17	200	126	378	286
2017-18	202	141	389	272

Note : *Net = Gross - (25% loss+ 5 % exports and Processing)*
Source : *Horticulture statistics at glance, 2018, MOAFW*

3.6 Horticulture in India vs World

India is now the second largest producer of fruits and vegetables in the world and is the leader in several horticultural crops. India is ranked second, both in fruits and vegetables with regard to the area and production, after China (Exhibit.8). It stands first in the production of Banana, Mango, Lime, Papaya, and Okra, second in Onion, Brinjal, Cabbage, Cauliflower, Potato and Tomato (Horticulture statistics, MoAFW, 2018). It holds the world record for the highest productivity in grapes. The country has a significant stake in global cashew nut output, processing and kernel trade.

Exhibit.8. India's Share of Horticultural Produce in Worlds Production

Name of Crop	India's % Share in World Production	Rank
Fruits excluding Melons	10.5	Second
Vegetables and Melons	11.2	Second
Tomato	10.4	Second
Potatoes	11.6	Second
Cabbage	12.3	Second
Onion (Dry)	21.0	Second
Cauliflower	32.5	Second
Brinjal	24.5	Second
Okra	62.1	First
Mango and Guava	40.4	First
Papaya	44.4	First
Banana	25.7	First
Lemon	17.2	First

Source : *Horticulture statistics at glance, 2018, MOAFW*

Overall, India's share in the global market of horticulture is nearly 1% only. Horticulture exports from India to various countries were 4997651 MT of products worth Rs. 25793 crores (Exhibit.9) in the year 2021-22. Of the total exports, fresh fruits & vegetables form a major chunk in quantity exported at 67% and processed fruits and vegetables at 31.7% in the year 2021-22. The share of processed fruits and vegetables is gradually increasing. However, the value-wise, the share of fresh fruits vegetables & vegetables and the share of processed fruits and vegetables stood at 44 % and 50% respectively of the horticultural exports in the year 2021-22. Grapes, Pomegranates, Mangoes, Bananas, and Oranges account for the larger portion of the fruits exports basket from the country while Onions, Mixed Vegetables, Potatoes, Tomatoes, and Green Chilly contribute largely to the vegetable export basket. Major destinations for Indian fresh fruits and vegetables are Bangladesh, United Arab Emirates (UAE), Nepal, Netherlands, Malaysia, Sri Lanka, the United Kingdom (UK), Oman and Qatar. Major destinations for Indian processed fruits and vegetables are the United States of America (USA), UAE, China, Netherland, UK and Saudi Arabia (APEDA website).

India is also one of the world's top honey exporters and exported 74,413 MT of honey in 2021–2022 for a total of Rs. 1221.17 crore.

Exhibit.9. Horticulture Exports from India

Name of the Product	2019-20		2020-21		2021-22	
	Quantity in MT	Rs. Crore	Quantity in MT	Rs. Crore	Quantity in MT	Rs. Crore
Floriculture	16949.39	541.61	15695.29	575.98	23597.22	771.41
Fruits & Vegetables Seeds	14796.09	723.44	17177.18	808.40	11549.89	750.67
Sub-Total	**31745.48**	**1265.05**	**32872.47**	**1384.38**	**35147.11**	**1522.08**
Fresh Fruits and Vegetables						
Fresh Onions	1149896.84	2320.70	1578016.57	2826.53	1537496.85	3432.16
Other Fresh Vegetables	754007.57	2064.77	682085.8	2143.20	770233.22	2160.74
Walnuts	1648.22	52.78	1069.66	29.79	2482.55	73.98
Fresh Mangoes	49658.68	400.21	21033.56	271.88	27872.77	327.45
Fresh Grapes	193690.51	2176.87	246107.37	2298.45	263075.62	2302.16
Other Fresh Fruits	496577.66	2065.82	609612.93	2233.31	761031.20	2900.70
Others (Betel Leaves & Nuts)	14003.48	137.13	10151.60	137.79	14056.58	215.23
Sub-Total	**2659482.96**	**9218.28**	**3148077.49**	**9940.95**	**3376248.79**	**11412.42**
Processed Fruits and Vegetables						
Cucumber and Gherkins (Prepd. & Presvd.)	189342.9	1241.21	223515.51	1651.82	217521.38	1487.30
Processed Vegetables	253276.97	2760.53	403355.38	3718.63	460621.00	3986.45
Mango Pulp	85725.56	584.32	98369.75	714.41	123476.71	924.54
Processed Fruits, Juices & Nuts	360488.14	3086.44	306990.51	3173.42	374260.06	3626.08
Pulses	235699.03	1533.74	296169.79	2116.69	410375.86	2834.29
Sub-Total	**1124532.6**	**9206.24**	**1328400.94**	**11374.97**	**1586255.01**	**12858.66**
Grand Total	3815761	19690	4509351	22700	4997651	25793
Growth Rate in %			18	15	11	14
Share of Fresh Fruits and Vegetables in Total Horticulture Exports	69.7	46.8	69.8	43.8	67.6	44.2
Share of Processed Fruits and Vegetables in Total Horticulture Exports	29.5	46.8	29.5	50.1	31.7	49.9

Source: *Statistics, APEDA, GoI website and Analysis by ASCI*

In recent times, the reason for the growth of exports is due to the increasing acceptance of horticulture produce from India by various countries. This has occurred due to developments in state-of -the-art cold chain infrastructure, integrated post-harvest handling facilities and quality assurance measures and other initiatives taken up by the government as well as private players. The APEDA, EIC, Horticulture departments and other government departments have taken up the capacity-building initiatives at the farmer, processor and exporter levels to promote exports.

3.7 Horticulture Value Chain and Marketing

Marketing of horticultural crops is a bit complex due to the perishableness of the produce, seasonality and bulkiness. The marketing arrangements at different stages play a significant role in price levels at various stages viz. from farm gate to the ultimate user/consumer. Price movements of horticulture produce are determined by various factors such as demand and supply of fruits and vegetables, various intermediaries/middlemen operating at different levels in the marketing value chain/system and keeping the quality of the produce. There is no MSP support for horticulture produce. So, the marketing system of fruits and vegetables is very different from other agricultural commodities, particularly in the nature of perishability, their form, storage and space utilities. Unlike cereals and dairy, where procurement and marketing are quite developed, a reasonable level of the value chain in fruits and vegetables is lacking. A typical marketing channel for horticultural crops involves a number of intermediaries, such as the preharvest agent/contractor, commission agent, wholesaler and retailer who are operating between producer and consumer. The most common marketing channels (Neeraj et al. 2017), for the majority of horticulture crops, are:

- Producer – Wholesaler – Retailer - Consumer,
- Producer - Retailer - Consumer
- Producer - Consumer
- Producer – Collection Centres of Retail Corporates - Consumer

In a few states like Karnataka, Horticulture cooperatives as well as farmer producer organisations (FPOs) are very active. In a few states, the farmers markets i.e Rythu bazaar in Andhra Pradesh and Telangana, Uzavar Santhai in Tamil Nadu, etc. are functioning very well and providing opportunities to producers to sell to consumers directly (analysis by ASCI team based on stakeholder discussions). In recent times, corporate/private food retailers are collecting produce from farmers through their collection centres and supplying through their outlets at various places by establishing quality control, logistics and cold chain. The corporates are delivering orders placed online through their cold storage/godowns/logistic centres to the consumers. The corporate/private food retailers integrated software with product stocks and price movements for sales to consumers ex. Big Basket, Grofers and others. The markets in many of the major cities in some states are not covered by market legislation and continue to function under the civic body as well as the private sector i.e retail chains, big vendors, mobile vendors (through mobile vehicles), etc. The horticulture value chain matrix with stakeholders is as under:

Figure 2. Matrix of Horticulture Value Chain Corresponding Stakeholders in India

Value Chain	Type of Farmers			Stakeholders
	Small, Medium & large farmers	Contract farmers	Corporate farming	
Inputs				
Seeds, Planting material	Local/nearby markets Nearby nurseries	Company supplies to the contract farmers with technical advice	Local market Or Vertical integration	Purchases from Private players, Agri/Horticulture university and ICAR institutes. In many states, state government provides at subsidized rates
Fertilizer	Local and nearby markets			Private players. Vermicompost and panchgavya like products prepared by farmers
/Pesticides and bio-agents	Local and nearby markets			Private players
Water – wells/ponds and open irrigation or Micro-irrigation	Installs at few places rain fed	On own Open / MI / mechanized	On own Open, MI and mechanized	Private players. Government provides subsidy for small & medium farmers for MI and farm ponds structures
Soil preparation & Sowing/ Planting	Mechanized - own/hired Manual with self/ hired labour	Mechanized - own/hired Manual – self/hired labour	Mechanized Mechanised and Manual- hired labour	Own farm machinery purchased from company dealers or hired Sowing /planting Manually by farmers or with hired labour and mechanization < 10%
Production				
INM, IPM and IDM	Local and nearby markets	Local and nearby markets	Local market Or Vertical integration	Purchased from Private players
Weeding Harvesting	Manual with self/ hired labour	Manual with self/ hired labour	mechanized with hired labour	Machinery and chemicals purchased from Private players
Post harvest management (cleaning, grading, packing, storage)	Very less and manual, unless a member of FPO/SHG or assisted by agent	Done as advised by Contracting firm Manual and/or mechanised	Yes done and mostly automatic	Machinery and required equipment purchased from private players Govt. providing subsidy for PHM activities A few private organisations and FPOs providing these services through packhouses
Marketing from producer to consumer	Open air rural market, roadside markets, (Agents CC) Wholesalers Retailers Institutional & retail Consumers	contracting company collects through their centres to Own outlets or malls or processing or exports with cold chain & logistics Institutional & retail Consumers (Domestic or international)	To Own outlets or malls or processing or exports with cold chain and logistics	Agents are middle men between farmers and wholesalers, Collections centres (CC) belong to retail firms or contracting firms

FPO/ SHG/ LF

The horticulture value chain (Fig.2) includes inputs, soil preparation, sowing/planting, production, wholesalers, retailers and finally reaching the consumer. Usually, small and marginal farmers source the inputs from the local market or cooperative of FPO. On the other hand, large farmers purchase from nearby urban seed markets or good nurseries. Very few farmers source from institutes such as ICAR organizations or universities that are also selling planting materials and seeds. In a few states, the state horticulture department is supplying the seed and planting material at subsidized rates. In respect of contract farmers, the inputs are supplied by contracting firms and corporate farms either source from the open market or have vertical integration (ex. Namdhari which is vertically integrated from seed production to production to consumer).

The next in the value chain is Soil preparation, sowing/planting. Usually, the soil preparation is mechanized mostly and producers are using tractors with implements either own or on hiring. The seeding and planting are still manual. Only a few commercial farms or corporate farms are mechanized in this area also. The produce is marketed through various channels as indicated below and from producer to middlemen at 2 to 3 levels, wholesale market to the retail shop and to the consumer. In recent years, retail giants like Reliance, Tata Consumer, Grofers, etc. are sourcing horticulture produce directly from producers through their collection centres in rural areas and store in godown cum cold storage in urban areas and move the produce from storage area to the consumer directly or their store in the city. From large commercial producers and contract farmers, the produce is going to the domestic market as explained above or goes for processing or exports.

The Producer's Share in the Consumer's Rupee (price received by the producer and indicated in the percentage of rupee paid by the consumers) is a good indicator of marketing efficiency and it is dynamic and varying. The higher the producer's share greater would be the marketing efficiency or vice versa. Some studies have shown that producers' share in consumers' rupee is comparatively lower for perishable crops (Niraj et al., 2017). The bulletin of RBI, October 2019 indicates that the farmers' average share in retail prices varies between 28-78 per cent across various crops with a lower share (28%) in the case of perishables (particularly, vegetables like potato, onion and green chillies) and higher share in case of non-perishables (e.g., soya, groundnuts like oilseeds and spices like red chillies).

The producers 'share in consumers' rupee was found to be highest in the marketing of vegetables through Modern Supply Chain (75%) followed by the Cooperative supply chain (68.8%) and Traditional supply chain (44.4%) in the state of Karnataka (Veerendra, et al, 2020). This could be due to a variety of factors such as the number of intermediaries and their exploitative practices, the cost of various market functions rendered by intermediaries, the spread of location between the producers and consumers, degree of perishability leading to quality loss and quantity loss, variety and keeping quality, market infrastructure, high storage costs, seasonality, etc. The Producers' share was found to be relatively high in areas where better infrastructure facilities such as cold chain for marketing were made available (Subbanarasaiah, 1991, Kumar, 2012).

Overall, as analysed by ASCI team, an efficient marketing and supply chain system coupled with post-harvest management can ensure the following:

- Reduce post-harvest losses
- Promote grading and food safety practices
- Enable higher value addition
- Facilitates export
- induce demand-driven production
- Enhance farmers' realization
- Reduce/stabilise consumer price

3.8 Farmer's Collectives in Horticulture

Farmer's collectives in the form of Cooperatives or Farmer producer companies (FPOs) are making a difference by bringing together small farmers and providing backward and forward linkages to member farmers. Essentially, the backward linkages include the supply of timely and quality certified seeds and fertilisers, creating awareness of the benefits of integrated pest management and various production aspects, and facilitate timely access to farm equipment, and credit. Forward linkages enable the farmer's collectives to establish a formal relationship with buyers of horticulture produce, and direct marketing with retailers to mitigate marketing risks. Ultimately, farmer's collectives change the mindset of farmers from supply-led production to demand-led production.

Tissue Culture Nursery – Hardening of Plants and Sectioning of Mother Plant for Propagation

It is practically seen during the COVID pandemic that many farmers incurred considerable income loss due to disruption in the supply chain. They could not market the harvested produce due to the non-availability of transport, high transportation costs, non-availability of the market and a sharp decline in prices. The average income loss to farmers, for instance in Karnataka, ranged from ₹59,000 to ₹1 lakh on account of the lockdown. But farmers of an FPO in Bangalore Rural district were relatively less affected as the FPO took the initiative of supplying vegetables and fruits to apartment complexes in Bengaluru City. Likewise, another FPO in Andhra Pradesh succeeded in the marketing of vegetables providing considerable relief to farmer members (The Hindu Business Line dated 3rd Aug 2020). Further, various cooperatives viz. HOPCOM (Horticultural Producers' Cooperative Marketing and Processing Society), DKHOPGCOMS (The Dakshina Kannada District Horticulture Produce Growers Cooperative Marketing Society Ltd.), FRESH (The Farmers' Rural Extension Service in Horticulture Marketing Cooperative Ltd), Cooperative Fruit (Banana) Sale Societies Jalgaon, etc. are successful in the marketing of horticulture produce. The HOPCOMS society is procuring fruits and vegetables from the member growers and supplying them to the consumers through its own retail outlets. There are 405 retail outlets in HOPCOM and it is handling approximately 44,000 MT of fruits and vegetables with a turnover of Rs 400 billion per annum (ICAR-Indian Horticulture, Sep-Oct 2021). Apart from marketing, the cooperatives/FPOs facilitate post-harvest management in other words market preparation (pre-cooling, sorting, grading, packaging and on-farm storage) and provide cold-storage facilities to farmers so that there is a reduction in post-harvest losses and counter price slumps.

The government of India under the Central Sector Integrated Scheme on Agriculture Cooperation (CSISAC) provides a subsidy for the development of Cooperatives through NCDC and provides assistance to Cooperatives for Training. The GoI also introduced a scheme for the promotion of 10,000 more FPOs with grant support and it is operated through SFAC and NABARD. As of date around 3500 FPOs formed under the central sector scheme. Additionally, NABARD and SFAC also promote FPOs which account for 2000 and 900, respectively.

GROWTH DRIVERS AND CHALLENGES

4. Growth Drivers and Challenges

Indian agriculture has seen a remarkable change over the last seven decades. It has been transformed from a food deficit nation and a net importer of food grains at the time of independence to one of the global leaders in the production of a number of agricultural products i.e cereals, pulses, sugarcane, fruits, vegetables, milk, fish and poultry. On one side it is sufficiently ensuring the nation's food security requirements, the agriculture sector has also become a key contributor to the nation's exports. Horticulture exports form around 12% of Indian agricultural exports (APEDA website) and India's share in the global market is only 1%. The government of India intend to double the farmers' income by addressing the issue of agriculture sustainability in the face of climate change, market and technological developments coupled with effective policy measures. The report on the doubling of farm income indicated that dairy, fisheries and horticulture are poised to play a significant role in achieving this mission. As indicated in the introduction, the Horticulture sector is widely considered a sunrise sector which provides the dynamic opportunity for improving economic conditions of the farmers and entrepreneurs, creating diversification opportunities, increasing the productivity of land, providing nutritional security and boosting immunity, generating employment, ensuring ecological sustainability and enhancing the export earnings. The growth drivers and challenges faced by the sector are as under:

4.1 Growth Drivers

- **Contribution to national income:** Agriculture and allied sectors' contribution to Gross Domestic Product (GDP) was 18.8 per cent of the total economic GDP in 2021-22. Horticulture contributes to 30 % of the GDP of Agriculture. A survey of NITI Aayog's evaluation of CISS schemes, in 2020 indicated that the average income for MIDH scheme beneficiaries has increased from Rs. 1.6 lakh to Rs. 2.55 lakh between 2015-16 and 2018-19.

- **Source of livelihood / employment:** The agriculture sector generates employment for 45% of the countries workforce and the horticulture sector is one of the major contributors to this workforce. About 1.75 crore workforce is working in the horticulture sector.

- **Source of food supply:** Horticultural produce and products are the major source of food supply ensuring nutritional security, health and immunity. As indicated in the introduction, the urban population are consuming fruits and vegetables as per the recommendation while the consumption of rural people is far less than the recommendation. Due to the impact of COVID, disease burden due to deficiency of micronutrients (ex. Iron, Vitamin A, etc.) and awareness created about healthy food intake, the consumption will increase in future. The increasing population, increasing incomes and changing dietary patterns also added to trigger the demand. As per the Horticultural commissioner presentation at 'International Year of Fruits and Vegetables, 2021', the estimated demand for fruits and vegetables will be increased by 78 and 37% respectively from the demand in 2011. Carmelia AC et. al. 2019 estimated that fruits and vegetables consumption will increase to 4 kg/month and 8 kg/month as against the level of 5 and 1 kg/month in 2012, respectively.

- **Role of horticulture in industrial development:** Several important industries in India, such as the food processing industry, plantation (tea, coffee, rubber), essential oils and agarbatti industries, as well as many agro-based cottage industries, depend on the horticulture sector for raw materials.

- **Share in exports:** Strategic geographic location, proximity to food-importing nations and niche products like spices favour India in terms of export of horticultural produce. Over the years, India has developed export competitiveness in certain specialised products.

- **Diversification advantage:** Horticulture crops have a great opportunity for diversification due to the income generated per unit of land. It is all the more important for small and marginal farmers as the produce, especially vegetables and local flowers, can be grown year round and get continuous income. Exotics fruits, vegetables, flowers and plantation crops give high income as well as export income compared to food grains.

4.2 Issues and Challenges

Productivity is an Issue:

- Indian agriculture is predominantly small holders' agriculture, as, over 82 per cent of the holdings are small and marginal. The declining average size of landholding (2.28 ha in 1970-71, 1.08 ha in 2021), with a concurrent increase in the absolute number of operational holdings (70 million to 129 million) would exert pressure on land use for horticultural crops. The majority of small & marginal farmers face problems in production, adoption of good agriculture practices, access to technology and market- leading to low productivity.

- Management of a fragile natural ecosystem with depleting organic matter and nutrient status in the soils, erratic monsoons, depleting water resources, deterioration in water quality, etc., is a challenge to be addressed immediately and in future also. Even in good arable lands, problems of land and water degradation are daunting challenges for sustaining productivity.

- The use of certified quality seeds is also low at the farmer's level and at the same time, there is a problem of rampant supply of spurious seeds.

- Indiscriminate usage of pesticides, and usage of fertilizers with improper N: P: K ratio leads to soil imbalance and threatens productivity as well as food safety. Use of spurious pesticides and their overuse threatens food safety as well as environmental degradation.

- **Water Use Efficiency:** High wastage and low water use efficiency coupled production of water intensive crops are unsustainable. inadequate surface irrigation facilities and monsoon based cultivation impact heavily and reduces production and productivity.

- **Labour Shortage and Low Levels of Mechanization in Horticultural crops:** Mechanization penetration in the horticulture sector is less than 20%. Farm operations such as soil preparation are mechanised to an extent but in the case of other plant protection, harvesting and others, mechanization is at a very low level. The NSSO and PLFS surveys indicate that there is a gradual withdrawal of labour and cultivators from agriculture which has pushed up labour costs.

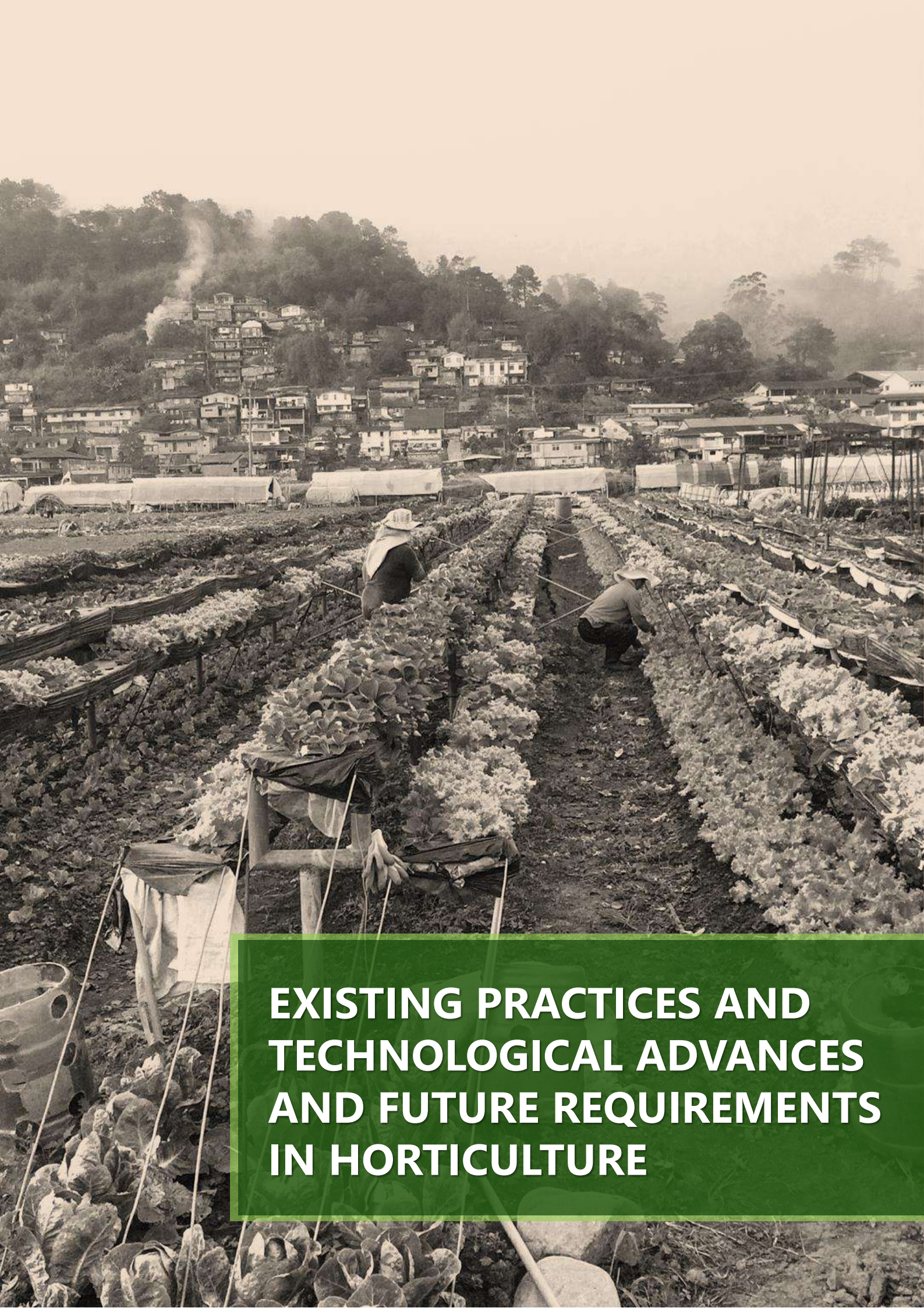
- **Excess Supply and Price Drop :** Quite often, the excess supply than demand coupled with minimal supply chain infrastructure, especially in seasonal and perishable produce i.e fruits and vegetables ex. Tomato and onion prices crash in harvest season which is resulting in bouts of production gluts and high pressure on commodity prices. FICCI and Yes Bank report, 2021 indicates that farmers have inadequate access to reliable and timely market information and supply & demand forecasting. e-NAM is not utilized to its maximum potential, given the infrastructure for quality testing, grading and certification is yet to come up.

- **Post-Harvest Losses and Value-Addition :** Post-harvest losses at estimated at 25-30 % and there is a huge mismatch between the production capacity of horticultural produce and the infrastructure available for post-production distribution, storage and value-addition. The high cost (14%) of agricultural value-chain logistics compared to other countries such as Japan (11%) and the USA (9-10%), high cost of cold storage due to low scale & poor access to affordable power, high dependence on road transport, inadequate road connectivity to reach the last farm-mile (FICCI and Yes bank report, 2021 on India Beyond 75: Envisioning Smart & Sustainable Agriculture) are a few of the reasons for higher post-harvest losses. Volatile raw material cost and quality, high power costs, seasonal capacity utilization and lack of product diversification render investment in processing economically unviable.

- **Climate Change :** The increase in global average temperatures, extreme rainfall events and erratic weather patterns may pose challenges like stress (excess moisture or low moisture) during critical crop growth stages, increased incidence of insect pests and diseases and the emergence of new insect pests and diseases All these changes would significantly influence productivity, production and quality of horticultural crops. The inadequate infrastructure for early warning systems further aggravates the climate-related loss in production.

Gerbera

Cocopeat



EXISTING PRACTICES AND TECHNOLOGICAL ADVANCES AND FUTURE REQUIREMENTS IN HORTICULTURE

5. Existing Practices and Technological Advances and Future requirements in Horticulture

Indian agriculture transformed from food shortages and imports to self-sufficiency and exports; from subsistence farming to technology-led intensive cultivation and became a leader in many crops including horticultural produce. In the past two decades, there was a remarkable achievement due to advancements in various production methods and technologies which resulted in a change in cultivation methods, the use of high-yielding and disease-resistant varieties, farm machinery and equipment and information technology. Also, sophisticated technologies such as robots, temperature and humidity sensors, usage of GPS etc. are making routes in the recent past. The benefits of technological advancements include increased crop productivity, sustainability of natural ecosystems/resources, efficient and optimal usage of water, judicious usage of fertilizer and pesticides, reduction in input costs and enhanced profit. The high value of horticulture and the potential for innovation pave way for exciting opportunities for farmers, entrepreneurs and young people to become involved in the production and other aspects of the value chain (Figure.2).

Adoption of technologies is also essential in order to tackle the effects of Climate change on various crops, management of natural resources for sustainability, meet the ever-increasing demand for food and nutritional security and also to address inefficiencies across the value /supply chain. Further, fruits and vegetables are highly perishable in nature which causes high levels of wastage /food loss at every step of the value chain, starting at the farms. As many fruits and vegetables are consumed raw or uncooked, they may also pose a risk for foodborne illnesses. in view of the issues and challenges mentioned above in various paragraphs of marketing, growth drivers and challenges, in order to achieve improved productivity, judicious use of resources, reduce wastage and main quality, it is very essential to continue with the adoption of technologies. An overview of the existing practices, technological advances and future requirements with special reference to horticulture are furnished below in **Exhibit.10.**

Tissue-Culture Planting Material

Skilling at Tissue-Culture Plant

Soilless (Cocopeat) Cultivation

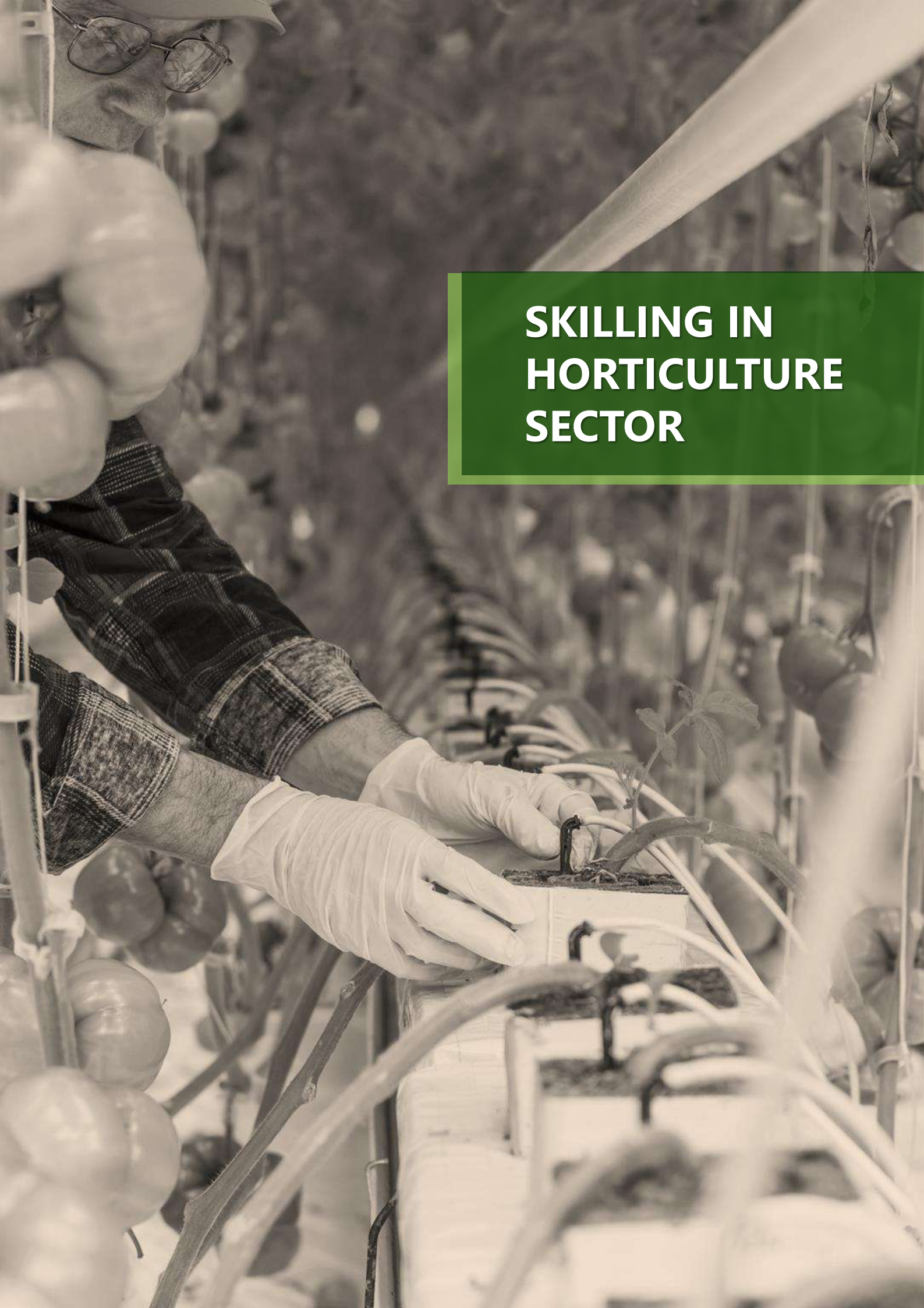
Exhibit.10. Existing Practices, Technological Advances and Future Technological Requirements

S. No.	Segment of Horticulture Value Chain	Existing Practices	Recent Trends and Developments	Future Requirements
A	Soil Preparation and Soil Health Management	• Soil testing through government testing labs and issue of Soil health cards (SHC) in a limited way • Soil preparation in new orchards/crops is mechanized	• Soil testing and issue of SHCs • Government enhancing facilities for soil testing by establishing soil testing labs • Linking Soil testing to fertilizer consumption • Enhancing soil health by use of bio-fertilizers/agents in a limited way	• Penetrate to village level soil testing in PPP mode and by farmers groups (FGs)/start-ups • Linking Soil testing to fertilizer consumption • and also, usage of micro-nutrients • Enhancing soil health by use of bio-fertilizers, bio-stimulants and micro-flora • Mechanization of soil management - nano-fertilizers, mechanized application of fertilizer • Establishing soil fertility maps using SHCs and GPS/GIS • Plant leaf analysis and advising for fertilizer and nutrient application in existing orchards/plantations • Application of Nano-fertilizers, fertilizer application based on crop response /site specific approach
B	Seed and Planting Material	• Seed is produced and supplied to farmers. Now and then problem of spurious seeds and lower quality seeds are in market • Conventional propagation • Tissue culture planting material for flowers and ornamental plants • Nurseries on the rise without proper knowledge and accreditation	• Hybrid Seed production in vegetables • Isolation, and Ensuring standards and certification of seeds • Start adopting Micro-propagation techniques • Tissue culture planting material for other crops also • Hydroponics or aeroponics for planting material and mini tuber/seed tuber production started • Nurseries are accredited by NHB	• Fully Certified Hybrid seed production • Wide usage of Micro-propagation techniques and plant protection measures for disease free planting material • Production of disease-free quality planting material through Micro-propagation techniques, Tissue culture for planting material of other crops also and wide usage of Hydroponics or aeroponics • Nurseries to be skilled in proper management in production of disease free and certified seeds/planting material

S. No.	Segment of Horticulture Value Chain	Existing Practices	Recent Trends and Developments	Future Requirements
C	Production Technologies	• GAP and Normal spacing of fruit crops/orchards • Cultivation of horticultural crops in traditional areas • Protected cultivation in flowers, high value vegetables • Plant protection – manual with chemical pesticides and started usage of vermi-compost and bio-pesticides, organic cultivation • Practicing Micro-irrigation (MI) in dry drought-prone areas • Manual Harvesting • Kitchen garden • Gardening in public and corporate areas	• GAP, High density planting and management started and rejuvenation of orchards • Cultivation of horticultural crops in non-traditional areas • Protected cultivation expanding rapidly, soilless cultivation, hydroponics, aeroponics in planting material, flowers, high value and exotic vegetables and fruits • Integrated pest management, application of pesticides through power machinery and along with vermicompost, started use of bio-pesticides and bio-agents; organic cultivation and certification • Expanding MI Fertilizers through MI • Initiated Harvesting through machines • Kitchen and terrace garden • Gardening coupled with land scaping in public and corporate areas, limited vertical gardening	• GAP and High-density planting and management and rejuvenation of orchards, canopy management and precision farming • Cultivation of horticultural crops in non-traditional areas and cultivation of non-traditional crops • Area under protected cultivation, hydroponic and aeroponics will expand exponentially in environment suitable areas as well as in other areas • Nurseries and farmers to be skilled in INM and IDM and IPM, Use of bio-pesticides, bio-stimulants and bio-agents, Usage of machines and drones for plant protection • organic cultivation, standards and certification • water efficiency through Expanding MI, Sensors based irrigation, Fertilizers through micro-irrigation systems • Increased mechanization for harvesting • Kitchen and terrace garden with protected cultivation • Expanding Gardening with landscaping in public and corporate areas, vertical gardening at all levels and terrace gardening

S. No.	Segment of Horticulture Value Chain	Existing Practices	Recent Trends and Developments	Future Requirements
D	Post-Harvest Management, Primary Processing and Marketing	• Very limited on farm sorting, grading, packing, proper storage • Limited cold chain from farm to consumer • Drying under natural conditions and machinery usage for drying in a limited way	• Sorting, grading, packing, and proper storage, packhouses, maintaining cold chain from farm to consumer is done by farmers associated with corporate retail chains, certain FPOs and cooperatives • Drying with machinery and solar driers	• Sorting, grading, packing, proper storage, maintaining cold chain from farm to consumer to be done on a big way, • Quality control and Enhancing shelf-life through wax treatment, vapour treatment, hot water treatment, packhouses, Environment controlled cold storage, Tracking and traceability • Drying with power machinery and solar driers, freeze driers
E	Bee Keeping	• Traditional bee keeping and production at low level	• Commercial scientific bee keeping • Honey processing, quality control and storage • Production of other products from bee hive – wax, propolis, bee venom, jelly, etc.	• Commercial scientific bee keeping with traceability, quality, • Queen bee breeding through artificial insemination • Honey processing, quality control and storage • Production and primary processing of bee hive products wax, propolis, bee venom, jelly, etc. on a larger/commercial scale
F	Climate Resilient Horticulture	• Using improved varieties, adoption as per the weather forecast • Reduction GHG, nitrogen emissions	• Identification and development of climate resilient varieties • Prediction of extreme climatic conditions in advance through early warning systems and micro-climate modelling in order to enable farmers response • Water use efficiency	• Prediction of extreme climatic conditions in advance through early warning systems and micro-climate modelling in order to enable farmers response • Reduction GHG, nitrogen emissions • Water use efficiency

Source: *ASCI team discussions with Stakeholders and its analysis*



SKILLING IN HORTICULTURE SECTOR

6. Skilling in Horticulture Sector

Skill is the ability to perform a task with effectiveness and efficiency to achieve pre-determined goals. Enough knowledge without skill doesn't equip a person to complete the task. Skill or expertise can be acquired through training and deliberate, systematic and sustained effort in order to smoothly and adaptively carry out complex activities involving ideas (cognitive skills), things (technical skills), and/or people (interpersonal skills). In agriculture cognitive skills are required to make better decisions, technical skills are required for handling various implements/operations and interpersonal skills are required for the exchange of farm related information. Understanding the workforce dynamics, technical education and training of the workforce, skill development framework and policy support, skilling in horticulture by existing institutions, skill gaps and need assessment and requirement of skilling of manpower in horticulture are given in these paragraphs.

6.1 Workforce Dynamics in Agriculture

The rural population in India constitutes 68 per cent of the total population. The agriculture sector engages 46.5% (PLFS survey) of the total labour force in the country in 2020-21, while its contribution to overall GVA is only 18.8 per cent and it indicates the overdependence of the Indian labour force on agriculture resulting in disguised unemployment and lower labour productivity. The agricultural workforce in India stood at 42.3% in 2018-19 as compared with 70 % in 1980 (Exhibit.11). The movement of the workforce from agriculture to other non-farm sectors (manufacturing/services) was faster after 2003 and it was reduced from 57.4% to 42.3% between 2003-04 to 2018 (Exhibit.11). Similar pattern of workforce reduction observed in horticulture sector also as the workforce in horticulture was 12.45% and 8.62% of agri workforce in 2017-18 and 2020-21, respectively (PLFS survey, 2020-21).

Exhibit.11. Percentage Distribution of Workforce in Broad Sectors of the Indian Economy

S. No.	Broad Sectors	1980-81	1994-95	2003-04	2008-09	2018-19
1	Agriculture, Forestry and Fishing	69.8	63.5	57.4	51.9	42.3
2	Mining and Quarrying	0.5	0.7	0.6	0.6	0.4
3	Manufacturing	10.4	10.4	11.3	11.6	11.5
4	Electricity	0.3	0.3	0.3	0.3	0.5
5	Construction	2.0	3.8	5.3	7.9	11.6
6	Services	16.9	21.4	25.1	27.6	33.8
7	Total Economy	100.00	100.00	100	100.00	100.00

Source: *India productivity report, RBI, 2022*

Later during the COVID pandemic, a sizeable workforce moved back to agriculture i.e the agricultural workforce to the total workforce stood at 46.5% in 2020-21 as against 42.3% in 2017-18 (PLFS surveys at section 7). As the economy is in the process of normalization after the COVID pandemic and geopolitical tensions raised in recent times, the agricultural/farm workforce would reduce as it happened before COVID due to the structural change in the Indian economy i.e the employment is being shifted from agriculture sector to non-agriculture sector.

However, the movement of surplus labour out of agriculture is at a lower pace due to various socio-economic constraints like low skill and education levels, the locational disadvantage of rural dwellers and the limited labour absorbing capacity of non-farm sectors. The level of labour productivity plays an important role in the level of earnings, the living standards of people and the GDP growth of the economy. The RBI India productivity report, 2022 says that labour would always have the incentive and the tendency to move from less-productive sectors to more-productive sectors to improve their income level ex. labour shifts from agriculture to manufacturing to services.

The productivity report of RBI, 2022 indicates that the average labour productivity in agriculture in the last decade is very less (Rs 71,400/year) compared to other sectors of the economy i.e manufacturing (Rs.2,96,800/year) and services (Rs 3,05,700). Also, the level of growth in labour productivity in agriculture is the lowest compared to manufacturing, market services and non-market services. Many farmers (around 40 per cent), have expressed willingness to move out of farming, if they find suitable alternatives (RBI Bulletin, Jan 2022).

The workforce in Agriculture and allied sectors reduced at the rate of around 0.5% in the decades between the 1980s to 2010 as mentioned above. Even then, Indian agriculture engages too many people as its workforce in relation to its contribution to the national economy (workforce @ 45.6 % and GDP @ 18.8% in 2021). in the last decade, the workforce in agriculture reduced at the rate of 0.9% and at this rate, it would reduce drastically in future too. Therefore, the country needs to shift a large proportion of its workforce from agriculture/farming to more remunerative and meaningful employment in allied sectors and non-farm sectors. Besides, this, traditional farming needs to be transformed into modern, more efficient, sustainable, and productive farming as there is high dependence on hired labour leading to increased costs and affecting profitability (Evaluation of CISS schemes, NITI Aayog, 2020).

6.2 Technical Education/Training in Workforce and Need For Skilling

The PLFS surveys also indicate that only 3.3% of the total workforce has technical education either a Degree or Diploma (Exhibit.12) and in the rest of the workforce, formally skilled persons were only 3.3% (Exhibit.13) and around 13.6 % were trained in an informal manner i.e hereditary, self-learning and learning while doing the job. A similar situation is applicable to the horticulture sector also. About 0.6 % total workforce received vocational/technical training in agriculture and allied sectors. Further, the per cent distribution of workers in usual status by broad status in employment (PLFS survey, 2020-21) in agriculture indicates that 76.3% were self-employed (Own account employer along with unpaid helper in household enterprise), 1.3% were regular wage workers and 22.6% are casual labourers as against to the total workforce in self-employment (61.3%), regular wages (12.1%) and casual labour (26.6%). The lack of access to education and training or the low quality of the workforce moves the vulnerable and marginalized sections into the vicious circle of low skills and low productive employment.

Exhibit.12. Percent Distribution of Persons of Age 15 Years and Above By Technical Education

S. No	Parameters / Years	Percent Distribution of Persons of Age 15 Years and Above by Technical Education			
		2017-18	2018-19	2019-20	2020-21
1	% Persons without any technical education	97.3	97.1	96.7	96.7
2	% Persons with Degree in Technical education	1.0	1.1	1.2	1.2
3	% Persons with Diploma/Certificate below graduate level	1.2	1.2	1.3	1.3
4	% Persons with Diploma/Certificate above graduate level	0.5	0.5	0.6	0.6

Source: *PLFS surveys of various years*

Exhibit.13. Percent Distribution of Persons in Age Group 15-59 Years by Status of Vocational / Technical Training Received

S. No.	Parameters / Years	Percent Distribution of Persons in Age Group 15-59 Years by Status of Vocational / Technical Training			
		2017-18	2018-19	2019-20	2020-21
1	Formal vocational / technical training	2.0	2.4	3.2	3.3
2	Other than formal vocational / technical training	6.1	8.9	10.7	13.6
A	Hereditary	1.6	2.1	3.3	4.2
B	Self-learning	1.8	2.5	3.0	3.8
C	Learning on the job	2.2	3.3	3.7	4.9
D	Others	0.5	1.0	0.7	0.7
3	Total received vocational/ technical training	8.1	11.3	13.9	16.9
4	Didn't receive vocational/ technical training	91.9	88.7	86.1	83.1

Source: *PLFS surveys of various years*

Agricultural households who are accessing technical advice at all India levels during the Kharif season (Jul-Dec) were 48.7% and 42.2% during the rabi season (Jan-Jun) in the country. of these, 89.5 % have followed the advice taken (Exhibit.14). The States in which the Agricultural households accessing technical advice are below the national average (48.7%) are Meghalaya, Arunachal Pradesh, Manipur, Assam, Nagaland, Tripura, Uttarakhand, Jharkhand, Bihar, Punjab, Rajasthan, Gujarat, Chhattisgarh, Madhya Pradesh, West Bengal, Karnataka. The states in which the Agricultural households accessing technical advice are above the national average (48.7%) are Uttar Pradesh, Sikkim, Haryana, Telangana, Maharashtra, Himachal Pradesh, Odisha, Jammu & Kashmir, Kerala, andhra Pradesh, Tamil Nadu, Mizoram (Exhibit.15).

Exhibit.14. Agricultural households accessing technical advice and agricultural households who adopted technical advice among those who accessed technical advice

Range (%)	No of states falling under each range of Agricultural households that accessed technical advice		No of states falling under each range of Agricultural households who adopted technical advice among those who accessed technical advice	
	Jul18- Dec18	Jan 19- Jun 19	Jul18- Dec18	Jan 19- Jun 19
No of States in Less than 25%	3	10	nil	Nil
No of States falling between 25 to 50%	13	10	1	Nil
No of States falling between 50 to 75%	10	7	Nil	4
No of States in more than 75%	2	1	27	24
National Average in %	48.7	42.2	89.8	89.5
No of states below national average	16	13	11	13
No of states above national average	12	15	17	15

Source: *Data source from Situation Assessment of Agricultural Households and Land and Holdings of Households in Rural India, 2019 (NSS 77 th round) and Analysis by ASCI Team*

Training at Plug-Nursery

Exhibit.15. State-wise Agricultural households accessing technical advice and agricultural households who adopted technical advice among those who accessed technical advice during the year 2018-19

in Percentage

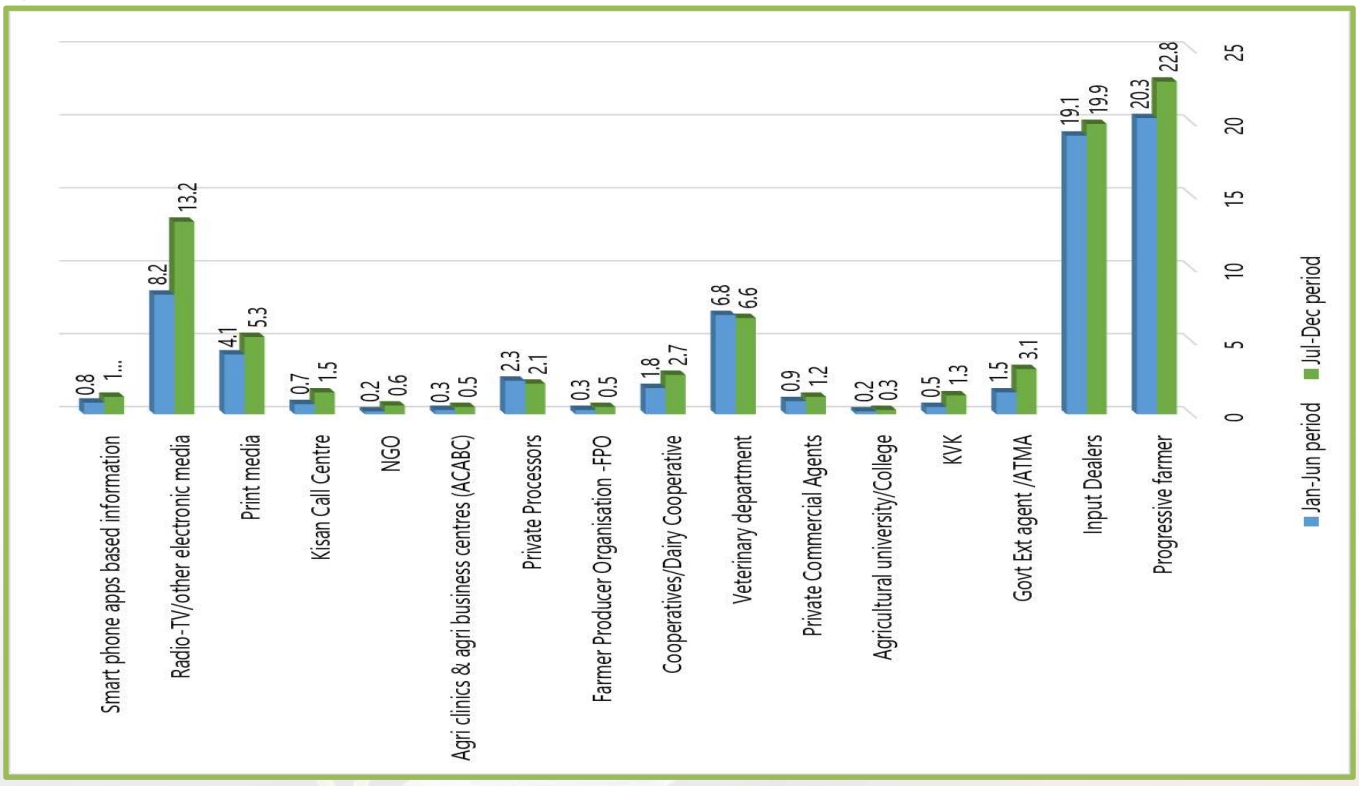
S. No.	Name of the State	Percentage of Agricultural households that accessed technical advice (%)		Percentage of Agricultural households who adopted technical advice among those who accessed technical advice (%)	
		Jul18- Dec18	Jan 19- Jun 19	Jul18- Dec18	Jan 19- Jun 19
1	Andhra Pradesh	73.5	65.2	91.8	90.5
2	Arunachal Pradesh	18.9	16.0	87.6	69.9
3	Assam	26.3	18.6	91.0	92.2
4	Bihar	35.4	41.5	91.3	92.1
5	Chhattisgarh	43.8	17.4	96.6	62.8
6	Gujarat	42.5	45.2	87.0	86.6
7	Haryana	61.7	63.0	98.0	97.3
8	Himachal Pradesh	65.0	58.8	76.1	85.0
9	Jammu & Kashmir	67.5	48.7	97.2	97.4
10	Jharkhand	33.3	22.0	88.9	86.6
11	Karnataka	47.7	46.2	77.8	79.3
12	Kerala	71.1	61.9	88.1	76.9
13	Madhya Pradesh	45.4	48.5	78.5	83.7
14	Maharashtra	64.1	46.6	93.3	92.1
15	Manipur	23.6	9.3	94.9	68.2
16	Meghalaya	6.7	12.5	34.8	50.3
17	Mizoram	80.2	79.0	84.9	85.9
18	Nagaland	39.4	19.3	78.0	81.0

S. No.	Name of the State	Percentage of Agricultural households that accessed technical advice (%)		Percentage of Agricultural households who adopted technical advice among those who accessed technical advice (%)	
19	Odisha	65.1	26.4	84.4	76.8
20	Punjab	40.7	44.7	98.6	99.8
21	Rajasthan	34.5	23.5	92.9	92.7
22	Sikkim	54.2	54	93.8	91.5
23	Tamil Nadu	78.6	62.8	91.5	91.5
24	Telangana	63.0	48.0	95.3	97.4
25	Tripura	39.7	22.7	92.5	99.9
26	Uttarakhand	29.0	16.3	93.0	95.4
27	Uttar Pradesh	50.6	50.2	90.8	92.2
28	West Bengal	36.6	40.7	93.7	94.3
29	All India	48.7	42.2	89.8	89.5

Source: *Situation Assessment of Agricultural Households and Land and Holdings of Households in Rural India, 2019 (NSS 77 th round)*

With regard to the source of technical advice to farmers, Situation Assessment of Agricultural Households and Land and Holdings of Households in Rural India, 2019 (NSS 77th round), indicates that around 22.8 per cent of households took technical advice from progressive farmers and 19.9 per cent of households took advice from input dealers. About 90 per cent of the farmers who reached out to progressive farmers and input dealers followed the advice (Fig.16).

Exhibit.16. Source-wise agricultural households accessing technical advice (%)



Source: *Situation Assessment of Agricultural Households and Land and Holdings of Households in Rural India, 2019 (NSS 77 th round) and analysis by ASCI*

6.3 Impact of Skilling After Skill Training

The primary survey (ASCI survey) of 50 skilled farmers under horticulture in ASCI-QPs / job roles indicates that about 30% working as regular wage employment, 2% as casual labour, and 54% trainees are self-employed. The income level of self-employed has doubled after skilling. The benefits of skilling include higher earnings, learning new methods/ways, higher productivity/efficiency, better information, etc. (Exhibit .17). As per the opinion of skilled trainees, they would need further training in pest and disease control, post-harvest technology and marketing of the produce. About 98% of the respondents were willing to suggest others to undertake the skill training and they had already suggested several people undertake the training as they found the training was very much benefiting and learnt many new things.

Exhibit.17. Benefits of Skill Training

Parameter	Very Good	Good	Average	Poor	Very Poor
Higher earnings	15%	56%	27%	0%	2%
Learn new methods/ ways	64%	30%	6%	0%	0%
Higher productivity/efficiency	40%	52%	8%	0%	0%
Better price realization	0%	0%	92%	8%	0%
Support for access to credit	4%	11%	5%	9%	70%
Achieved Higher sales of the product	0%	8%	85%	4%	4%
Better information about grading/quality	46%	31%	19%	4%	0%
Support for placement	15%	19%	12%	0%	54%

Source: *ASCI analysis*

6.4 Skill Development Framework and Policy Support

The central ministries which are committed to rural development through agriculture and allied activities including horticulture and skill development are the Ministry of Agriculture and farmers welfare, the Ministry of Skill Development and Entrepreneurship and the Ministry of Rural Development. For operational expenses such as for conducting trainings, etc. the central government ministries could be approached to ensure the uninterrupted flow of funds. Others could be sponsored programmes from various schemes (as given below), CSR funds and fee-based income. Further, there are funds available as such for conducting the Skill Development programme from different sources. The relevant sources for this centre are as follows:

A. Mission for Integrated Development of Horticulture (MIDH)

Mission for Integrated Development of Horticulture (MIDH) is a Centrally Sponsored Scheme for the holistic growth of the horticulture sector covering fruits, vegetables, root & tuber crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew, cocoa and bamboo. While the Government of India (GOI) contributes 85% of the total outlay for developmental programmes in all the states except the states in North East and the Himalayas, 15% share is contributed by State Governments. in the case of North Eastern and Himalayan States, GOI contribution is 100%. Objectives of the scheme: -

- Promote holistic growth of the horticulture sector, including bamboo and coconut through area-based regionally differentiated strategies, which include research, technology promotion, extension, post-harvest management, processing and marketing, in consonance with comparative advantage of each State/region and its diverse agro-climatic features.
- Encourage aggregation of farmers into farmer groups like FIGs/FPOs and FPCs to bring economy of scale and scope.
- Enhance horticulture production, augment farmers, income and strengthen nutritional security
- Improve productivity by way of quality germplasm, planting material and water use efficiency through micro-irrigation.
- Support skill development and create employment generation opportunities for rural youth in horticulture and post-harvest management, especially in the cold chain sector.
- Under the MIDH scheme also a few sectors specific CoEs were sanctioned. As part of capacity building, various aspects of horticulture such as production technologies, demos, exposure visits, market intelligence, FPO training, and new technologies can be promoted.

B. Rashtriya Krishi Vikas Yojana under Ministry of Agriculture

Rashtriya Krishi Vikas Yojana was initiated in 2007 as an umbrella scheme for ensuring holistic development of agriculture and allied sectors by allowing states to choose their own agriculture and allied sector development activities like crop development, horticulture, agricultural mechanization, natural resource management, marketing & post-harvest management, animal husbandry, dairy development, fisheries, extension, etc. as per the district/state agriculture plan. One of the objectives of RKVY is "to empower youth through skill development, innovation and agri entrepreneurship-based agribusiness models" that attract them to agriculture. This fund under RKVY could be approached for conducting skill development programmes.

C. Boards related to Horticulture- NHB, NBB, NCCD and other boards

These boards are providing funding assistance to the organization of training programmes, seminars, demos and exposure visits. National horticulture board (NHB) under its scheme 'Technology Development and Transfer for Promotion of Horticulture' provides financial assistance for Exposure visits of farmers (Outside State), Visit Abroad for Government Officers and Organizations/Participation in Seminar/symposia/workshops for development of horticulture. The National Centre for Cold chain development (NCCD) provides funding assistance for the organisation of training in cold chain management, and cold storage. National Bee Mission (NBM) schemes include funding for technology demonstrations on the impact of Honeybees on Agricultural and Horticultural Production, conducting seminars/ workshops/ conferences, conducting Trainings/ Exposure Visits for farmers/ beekeepers and officers. Also provides financial assistance for publicity /publications including printing of literature /magazine/ books /guidelines, advertisements, exhibitions/ fairs for promotion of scientific Beekeeping and Honey Consumption. Similarly, Coconut board, spices board, and others also provide assistance for the capacity building of farmers and entrepreneurs.

D. Support for Capacity Building for Adoption of Technology (CAT) of NABARD

Technological upgradation and innovation in agriculture have been the hallmark of Indian Agriculture. To widen the horizon of new agri-technology, the farmers need to be motivated to adopt new technologies by educating them through exposure visits to innovative projects being implemented by various agencies in different parts of the country. NABARD has been at the forefront in facilitating the adoption of modern technology by farmers/ entrepreneurs through promoting institutions/ agencies like banks, corporates, NGOs, SHGs, Farmers' Clubs, etc. through a grant to these institutions. During 2022-23, as on 31st December 2022, an amount of Rs.2.36 crore has been disbursed under Capacity Building for Adoption of Technology (CAT) to build the capacity of around 12000 farmers for adopting new/innovative methods of farming. The areas covered under the exposure visits were agri-extension services, integrated farming methods, organic farming, etc.

E. Micro Enterprise Development Programme (MEDP) and Livelihood and Enterprise Development Programme (LEDP) of NABARD

NABARD is implementing the schemes namely the Micro Enterprise Development Programme (MEDP) and Livelihood and Enterprise Development Programme (LEDP) for the holistic development of livelihoods and enterprises of SHGs and enabling SHG members to take up income generating activity. These programmes involve intensive training and hand-holding support on various aspects including understanding the market, potential mapping and ultimately fine tuning skills and entrepreneurship to manage the enterprise. These programmes are skills specific, location specific and focus on skill building /skill up-gradation and development of micro-enterprises by matured SHG members and run as a successful enterprise for income Generation. The sanctions are based on project proposal submission by agencies involved in SHG promotion and skilling and proposals to be submitted to respective Regional Offices of NABARD.

F. Prime Minister's Kaushal Vikas Yojana (PMKVY)

Prime Minister Kaushal Vikas Yojana is the flagship programme of the Ministry of Skill Development and Entrepreneurship which has a target of training 10 million youth between 2016 and 2020. The nodal agency for implementing the scheme is the National Skill Development Corporation. Under this programme, unemployed youth are provided with 150 to 300 hours of skilling as per the job role and also provide placement assistance free of cost. Training imparted under the Short-term Training component of the Scheme shall be National Skill Qualification Framework (NSQF) Level 5 and below. Agriculture is one of the major sectors in which training is imparted on 173 job roles and horticulture job roles are around 40.

G. Deen Dayal Upadhyay Grameen Kaushalya Yojana (DDUGKY)

DDUGKY is the placement linked skill training programme of the Ministry of Rural Development and DDU-GKY state missions implement the programme as per the rules from time to time. Training Courses on horticulture are also run for rural youth with special emphasis on the poor rural youth belonging to socially backward groups (SC/ST 50 per cent, minority 15 per cent, and women 33 per cent); guaranteed placement of at least 75 per cent of the trained candidates; post-placement support, migration support, and alumni network.

H. Agri-clinics and Agribusiness Centres (ACABC) Scheme of MANAGE

Universities, the Indian Society of Agribusiness Professionals (ISAP) and other no-profit professional agencies are running an entrepreneurship development programme (EDP) as part of the Agri-clinics and Agribusiness Centres (ACABC) Scheme steered by the National Institute of Agricultural Extension and Management (MANAGE) with EDP locations in various states across India. The programme is 60 days of training and one year of handholding support. The training covers modules for soft skills, business skills, preparation of Detailed Project Reports (DPR) for access to credit, and the support phases include mentoring and guidance.

I. National Skill Foundation of India (NFSI)

The National Skill Foundation of India (NFSI), a non-profit organisation, focuses on skill development and entrepreneurship for enhanced and suitable outcomes. The NFSI provides training need analysis, training, and evaluation facilitates certification and provides incubation services. Skill development in dairy entrepreneurship is one of the projects implemented by NSFI.

J. ICAR Organisations, Government Departments, Universities, Private Players and Developmental Institutes

The prime mandate of the institutions like ICAR organisations, government departments, universities, KVKs, CoEs, private players and developmental institutes is different and have different roles such as policy making, research and education (higher education like Graduation, PG, PhD), a large business in protected cultivation and tissue culture, a developmental role like promotion of livelihoods and so on. However, each and every one of these is contributing to training and skilling in horticulture as per their expertise. Skill development programmes for farmers are organised by these organisations with their own budget as well as under various schemes of GoI /Boards pertaining to horticulture. The private players are also engaged in Skill Development and undertake skill training as part of their core business and/or as part of CSR activities. Some more private players i.e private training institutes conduct trainings for captive usage. Apart from skilling programmes, melas/fairs, demos, exposure visits, filed-days are also conducted.

6.5 Skilling / Training Area and Type of Training of Existing institutions

Training area and level of training in the horticulture sector of the organisations with whom the ASCI team had discussions are given in Exhibit.18. These organisations i.e ICAR organisations, government departments, universities, KVKs, CoEs, private players and developmental institutes are conducting various capacity building programmes as mentioned above. They design and have their own content for each programme they are conducting. Sometimes the content is customised as per the need of the client. Quite a few of these organisations are training partners of ASCI and conducting programmes as per the ASCI job roles and QPs. The areas and level of capacity building and special initiatives of various stakeholder institutions are also furnished in Exhibit.18.

Planting Material at Nursery

Exhibit.18. Current areas of Trainings, Level of Training and Specialties of Various institutes with Whom the Discussions Were Held

S. No.	Category	Role in Capacity Building	Special Initiatives
1	ICAR and its Institutes	Extension services under 'Mera gaon mere gaurav' by adopting villages; Crop calendar on respective website Help line for queries; Conducting 7 to 15 days skilling programmes on their own as well as through attached KVKs ; incubation cell Mela/Exhibition; Associated with ASCI on their own or through KVKs	Directorate of Floriculture research organizing 'Certified farm adviser course' with MANAGE, Hyderabad IIVR, Varanasi recognised as CoE by MoAFW IIHR has ATIC and adopted FPO also.
2	State Horticulture / Agricultural Universities (SAU)	Through Extension education division and training cell, conducting awareness programmes, demos, exposure visits and Melas/exhibitions. A few skilling programmes are also conducted. RAWEP for students incubation centre at university level	A few universities are having attached CoE and doing skilling programmes and associated with ASCI also. AAU conducted 3-6 months course for tea garden people
3	Krishi Vigyan Kendra's (KVKs)	1 day awareness programmes Field days at villages 1-2 weeks skilling programmes ASCI associated Job roles	Providing hand holding support for entrepreneurs who took skilling training
4	Government Department	Policy, Budget, designing of schemes and their implementation, training and funding support to training State governments are maintaining parks, gardens and supplying seeds and planting material Fruit and flower shows	10 months certificate course in Horticulture in Kannada
5	Industry (Tissue culture, protected cultivation, nurseries, gardening)	Tissue culture techniques Protected cultivation practices, Installation, repairs & maintenance of protected cultivation structures,	Mostly conducting skill training on rolling basis or for new employees at their units.
6	Training Centres / CoEs	Awareness programmes 5 days capacity building 2 weeks skilling programmes	in Haryana training is linked to subsidy schemes
7	Development Organisations	Conducting and funding for Capacity building programmes	Sectoral as well as FPOs

Source: *Stakeholder discussions and analysis by ASCI team*

6.6 Skill Gaps in Horticulture Sector

The ASCI team has identified the existing skill gaps in horticulture in consultation with various organisations such as ICAR organisations, government departments, universities, KVKs, CoEs, private players and developmental institutes. These organisations in general felt that there is a need for skilling in horticulture and also indicated that there is a skill gap existing in the horticulture sector in the country. The main areas identified are production related aspects and GAP, integrated nutrient, disease and pest management (INM, IPM and IDM), protected cultivation & precision farming, seed production along with seed supply chain management, nursery management for quality disease free planting material, PHM and value addition. The areas identified for skilling of farmers, perspective entrepreneurs, FPOs and farmers collectives, SHGs, rural youth and women under the horticulture sector are as under:

- Production technologies & GAP
- INM, IPM, IDM in horticultural crops
- Post-harvest management
- Value addition and processing
- Land scaping, gardening, vertical gardening
- Kitchen garden/terrace garden
- Protected cultivation
- Precision farming
- Hydroponics/aeroponics/soilless cultivation
- Tissue culture
- Seed production and seed supply chain
- Nursery management for Quality and disease-free planting material
- Mechanization including micro-irrigation
- Soil health management through testing linked application
- Organic farming
- Marketing aspects and management
- Finance management
- Documentation and legal aspects for establishing a unit
- Export oriented aspects
- Quality control of horticulture produce
- Skilling for students in new technologies
- Bee keeping and bee hive products
- Mushrooms – production and spawn production

The state specific needs identified by ASCI team during stakeholder discussion are furnished at **Exhibit.19.**




Exhibit.19. State specific skilling needs as indicated by Stakeholders

S.No.	Name of the Skill	States
1	Production technologies & GAP, INM, IPM, IDM in horticultural crops, Soil health management through testing linked application, Permaculture	All over India
2	Post-harvest management, Value addition and processing	All over India
3	Land scaping, gardening, vertical gardening	Metros, Urban areas of country
4	Kitchen garden/terrace garden	Metros, Urban areas and peri-urban areas of country
5	Marketing aspects and management	Maharashtra, Karnataka, AP, Telangana, TN, Assam, Haryana, UP,
6	Finance management	NE states
7	Protected cultivation and precision farming, Pollinizers and pollination in protected structure	Maharashtra, Karnataka, AP, Telangana, TN, MP, Assam & NE states, Haryana, UP
8	Seed production and seed supply chain	All major states such as Maharashtra, Karnataka, AP, Telangana, TN, Assam, Haryana, UP, Bihar, WB, Gujarat
9	Nursery management for Quality and disease-free planting material	Andhra Pradesh, Uttar Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Karnataka, Tamil Nadu, Bihar, West Bengal, Assam
10	Mechanization including micro-irrigation	All over India and specially more in the states where labour shortage is there such as Maharashtra, Karnataka, AP, Telangana, TN, Haryana, Punjab, Gujarat
11	Tissue culture	Maharashtra, Karnataka
12	Organic farming	All over India
13	Documentation and legal aspects for establishing a unit	Kerala, Karnataka, Maharashtra, AP, Telangana, TN, MP, Haryana, Punjab, UP, Assam & NE states,
14	Export oriented aspects and Quality control of horticulture produce	Maharashtra, Karnataka, Andhra Pradesh, Uttar Pradesh Tamil Nadu, Gujarat, West Bengal, Assam & NE States
15	Hydroponics/aeroponics/soilless cultivation	Maharashtra, Karnataka, TN, Haryana
16	Beekeeping and beehive products	Haryana, Punjab, UP, Sothern States, Assam & NE States
17	Plantation crops	States in Himalayan region and western ghats
18	Spices	All the states in the country are producing one or the other spice but leading states are Rajasthan, Andhra Pradesh, Madhya Pradesh, Gujarat and Telangana and Kerala
19	Mushroom cultivation	All areas nearer to peri-urban and urban areas

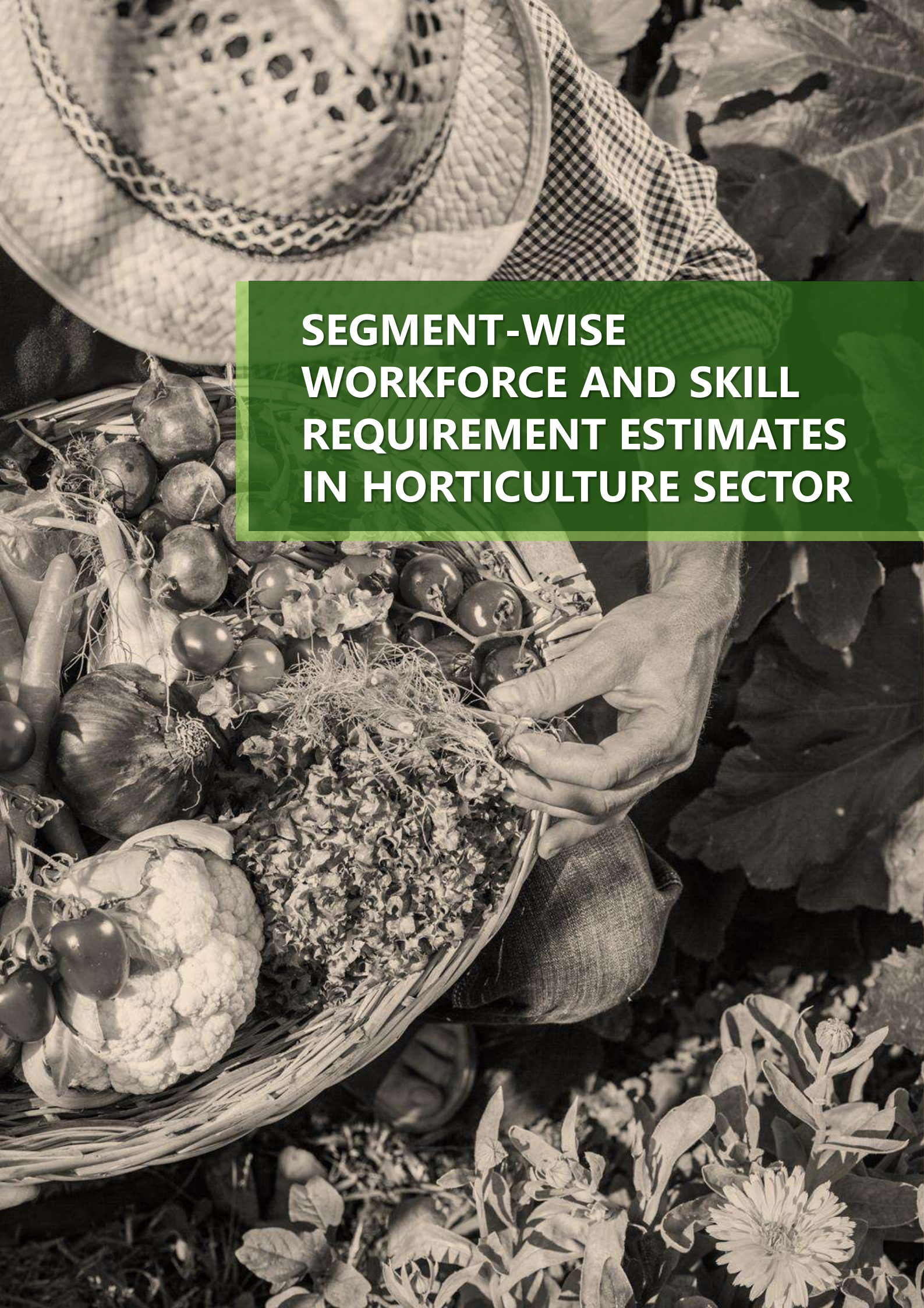
Source: *ASCI analysis*

6.7 Need for Skilling in Horticulture

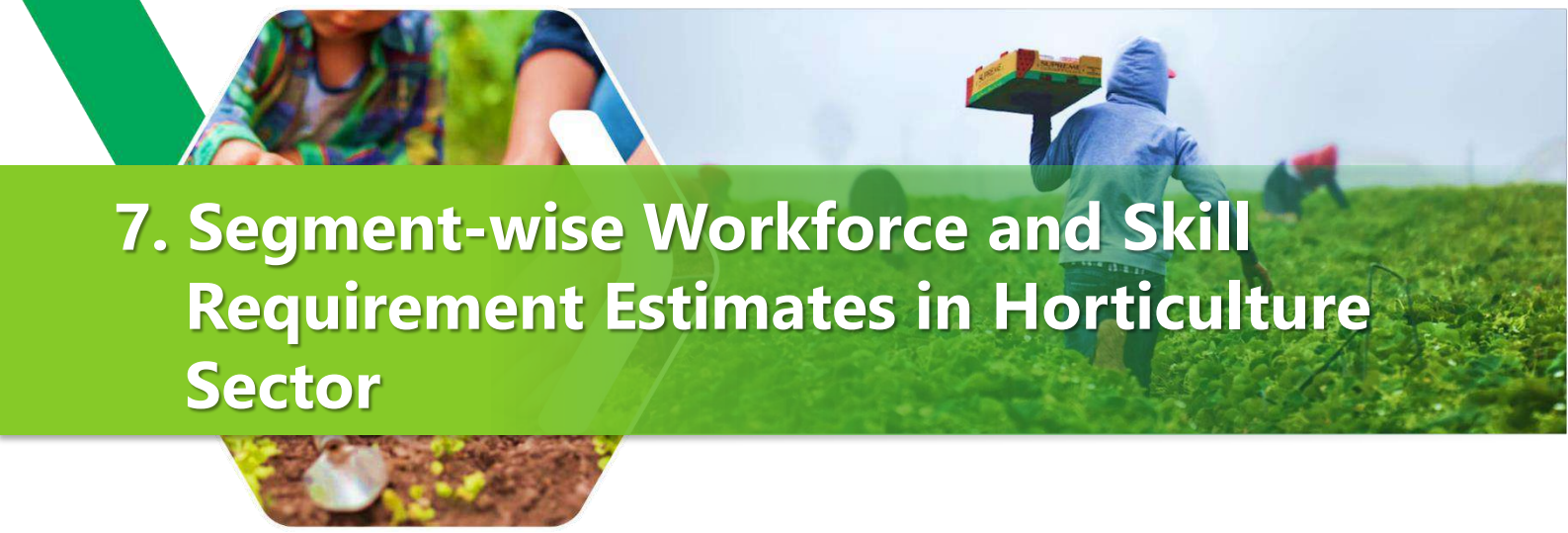
Agricultural and allied sector labour productivity continues to be dismally low on account of a large variety of reasons such as quality of inputs, levels of technology, and constraints in output marketing. It is, therefore, not surprising that young people are disinterested to perform low-paying and hard farm work. One of the strategies is to 'accelerate productivity-enhancing investment in agriculture' in conjunction with the movement of workers 'off the farm elsewhere'. Agricultural production is required to be increased with fewer farm workers to facilitate the movement of workers off the farm. This would reduce the disparity between the wages of farm and non-farm workers.

The Evaluation of CISS schemes by NITI Aayog, 2020 suggested conducting more field demonstration activities, hands-on-training and establishment of commercial models to encourage to take up GAP, improve technical and business skills and new technologies for adoption among farmers in general and more in the tribal/ aspirational districts to increase farmers' participation in respect of MIDH scheme. Successful small and marginal farmers can be used as resource persons to encourage and motivate others to take up horticulture. The important issue highlighted by the report is 'low awareness about the training programmes and other benefits of the scheme' and there is a need for awareness generation about the scheme. It is suggested to impart specific training on gender awareness under the MIDH scheme for encouraging the involvement of women beneficiaries. The FICCI and Yes Bank report, 2021, suggested skilling by linking farmers to agricultural technology and information through ICT; promoting further decentralization and autonomy to reorient ATMA/KVKs towards action-oriented extension programs through synergy between ATMA and KVKs; encouraging market-led extension activities focusing on value addition opportunities to curb post-harvest losses, district level skill mapping to map the demand for and supply of skills in agriculture at the district level, and coordinate with skill development missions to impart the required skills to farmers and agricultural labour.

The horticulture sector is widely believed a promising area that provides the opportunity for improving farm incomes, opens-up up diversification with high-value crops, provides health and nutritional security, generation of employment, enhances export earnings and helps in ecological sustainability. in the past two decades, there was a remarkable achievement due to advancements in various production methods and technologies which resulted in a change in cultivation methods, the use of high-yielding and disease-resistant varieties, farm machinery and equipment and information technology. In view of the rapidly changing horticulture production ecosystem and to support the evolving horticulture sector, it is necessary for skilling human resources to effectively manage the existing and technological advances across various areas within the sector.



SEGMENT-WISE WORKFORCE AND SKILL REQUIREMENT ESTIMATES IN HORTICULTURE SECTOR



7. Segment-wise Workforce and Skill Requirement Estimates in Horticulture Sector

7.1 Workforce in Various Segments of Horticulture Cultivation /Production Activities:

The estimated workforce (ps+ss) under each category of the horticulture sector as per PLFS surveys is given below in Exhibit.20 from 2017-18 to 2020-21. Out of the total agricultural workforce, about 8.62% belong to the horticulture sector. Within the horticulture sector, the highest percentage of the workforce is working in fruit crops followed by vegetable crops in 2020-21. Whereas, it was just the reverse in the year 2017-18. Over all workforce in horticulture has reduced from 12.49% in 2017-18 to 8.62% in 2020-21. The workforce in the horticulture segments of Plant Propagation, Processing and preservation of fruits and vegetables, and growing of non-perennial crops (rose, gladiolus and others), is more or less stable. The reduction is more drastic in the workforce of vegetable cultivation and the workforce has marginally increased in respect of fruit crops which might be due to a special focus on orchards and the expansion of area under fruit crops.

Exhibit.20. Estimated working persons under usual status (ps+ss) in Horticulture Sector

S. No	2008 NIC Codes	Type of work (code description)	Percent distribution and number of estimated working persons (ps+ss) under each category of Horticulture							
			2017-18		2018-19		2019-20		2020-21	
		Name of the workforce	%	Number	%	Number	%	Number	%	Number
i	113	Growing of vegetables, melons, roots and tubers	3.3	12296453	3.24	12330462	1.47	6273197	1.68	7350682
ii	119	Growing of flowers (non-perennial crops – rose, gladiolus and other flowers)	0.19	707978	0.32	1217823	0.18	768147	0.14	612557
iii	12	Growing of Fruit crops, nuts, beverage crops, Spice, aromatic, pharma crops	1.86	6930728	1.87	7116655	1.81	7724141	2.03	8882074
a	121	Growing of grapes	0.05	186310	0.09	342513	0.04	170699	0.04	175016
b	122	Growing of tropical and sub-tropical fruits	0.24	894288	0.33	1255880	0.30	1280244	0.3	1312622
c	123	Citrus fruits	0.06	223572	0.06	228342	0.07	298724	0.06	262524
d	124	Pome and stone fruits	0.17	633454	0.12	456684	0.11	469423	0.12	525049

S. No	2008 NIC Codes	Type of work (code description)	Percent distribution and number of estimated working persons (ps+ss) under each category of Horticulture							
			2017-18		2018-19		2019-20		2020-21	
		Name of the workforce	%	Number	%	Number	%	Number	%	Number
e	125	Growing tree and bush fruits	0.21	782502	0.17	646969	0.20	853496	0.21	918835
f	126	Oleaginous crops (Coconut, Olive, Palm)	0.16	596192	0.24	913368	0.18	768147	0.19	831327
g	127	Beverage (Tea, Coffee, Cocoa) crops	0.52	1937623	0.35	1331994	0.35	1493618	0.47	2056441
h	128	Growing of spices, aromatic, drug and pharmaceutical crops	0.28	1043335	0.3	1141709	0.33	1408269	0.38	1662654
i	129	Growing of rubber, bamboo and cane	0.17	633454	0.21	799197	0.23	981521	0.26	1137606
iv	13	Plant Propagation	0.05	186310	0.05	190285	0.02	85350	0.03	131262
v	1030	Processing and preservation of fruits and vegetables	0.04	149048	0.04	152228	0.02	85350	0.05	218770
vi	163	Post-harvest crop activities	0.05	186310	0.02	76114	0.04	170699	0.03	131262
vii	813	Landscape care and maintenance service activities	0.02	74524	0.02	76114	0.04	170699	0.05	218770
A		No of Total workforce under all groups of Horticulture (i+ii+iii+iv+v+vi+vii)		20531351		21159681		15277582		17545378
B		No of Total estimated workforce in India (PLFS surveys)		372619800		380569800		426748100		43,75,40,600
C		% Agricultural workers (PLFS surveys) in total workforce		44.1		42.5		45.6		46.5
D		Number of workers in Agriculture (BxC/100)		164325332		161742165		194597134		203456379
E		% Horticulture Workforce in agricultural workforce (A/D*100)		12.49		13.08		7.85		8.62

Source : *Data from PLFS surveys of various years and Analysis by ASCI*

Calculation : *The % of workers under A and total estimated workforce (B) taken from PLFS survey.*

Number of workers for various segments of Horticulture = % of workers at each type at A x Total estimated workers at B

7.2 Workforce in Horticulture Processing Industry and Their Skill Level

The Annual Survey of Industries (ASI) indicate that there are 1298 operational manufacturing units under the segment of 'processing of fruits and vegetables in 2019-20 as against 1254 in the year 2016-17 (Exhibit.21). A total of 77810 persons engaged in the fruits and vegetables processing sector in 2019-20 and out of this 75.84% are workers and 9.79% are Supervisory and managerial personnel and rest (14.05%) are in other roles. These product units grew with an average growth rate of 0.88%, while the growth rate in the workforce (employment) is @ -0.82% between 2016-17 to 2019-20 and the corresponding growth rate for the period 2013-14 to 2019-20 is at 2.5% for factories and 4.6% for the workforce. The growth rate of workers is less than that of managerial personnel (Exhibit.21).

Exhibit.21. Workforce in Processing of Fruits and Vegetables Industry (In numbers)

S. No.	Particulars	Years					Average growth rate from	
		2019-20	2018-19	2017-18	2016-17	2013-14	2013-14 to 2019-20	2016-17 to 2019-20
A	Factories							
1	Number of factories	1298	1240	1256	1254	1101	2.5	0.88
B	Total Persons engaged	77810	74240	77989	80440	58331	4.6	-0.82
1	Workers	59011	56858	61860	65853	45924	3.9	-2.60
1.1	Directly Employed	28170	26236	26827	27607	24406	2.1	0.51
	Men	18404	17607	17193	17396	16107	2.2	1.45
	Women	9766	8629	9634	10211	8299		
1.2	Employed through contractors	30841	30622	35039	37976	21519		
2	Employees other than workers	18555	17093	15855	14390	12029	7.8	7.24
2.1	Supervisory and Managerial	7619	6875	6308	6089	5538	6.3	6.28
2.2	Other employees	10936	10218	9547	8301	6491	8.8	7.94
3	Unpaid family members/ proprietors, etc.	245	288	268	468	378		
C	Percentage of various categories of workforce to total workforce							
1	% Workers to total workforce	75.84	76.59	79.32	81.87	78.73		
2	% Supervisory and managerial workforce	9.79	9.26	8.09	7.57	9.49		
3	% Other employees	14.05	13.76	12.24	10.32	11.13		
4	% contract workers to workers	52.26	53.86	56.64	57.67	47.66		

Source : *Data from ASI of various years and Analysis by ASCI*

As per the MoFPI report on human resources and skill requirements, there are 62% of contract employees and 32% permanent employees. The ASI survey reports indicate that the number of contractual workers to total workers is about 52%. There are operator level employees @71%, top management @9%, middle management @3% and lower management or supervisory are 17%. Here the percentage of top management is on the higher side due to the nature of units which are more under small categories rather than under medium or large categories. These are more or less corroborating with those of ASI data (Exhibit.20). The analysis of the per cent distribution of the workforce as per the job profiles, their education level and experience are furnished below in **Exhibit.22.**

The personnel (workers + managerial) in the fruits and vegetable processing sector is highest in Maharashtra (14480) followed by Tamil Nadu (9978), Punjab (9819), Karnataka (7638), Gujarat (7385), Andhra Pradesh (6700), Uttar Pradesh (3359), Uttarakhand (3258), Haryana (2749) and Madhya Pradesh (2023) which contributes to 87% of the employment (state-wise data in Annexure. II). The location of units is more related to business (near domestic consumers/markets and easy access to exports), other infrastructure and the incentives of the corresponding states.

Exhibit.22. Workforce distribution in Fruits and vegetables processing units and education level

S. No.	Particulars of Workforce	Details of workforce	% Workforce to total workforce in Dairy manufacture*	Education level	Experience
1	Top Management	Head of the unit, Senior Plant manager	9	UG (Agriculture, horticulture, Food Tech) with MBA	Experience of 10 years for large plants and 3-5 years for medium /small units
2	Middle management	Procurement, Production, Quality control, accounts and finance, sales & marketing R&D in big plants	3	UG (Agriculture, horticulture, Food Tech) with or without MBA, CA for accounts	Experience of 8-10 years for large plants and 3-5 years for medium and small units
3	Lower management	Sourcing, Line in-charges/ supervisors of various products, Quality analysts, Filed supervisors, area sales	17	Diploma/ITI	3-4 years' experience in industry
4	Operator-Level Employees	Total operator level	71		
		Loader and Unloader	16	10-12th or less	1-2 years' experience in industry
		Helpers	17	10-12th or less	
		Cleaning and pre-processing	10	Diploma/ITI	
		Processing	43	Diploma/ITI	
		Packing	9	10-12th or less	
		Supervisor	5	Diploma/ITI	

Source : **Data from "Study to assess Human Resource and Skill Requirement in the Food Processing Sector from 2021- 2030" of MoFPI and analysis by ASCI*

7.3 Estimates of Skilling Requirement

The PLFS data on the workforce in respect of horticulture are categorised under various sub segments such as "Growing of vegetables, melons, roots and tubers; Growing of non-perennial crops – rose, gladiolus and other flowers; Growing of Fruit crops, nuts, beverage crops, Spice, aromatic, pharma crops (grapes, tropical and sub-tropical fruits, Citrus fruits, Pome and stone fruits, tree and bush fruits, Oleaginous crops -Coconut, Olive & Palm, Beverage (Tea, Coffee, Cocoa) crops, Growing of spices, aromatic, drug and pharmaceutical crops); Growing of rubber, bamboo and cane; Plant Propagation; Processing and preservation of fruits and vegetables and Post-harvest crop activities and the number of workers year-wise are presented at Exhibit.19 at previous section. Skilling requirements are estimated based on the data of these sub-segments. As mentioned in previous paragraphs, the growth rate in the workforce in respect of vegetables reduced over the years, under fruit crops it increased and remained more or less stable in other segments. It is observed from the trend that the overall workforce in horticulture is reducing gradually from 2017-18 to 2020-21 except in the growing of fruit crops. Even during the COVID period also it is in reducing mode only unlike other agricultural activities where the workforce increased during the COVID period. As the workforce is withdrawing from the sector, it is very essential to develop the skills of the farmers, farm workers, youth and women in order to enhance the production and productivity of horticulture produce to meet the growing requirements. The segment-wise skill requirements aligned with ASCI job roles and QPs are as under:

7.3.1 Growing of Vegetables, Melons, Roots and Tubers

The job roles /QPs of ASCI related to growing of vegetables, melons, roots and tubers are:

- Bulb Crop Cultivator - onion and garlic, etc.
- Solanaceous Crop Cultivator – Tomato, Brinjal, Chilli
- Chillies Cultivator
- Tuber Crop Cultivator – Potato, cassava, sweet potato, Yam, yam bean, arrow root , etc.
- Vegetable Grower

The PLFS survey NIC 2008-4 digit code data of workforce in this category of 'growing of vegetables, melons, roots and tubers' in the year 2020-21 was 7350682 workers as against 12296453 in 2017-18. The area, production, percentage of each crop to total vegetables and proportionate workforce is furnished below. The number of workers working under various vegetable crops is calculated from the workforce under vegetable production which is = Workforce under total vegetables production x % of cropped area of specific vegetable/100.

Exhibit.23. Estimate of Workforce under each Vegetable crop

Area in 000' ha and production in 000'MTs

S. No	Name of the crop	Crop-wise Vegetables Production						Proportion (%) of crop to total vegetables		Crop-wise Workforce engaged (no.s)
		2018-19		2019-20		2020-21		2020-21		
		Area	Production	Area	Production	Area	Production	Area	Production	
1	Beans	236	2356	239	2269	219	2169	1.69	0.87	124443
2	Bitter gourd	99	1205	107	1268	101	1174	0.78	0.47	57392
3	Bottle gourd	187	3011	189	3106	187	3165	1.45	1.27	106260
4	Brinjal	727	12680	744	12682	758	13154	5.86	5.29	430722
5	Cabbage	400	9127	401	9272	404	9586	3.12	3.85	229567
6	Capsicum	34	497	34	534	35	560	0.27	0.23	19888
7	Carrot	109	1893	105	1828	105	1865	0.81	0.75	59665
8	Cauliflower	465	9083	467	8941	463	9038	3.58	3.63	263093
9	Cucumber	105	1588	112	1656	109	1664	0.84	0.67	61938
10	Chillies green	377	3783	387	4119	399	4393	3.08	1.77	226726
11	Elephant Foot Yam	33	817	31	724	36	941	0.28	0.38	20456
12	Mushroom		182		211		243	0.00	0.10	0
13	Okra	513	6176	521	6355	532	6513	4.11	2.62	302301
14	Onion	1220	22819	1431	26091	1654	26916	12.79	10.82	939860
15	Parwal	55	757	59	754	61	794	0.47	0.32	34662
16	Peas	552	5562	568	5848	573	5823	4.43	2.34	325598
17	Potato	2173	50190	2051	48562	2250	53687	17.39	21.58	1278528
18	Radish	200	3143	207	3184	205	3239	1.58	1.30	116488
19	Pumpkin/ kaddu	94	2043	104	2183	105	2265	0.81	0.91	59665
20	Sweet Potato	2173	50190	2051	48562	2250	53687	17.39	21.58	1278528
21	Tapioca	163	4976	173	6060	163	5479	1.26	2.20	92622
22	Tomato	781	19007	818	20550	852	21003	6.59	8.44	484136
23	Others	1441	21118	1453	20945	1475	21390	11.40	8.60	838146
24	Total Vegetables	12137	232203	12252	235704	12936	248748	100	100	7350682

Source : *Data from Horticulture advanced estimate 2021-22, MoAFW and analysis by ASCI team, Workforce under each vegetable production = Workforce under total vegetables production x % of cropped area of specific vegetable/100*

The job role-wise skill requirement is estimated as given below and furnished in Exhibit.23. The workforce is withdrawing from the horticulture sector and more specifically from the production of vegetables, it is very essential to develop the skills of the farmers, farm workers, youth and women in order to enhance the production and productivity of horticulture produce to meet the growing requirements. Skilling the new entrants into vegetable production, progressive farmers and unemployed rural youth to a maximum extent is also possible in this way. Therefore, it is proposed to cover 1% of the workforce crop-wise or subsegment-wise for skilling. in subsequent years, it is proposed to cover 1.05 times (@5% more) the candidates in the previous year. A special preference will be given to women candidates also as they stay in villages looking after land if male members leave for work in urban areas or nearby towns. The skill requirement estimation also covers the one district one product programme also as per the product related to vegetable crops. Skilling requirements are aligned with ASCI job roles and QPs which are as under:

Exhibit.24. Skilling requirement in production of vegetable crops

S. No.	Job role	Crops included	Work force under Vegetables (2020-21)	Skilling @ 1% of work-force	Personnel to be skilled in each year with increase at 5% over previous year				
				2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Bulb Crop Cultivator	Onion and garlic, etc.	939860	9399	9869	10362	10880	11424	11995
2	Solanaceous Crop-cultivator	Tomato and Brinjal	914858	9149	9606	10086	10591	11120	11676
3	Chillis Cultivator	Chillis - green	226726	2267	2381	2500	2625	2756	2894
4	Tuber Crop Cultivator	Potato, tapioca, sweet potato, Yam	2649678	26497	27822	29213	30673	32207	33817
5	Vegetable Grower	All vegetables other than tuber crops, solanaceous and chillis	2619560	26196	27505	28881	30325	31841	33433
6	Total	of 1 to 5	7350682	73507	77182	81041	85093	89348	93815

Source : *Workforce calculated as given at Exhibit.22 (crop wise and for Vegetable grower = Total workforce under vegetable crops – workforce at s.no 1 to 4) and ASCI analysis*

7.3.2 Growing of Flowers Crops

The workforce under the category of flowers increased during the pre-covid period reaching a level of 217823 in 2018-19 and later reduced to 612557 in 2020-21 (PLFS surveys). During the stakeholder discussion also, the experts have expressed that the workers who left during covid didn't return fully and they are managing with available labour. The production is also more or less stagnated during the last 2 years and the area under flower cultivation is around 315 thousand ha and production is around 2900 thousand MTs (Advanced estimates horticulture 2021-22, MoAFW). In India, nearly 98.5% of flowers are grown under open cultivation while around 1.5% are grown under greenhouse cultivation and the area under floriculture doubled in the last 15 years and tripled in production with a CAGR of 10%. However, the COVID period is an exception. in India, nearly 75 per cent of the area under floricultural crops is concentrated in the states of Tamil Nadu, Karnataka, Andhra Pradesh, West Bengal, Maharashtra, Haryana, Uttar Pradesh, etc. Global demand for floricultural products is growing at a faster rate and India has a wide scope to bridge the gap between demand and supply. India is enriched with diverse agro-climatic conditions and is suitable for growing a variety of flower plants throughout the year. Floricultural crops are highly labour-intensive and have the potential for the generation of gainful employment. The average labour requirement per ha is around 3 workers either family labour or hired labour.

Every year additionally 10000 to 12000 ha are coming under floriculture, and the additional employment generated is around 30000 to 35000. Hence, the workforce to be skilled are equivalent to additional employment generated as floriculture is skill oriented and in subsequent years the growth rate applied is @ 5 % (Exhibit.25). Equivalent workforce is considered for flower handling and packaging. There are around 4000 florists in cities like Delhi, Mumbai and Chennai and 2500 Florists in cities like Hyderabad, Bangalore, etc. and there are around 100000 professional florists in India (Justdial.com) and it is assumed that about 5 % of it i.e 10000 are added additionally. Florists are required more in metro cities, state capitals and tier-II cities due to the high concentration of customers and changing lifestyles which is increasing flower consumption in one or another fashion.

Exhibit.25. Estimated Skilling requirement in production of Flower crops (cut and loose)

S. No.	Job role	Crops included	Incremental workforce added / year	Personnel to be skilled in each year (number)					
				2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Floriculturist-Open Cultivation and Floriculturist-Protected Cultivation	Cut and loose	30000	30000	31500	33075	34729	36465	38288
2	Flower Handler-Packaging, Palletising, drying and others		30000	30000	31500	33075	34729	36465	38288
3	Florist		10000	10000	10500	11025	11576	12155	12763
4	Total			70000	73500	77175	81034	85085	89340

Source: *Analysis by ASCI, Skill requirement in initial year = incremental workforce added per annum and in later years Skill requirement is 5% higher on the previous year.*

7.3.3 Growing of Fruit Crops, Nuts, Beverage Crops, Spice, Aromatic, Pharma Crops

The PLFS data classified fruits crops, nuts, beverage crops, spices, medicinal and aromatic plants under NIC 2008 code 012 with subcategories i.e Grapes, tropical and subtropical fruits, citrus fruits, pome fruits, beverage crops, etc. (Exhibit.20). The skilling requirement is estimated from the workforce data under each sub-segment and relevant ASCI Job roles. The methodology of estimation of skill requirement is as under and estimated provided at **Exhibit.26:**



- The data on segment-wise workforce involved in the growing/production of fruit crops, nuts, beverage crops, Spice, aromatic, and pharma crops are collected from PLFS surveys from 2017-18 to 2020-21 (Exhibit.20).
- Based on this data, calculated average incremental workforce added per annum.
- Then calculated average growth rate at which workforce is added per annum.
- The average incremental workforce added is taken as a skill requirement for the first year and a growth rate @ 8 % is applied to it to arrive at the skilling requirement in subsequent years (as the workforce under overall fruit crops growing at 8%)

From the workforce data, however, it is observed that there is almost stagnation or very lower addition of workers in respect of grapes, pome fruits and beverage crops (tea, coffee and cocoa) and medium level addition in respect of citrus fruits and tree & bush fruits. The addition of incremental workforce is at a higher rate of 10% in respect of tropical & subtropical fruits (Mango, banana, Litchi, Guava, pineapple), Oleaginous- coconut, palm, spices, medicinal and aromatic plants and rubber, bamboo and cane which have commercial importance as well as export potential. There is much disturbance due to COVID in the near past, and the workforce movement is more towards agri and allied activities hence, instead of taking varied growth rates, the growth rate for the overall workforce in fruit crops is taken to estimate skill requirements.

Exhibit.26. Estimated Skilling requirement in production/growing of fruit crops, nuts, beverage crops, Spice, aromatic, pharma crops

S. No.	Job role	Crops included	Incremental workforce added / year (numbers)	Average growth rate (%)	Personnel to be skilled in each year (numbers)					
					2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Vineyard grower Vineyard Worker	Growing of grapes*	17502	8	17502	18902	20414	22047	23811	25716
2	Tropical/Sub-tropical Fruit Grower Mango Grower Banana Farmer	Growing of tropical and sub-tropical fruits – (Mango, banana, Litchi, Guava, pineapple)	139445	8	139445	150601	162649	175661	189713	204890
3	Citrus fruit Grower	Citrus fruits	12984	8	12984	14023	15145	16356	17665	19078
4	Temperate Fruit Grower	Pome and stone fruits – apples, apricots, peaches, nectarines, cherries, Pear, Plum, Kiwis	22788	8	22788	24611	26580	28706	31003	33483
5	Orchard workers	Berries, nuts, and other crops	45444	8	45444	49080	53006	57246	61826	66772
6	Coconut Grower Friends of Coconut Tree Neera Technician	Oleaginous crops (Coconut, Olive, Palm)	78378	8	78378	84648	91420	98734	106632	115163
7	Coffee Plantation Worker Tea Plantation Worker	Beverage (Tea, Coffee, Cocoa) crops	39606	8	39606	42774	46196	49892	53884	58194
8	Spice Crop Cultivator Coriander Cultivator Medicinal Plants Grower Essential Oil Extractor	Growing of spices, aromatic, drug and pharmaceutical crops	84795	8	84795	91579	98905	106817	115363	124592
	Sub-total				440942	476217	514315	555460	599897	647888

Source: *Data from PLFS surveys 2017-18 to 2020-21 and analysis by ASCI Team * Workforce under grapes is reducing over the years and hence took 10% of workforce for skilling.*

7.3.4 Nurseries and Plant Propagation

The perennial horticultural crops have a long gestation period and planting material quality and its effects are known only in later stages. The nurseries exist in government, ICAR, SAUs and under the private sector also. There are just over 100 big nurseries in the country and the number of small and medium-scale nurseries is over 6300 (NHB guidelines on nurseries). At present, only half the demand for planting material is being met by the existing infrastructure. Farmers need good quality certified disease-free planting material of true to type varieties for reasonably good production, productivity and quality of the produce. About 75% of the nurseries are under the private sector in most of the states which lack modern infrastructure such as a greenhouse, mist chamber, efficient nursery tools and gadgets, implements and machinery. There are several constraints in the existing system of plant propagation. Many nurseries follow traditional methods and lack adequate infrastructure and sell plant material of unknown pedigree. The nursery industry needs skilled and semi-skilled manpower/workforce. A small to medium nursery needs 1 Manager with plant propagation knowledge, 2 skilled workers, 2 gardeners, 2 unskilled workers and 5-8 other staff for administration/accounts and sales. The Managerial workforce will be at 5%, skilled workers and gardeners at 35-40% and the rest at 55% for administration/accounts and sales.

The PLFS survey workforce data on plant propagation includes the production of all vegetative planting materials including cuttings, suckers and seedlings for direct plant propagation or to create plant grafting stock into which selected scion is grafted for eventual planting to produce crops. The workforce under plant propagation was 186300 in 2017-18 which raised to 190285 in 2018-19 (PLFS). However, during COVID, the workforce nearly halved to 85350 in the year 2019-20 and later increased to 131262 in 2020-21 and it didn't reach to pre covid levels. To reach pre-COVID levels it may take about 5-6 years if the workforce is increasing on par with fruit crops between 8 to 10%. Hence, the incremental workforce added is taken @ 10% of the workforce in 2021 i.e 10% of 131262 workouts to 13126 in 2023-24 with a growth rate of 10%.

The incremental workforce added in 2022-23 = 13126

- of this, Managerial @5% = 650 and these are usually horticulture graduates and hence skilled personnel are available.
- Skilled workers @ 20% = 2625
- Skilled Gardeners @ 20% = 2625
- in subsequent years it assumed to grow the workforce @ 10% per annum.

Exhibit.27. Estimated Skilling requirement in Plant propagation

S. No.	Job role	Crops included	Incremental workforce added / year (numbers)	Average growth rate (%)	Personnel to be skilled in each year (numbers)					
					2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Gardener cum Nursery Raiser	Plant propagation of all crops	2625	10	2625	2888	3176	3494	3843	4227
2	Nursery Worker		2625	10	2625	2888	3176	3494	3843	4227
	Sub-Total		**5250**		**5250**	**5775**	**6353**	**6988**	**7687**	**8454**

Source: *Sources : ASCI Analysis*

7.3.5 Landscape Care and Maintenance Service Activities

Landscape gardening is an aesthetic branch of horticulture and becoming a vital part of society. It deals with the application of various garden forms, styles, methods and materials with a view to improving the landscape. In recent years, landscape gardening is rapidly developing due to the emphasis of the government on public gardens, the importance of it in gated communities, changing attitudes of people towards ornamental plants and flowers, and so on. Landscape designers use a design process that systematically considers all aspects of the land, environment, growing plants, and needs of the user to ensure a visually pleasing and ecologically healthy design. The data of PLFS surveys shows that the workforce in landscaping care and maintenance services is increasing rapidly from 74524 in 2017-18 to 170699 in 2019-20 to 218770 in 2020-21. PLFS survey covers sample households and their economic activity and the survey indicated that 76.3% were self-employed (Own account employer along with unpaid helper in household enterprise), 1.3% were regular wage workers and 22.6% are casual labourers in agriculture. The stakeholder discussion indicates that the managerial/supervisory strength will be at 6-8%, skilled workers are around 15-20%, gardeners are at 15-20% and unskilled labour at 15% and the rest are in admin/accounts and sales. Accordingly, the skill requirement among the incremental workforce is worked out and the methodology is as under:

- The incremental workforce is the average addition of the workforce under the plant propagation category of PLFS surveys from 2017-18 to 2020-21. The incremental workforce is 48082.
- The growth rate assumed is 10% per annum in tandem with the overall horticulture growth rate for the estimation of skill requirements in subsequent years.
- Of the incremental workforce added, the category-wise proportion is @ 5% for horticulture supervisors, 10% each for the gardener, rooftop gardener, Interior landscaper and 5% for heritage gardener and 20% each for Asst gardener, Assistant interior landscaper and Assistant grounds keepers.
- The incremental workforce added is 48082 which is allocated as per the proportion indicated at point 'c' above.

Exhibit.28. Estimated Skilling requirement in Plant propagation

S. No.	Job role	Crops included	Incremental workforce added / year (numbers)	Average growth rate (%)	Personnel to be skilled in each year (numbers)					
					2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Horticulture Supervisor	Design and implementation of Lawns, turf, rooftop/ terrace gardening, kitchen gardening, vertical gardening	2404	10	2404	2645	2909	3200	3520	3872
2	Gardener		4808	10	4808	5289	5818	6400	7040	7744
3	Assistant Gardener		9616	10	9616	10578	11636	12799	14079	15487
4	Rooftop Gardener		4808	10	4808	5289	5818	6400	7040	7744
5	Interior Landscaper		4808	10	4808	5289	5818	6400	7040	7744
6	Assistant Interior Landscaper		9616	10	9616	10578	11636	12799	14079	15487
7	Assistant Grounds keeper		9616	10	9616	10578	11636	12799	14079	15487
8	Heritage Gardener		2404	10	2404	2645	2909	3200	3520	3872
	Sub-Total		**48082**		**48082**	**52890**	**58179**	**63997**	**70397**	**77437**

Source: *Analysis*

7.3.6 Hi-Tech Horticulture - Protected Cultivation, Hydroponics, Plant Tissue Culture Technician

Protected cultivation is the new technology for the cultivation of horticultural crops, especially flowers, exotic fruits and vegetables in India. It was introduced in the 1990s on an experimental basis and later expanded rapidly. Greenhouse/poly house/net houses are the most common and commanding technology under varying climatic conditions for round the year vegetable and flower production. It is also used for virus-free seedlings/planting and hybrid seed production. However, The technology requires vigilant planning, awareness and skill about cultivation practices, time-line of production, harvest time to coincide with high market prices, and choice of varieties adopted. Protected cultivation needs basic components i.e infrastructure (engineering aspects of installation, repairs, maintenance) and production technology (varieties, production protocols and package of practices) of crops. The government of India is promoting protected cultivation through the MIDH scheme and providing a financial incentive to farmers.

The area covered under protected cultivation in India is 2.31 lakh ha as of 2018 (MIDH progress at its website) and every year 28000 to 35000 ha are brought under protected cultivation (Impact evaluation of NHM, 2020).

The area under fruits, vegetables, flowers and nurseries is 1%, 60%, 24% and 15% respectively. The technology needs higher labour requirements (Paramvir Singh et al., 2020) also and the per unit labour (skilled & unskilled) requirement of a greenhouse cultivated area (10 men/ha) is more than field cultivation (1man/ha). During discussions with stakeholders, they have expressed that it is labour-intensive and needs skilled labour. About 2-3 skilled workers, 2-3 normal workers and a horticulturist are working at the 4000 sqm polyhouse/greenhouse. The same norms are proposed to estimate the skill requirement which is as under:

- The new area under protected cultivation per annum – 28000 ha. with an annual growth rate of 10%
- The number of horticulturists for protected cultivation required per annum with expansion in area is @ 1 per ha i.e 1 x 28000 = 28000
- The number of Floriculturists for protected cultivation required per annum with expansion in area is @ 1 per ha and 24% of existing protected cultivation is under flowers i.e 1 x 28000 x 24% = 6720
- Hydroponics is a recent new technology and hence 1 per district thus the requirement for Hydroponics Technicians is 700 per annum.
- Protected cultivation worker @ 2 /ha and requirement would be 2 x 28000 =56000

Exhibit.29. .Estimated Skilling requirement in Protected cultivation

S. No.	Job role	Crops	Incremental workforce added / year (numbers)	Average growth rate (%)	Personnel to be skilled in each year (numbers)					
					2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Horticulturist -Protected Cultivation	Vegetables (Sweet Pepper, Tomato, Cucumber & Leafy, berries) and flowers	28000	10	28000	30800	33880	37268	40995	48315
2	Floriculturist – Protected cultivation	Flowers (Anthurium, Rose, Gerbera, Carnation & Orchids)	6720	10	6720	7392	8131	8944	9839	10823
3	Hydroponics Technician	Vegetables, fruits & flowers	700	10	700	770	847	932	1025	1127
4	Protected cultivation worker	Vegetables, fruits & flowers	56000	10	56000	61600	67760	74536	81990	90189
	Sub-Total		**93420**		**93420**	**102762**	**113038**	**124342**	**136776**	**150454**

Source: *Analysis*

7.3.7 Post-Harvest Management

Post-harvest management is one of the important aspects of the horticulture sector in order to reduce post-harvest quantity losses and retain the freshness/quality of the produce. Strengthening the integrated cold chain will reduce post-harvest losses, add to farmers' income, stabilise prices, and create near-farm jobs and quality products for consumers. The NABCONS cold storage study 2015, indicated that there is a gap of 99.6% in pack-house capacity, a gap of 85% in reefer vehicles, a gap of 91% in ripening chambers and only 10% in cold storage.

There is a need for 69831 packhouses, 52826 reefer vehicles, 8319 ripening chambers and 32.76 lakh MT cold storage space. Accordingly, the MoAFW has encouraged the setting-up of post-harvest infrastructure for horticulture produce and cumulatively 78776 PHM units were established by 2017-18. Together on average 20700 packhouses, 101 pre-cooling units, 4421 cold storages with 3.5 lakh MT, 443 ripening chambers, 4257 primary processing centres and 12568 low-cost onion storages (3.14 MT capacity) are established per annum. The same is used for the estimation of skilling needs in post-harvest management and assumptions are as under:

- **Cold storage:** On average around 4500 cold storage with an average capacity of 5000 MT are added every year under various schemes such as NHM, NHB and others. Each cold storage needs a Manager, 2 Supervisors, and 3-5 Cold storage keepers (skilled workers) and accordingly, incremental manpower is added every year. The incremental workforce added is 4500 managers, 9000 supervisors, 13500 skilled workers/keepers and 4500 technicians.

- **Packhouse:** On average around 20700 packhouses are added. About a supervisor and 2 skilled workers are needed for the operation of it. Hence, the incremental workforce added per annum are 20000 supervisors and 40000 workers in packhouse operations. These workers will be skilled in quality aspects such as cleaning, grading, sorting and testing also will be covered.

- **Ripening chambers:** About 400 ripening chambers are added per annum which needs a supervisor and 2 skilled workers. Hence 800 operators/workers are needed.

- Reefer vehicles 200 and 4257 primary processing units are added every year. About 112568 onion storages were added per annum, Accordingly, pooled skilled workers of about 5000 per annum were needed as supply chain field assistants and about 5000 farmers were trained in onion storage.

Exhibit.30. Estimated Skilling requirement in Post-Harvest Management

S. No.	Job role	Incremental workforce added / year (numbers)	Average growth rate (%)	Personnel to be skilled in each year (numbers)					
				2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Cold Store Technician	4500	5	4500	4725	4961	5209	5470	6017
2	Cold Storage Manager	4500	5	4500	4725	4961	5209	5470	6017
3	Cold Storage Supervisor	9000	5	9000	9450	9923	10419	10940	12034
4	Cold Store Keeper	13500	5	13500	14175	14884	15628	16409	18050
5	Packhouse Worker/supervisor	40000	5	40000	42000	44100	46305	48620	53482
6	Ripening Chamber Operator	800	5	800	840	882	926	972	1069
7	Supply Chain Field Assistant	5000	5	5000	5250	5513	5788	6078	6686
8	Onion storage for farmers	5000	5	5000	5250	5513	5788	6078	6686
	Sub-Total			**82300**	**86415**	**90736**	**95273**	**100036**	**110040**

Source: *Analysis*

7.3.8 Other Activities of Horticulture Sector

Other activities include Beekeeper @ 10000 (bee mission targeted 500 trainings with 20-25 members /batch), Mushroom Grower @2 per district, Vermicompost Producer (@10-15 per district workout to 10000 and Makhana Grower cum Processor. With respect to tissue culture, the major activity is in the state of Maharashtra and Karnataka where mostly bigger units are operating. The bigger units are providing the skill training as per the protocols of tissue culture labs and inducting on the job. The smaller units would be around 50 in the country who are facing a problem. New units are hardly a few @ 5 per annum. Therefore 20 persons per unit workout to 200 is considered an incremental requirement. The skilling needs in this area are :



Exhibit.31. Estimated Skilling requirement in Other Activities of Horticulture Sector

S. No.	Job role	Assumptions per year (numbers)	Average growth rate (%)	Personnel to be skilled in each year (numbers)					
				2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Bee keeper	10000	5	10000	10500	11025	11576	12155	13371
2	Mushroom grower	1500	5	1500	1575	1654	1736	1823	2005
3	Vermi-compost Producer	10000	5	10000	10500	11025	11576	12155	13371
4	Plant Tissue Culture Technician	200	5	200	210	221	232	243	267
5	Makhana Grower cum Processor	1000	5	1000	1050	1103	1158	1216	1338
	Sub-Total			**22700**	**23835**	**25027**	**26278**	**27592**	**30351**

7.3.9 Skill Requirement in Upcoming Fields and Advanced Technologies

- **Organic farming:** The government of India as well as state governments are emphasising organic/natural farming of all horticulture produce. Organic/natural product is good for the environment as well as the health of human beings. Therefore, 5 per district would work out to 3500 (700 x 5) for skilling.

- **Farmers collectives:** The role of cooperatives and FPOs in the horticulture sector is provided in para 1.5. As per NABARD (nabfpo) about 2065 FPOs are formed and of these 15% are horticulture FPOs. The government of India has given emphasis on the organization of Farmer producer organisations (FPOs) with a target of 10,000 farmer producer organisations by 2023-24 (GOI, 2020 budget). The farmer's collectives have done well during COVID by directly marketing their produce. Many FPOs and cooperatives are involved in post-harvest management, marketing and provision of inputs. During discussions, they indicated that they need skill training in PHM, residue management, documentation, profitability, general management, etc. Thus, there is a scope for the formation of FPOs in the sector to the tune of 500 - 700 FPOs/per annum. The estimated skill requirement in FPOs is 500 x 5 persons/FPO/year=2500

- **Drones:** Drones are used in plant protection, security in bigger farms, etc. The skill requirement in IoT and Drones would be @ 2 per district = 700x 2= 1400 per annum.

Exhibit.32. Skill requirement in upcoming fields and advanced technologies

S. No.	Job role	Skill Requirement (In Numbers)					
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	FPO management	2500	2500	2500	2500	2500	2500
2	Organic/Natural farming under horticulture	3500	3500	3500	3500	3500	3500
3	Drones	1400	1400	1400	1400	1400	1400
4	**Sub-total**	**7400**	**7400**	**7400**	**7400**	**7400**	**7400**

7.3.10 Skill Requirement in Horticulture Processing Sector

About 1298 horticulture processing units operating in India (para 7.2 as per ASI data for 2019-20) with total employees of 77810. The employees at the managerial level are 56244 and the workers are 158363. The growth rate among the workforce is at 5%. Out of the total persons engaged in the processing sector in 2019-20, 75.84% are workers and 9.79% are Supervisory and managerial personnel and the rest (14%) are in other roles. As per the MoFPI report on human resources and skill requirements, there are 62% of contract employees and 32% of permanent employees. The ASI survey reports indicate that the contractual workers to total workers are about 52%. There are operator-level employees @71%, top management @9%, middle management @3% and lower management or supervisory are 17%. Here the percentage of top management is on the higher side due to the nature of units which are more under small categories rather than under medium or large categories. These are more or less corroborating with those of ASI data. The assumptions to estimate the skill required in this segment are as follows :

- **Managerial Level:** The managerial level employee growth rate is irregular and hence took an average of 6 years from 2012 to 2019. Skill requirement in 2023-24 would be assumed as the incremental managerial category employees added every year with a growth rate @ 8% in subsequent years. Generally, the managerial employees belong to Engineering or food technology graduates with or without MBA. Especially in large plants, the employees are experienced people. Thus, they need skill training in management roles, leadership and behavioural aspects, etc. Hence, average incremental employees added are considered for skilling requirements in 2023-24. There onwards applied an 8% growth rate in subsequent years.

- **Workers /Operator Level:** The incremental workers added are considered for skilling in 2023-24 and with a 5 % growth rate in further years. The average growth rate in the worker's category is @ 5%.

The skill requirement estimate in respect of milk processing is furnished below in Exhibit.33

Exhibit.33. Estimated skilling requirement under Horticulture Procurement Segment

S. No.	Particulars of Workforce	Job role	Category-wise % workforce to total	Incremental workforce added/ year (nos)	Growth rate (%)	Skill requirement (in numbers)					
						2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Managerial										
a	Top Management	Plant manager and Sr. Plant manager	9	360	8	360	389	420	453	490	529
b	Lower and Middle management	Personnel looking after Sourcing, Production (Line in-charges/supervisors of various products, Quality analysts) & marketing	20	800	8	800	864	933	1008	1088	1175
2	Total Operator-Level Employees/ workers										
a	Operator-Level Employees/workers	Plant worker (for Loader and Unloader, Helper, Cleaning and pre-processing)	38	1520	5	1520	1596	1676	1760	1848	1940
b		Supervisor	4	160	5	160	168	176	185	194	204
c		Packaging operator	18	720	5	720	756	794	833	875	919
d		Machine operator	5	200	5	200	210	221	232	243	255
	Total					**3760**	**3983**	**4220**	**4471**	**4738**	**5022**

Source: *Data from ASI and Industry and Analysis by ASCI*

Calculation : *Skill requirement = Incremental workforce added with growth rate @ 8% in subsequent years for managerial category and with 5% growth rate workers category.*

7.3.11 Academia and Officials

- **Students:** There are around 12000 seats of horticulture in agri/horticulture universities and private colleges. The students undergo the 'Earn while you learn to programme' and RAWEP programmes. These students can be skilled in new technologies and upcoming technologies as these are not included in the curriculum. Apart from graduate students, school students and vocational students also can be tapped. About 20% of the students can be tapped which workout to 2000 per annum.

- **Faculty:** For advanced technologies, 200 faculty members of these horticulture faculty (@ 1-2/college (2 x 100) need to be trained annually.

- **Horticulture Officials:** Horticulture graduates are employed in different central and state government agencies, banks and development organisations and need to be kept up to date with the changing scenario of horticulture locally as well as globally to exercise their duties effectively. Therefore, it is projected that 500 officers from all over India are trained annually.

7.3.12 Summary of Skill Requirement

The summary of incremental skill requirement/needs in horticulture sector year-wise and job role-wise is furnished below in Exhibit.34:

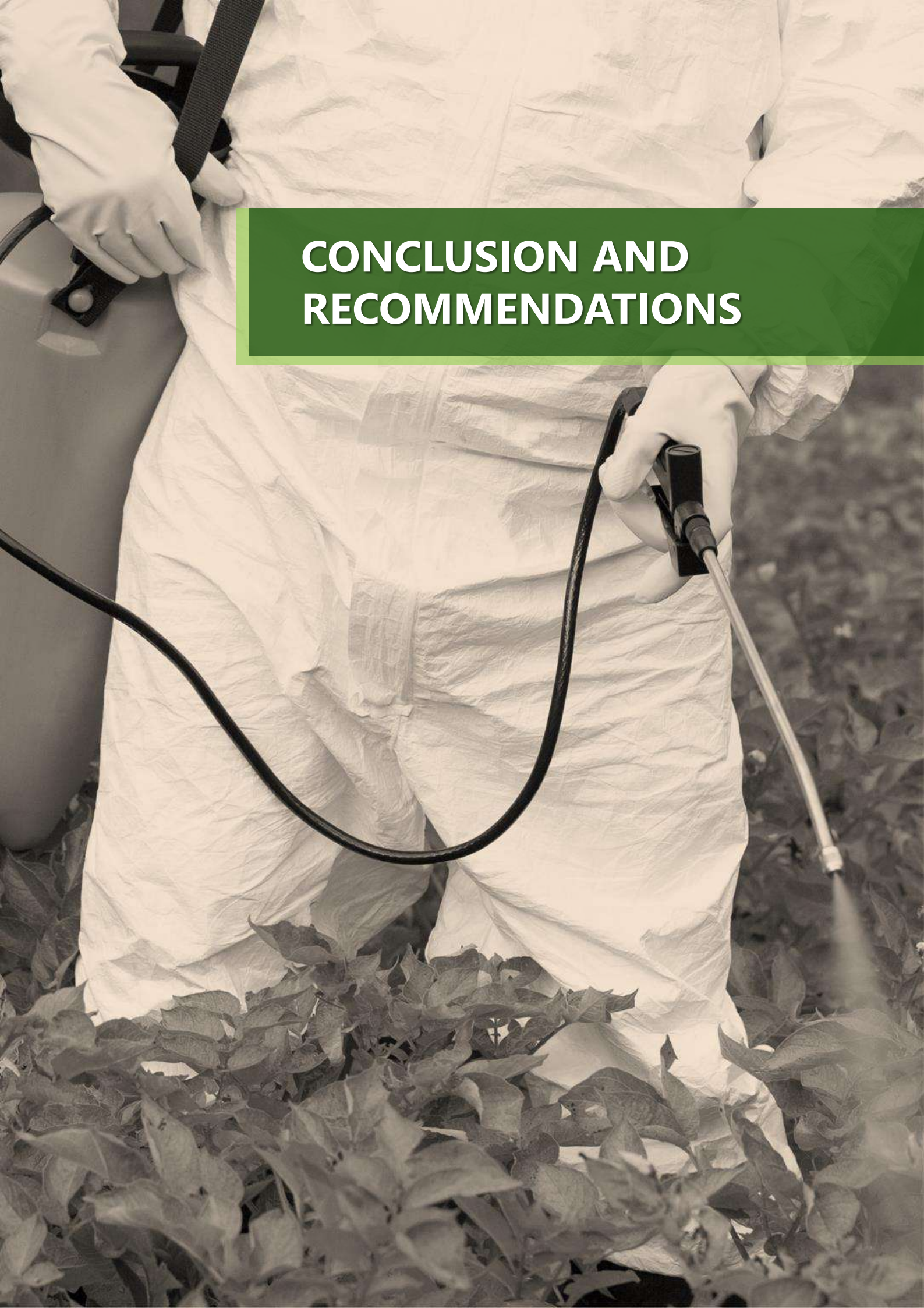
Exhibit.34. Total Estimation of Incremental skilling needs for various activities of Horticulture

S. No.	Job role	Workforce in horticulture to be skilled in each year (In Numbers)					
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
i	Growing / production of vegetable crops						
1	Bulb Crop Cultivator	9399	9869	10362	10880	11424	11995
2	Solanaceous Crop Cultivator	9149	9606	10086	10591	11120	11676
3	Chillies Cultivator	2267	2381	2500	2625	2756	2894
4	Tuber Crop Cultivator	26497	27822	29213	30673	32207	33817
5	Vegetable Grower	26196	27505	28881	30325	31841	33433
	Sub-Total	**73507**	**77183**	**81042**	**85094**	**89348**	**93815**

S. No.	Job role	Workforce in horticulture to be skilled in each year year (In Numbers)					
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
ii	Production of Flower crops (cut and loose)						
1	Floriculturist-Open Cultivation and Floriculturist-Protected Cultivation	30000	31500	33075	34729	36465	38288
2	Flower Handler-Packaging & Palletising	30000	31500	33075	34729	36465	38288
3	Florist	10000	10500	11025	11576	12155	12763
	Sub-Total	**70000**	**73500**	**77175**	**81034**	**85085**	**89340**
iii	Production / growing of fruit crops, nuts, beverage crops, Spice, aromatic, pharma crops						
1	Vineyard grower and Vineyard Worker	17502	18902	20414	22047	23811	25716
2	Tropical/Sub-tropical Fruit Grower Mango Grower, Banana Farmer	139445	150601	162649	175661	189713	204890
3	Citrus fruit Grower	12984	14023	15145	16356	17665	19078
4	Temperate Fruit Grower	22788	24611	26580	28706	31003	33483
5	Orchard workers	45444	49080	53006	57246	61826	66772
6	Coconut Grower , Friends of Coconut Tree Neera Technician	78378	84648	91420	98734	106632	115163
7	Coffee Plantation Worker and Tea Plantation Worker	39606	42774	46196	49892	53884	58194
8	Spice Crop Cultivator, Coriander Cultivator, Medicinal Plants and Grower Essential Oil Extractor	84795	91579	98905	106817	115363	124592
9	**Sub-total**	**440942**	**476217**	**514315**	**555460**	**599897**	**647888**
iv	Nurseries and Plant Propagation						
1	Gardener cum Nursery Raiser	2625	2888	3176	3494	3843	4227
2	Nursery Worker	2625	2888	3176	3494	3843	4227
	Sub-total	**5250**	**5775**	**6353**	**6988**	**7687**	**8454**
v	Landscape care and maintenance service activities						
1	Horticulture Supervisor	2404	2645	2909	3200	3520	3872
2	Gardener	4808	5289	5818	6400	7040	7744
3	Assistant Gardener	9616	10578	11636	12799	14079	15487
4	Rooftop Gardener	4808	5289	5818	6400	7040	7744

S. No.	Job role	Workforce in horticulture to be skilled in each year year (In Numbers)					
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
3	Assistant Gardener	9616	10578	11636	12799	14079	15487
4	Rooftop Gardener	4808	5289	5818	6400	7040	7744
5	Interior Landscaper	4808	5289	5818	6400	7040	7744
6	Assistant Interior Landscaper	9616	10578	11636	12799	14079	15487
7	Assistant Grounds keeper	9616	10578	11636	12799	14079	15487
8	Heritage Gardener	2404	2645	2909	3200	3520	3872
	Sub-Total	**48082**	**52890**	**58179**	**63997**	**70397**	**77437**
vi	Protected cultivation						
1	Horticulturist-Protected Cultivation	30000	33000	36300	39930	43923	48315
2	Floriculturist – Protected cultivation	6720	7392	8131	8944	9839	10823
3	Hydroponics Technician	700	770	847	932	1025	1127
4	Protected cultivation worker	56000	61600	67760	74536	81990	90189
	Sub-Total	**93420**	**102762**	**113038**	**124342**	**136776**	**150454**
vii	Post-harvest management						
1	Cold Store Technician	4500	4725	4961	5209	5470	6017
2	Cold Storage Manager	4500	4725	4961	5209	5470	6017
3	Cold Storage Supervisor	9000	9450	9923	10419	10940	12034
4	Cold Store Keeper	13500	14175	14884	15628	16409	18050
5	Packhouse Worker/supervisor	40000	42000	44100	46305	48620	53482
6	Ripening Chamber Operator	800	840	882	926	972	1069
7	Supply Chain Field Assistant	5000	5250	5513	5788	6078	6686
8	Onion storage for farmers	5000	5250	5513	5788	6078	6686
	Sub-Total	**82300**	**86415**	**90736**	**95273**	**100036**	**110040**
viii	Other activities under horticulture						

S. No.	Job role	Workforce in horticulture to be skilled in each year year (In Numbers)					
		2022-23	2023-24	2024-25	2025-26	2026-27	2027-28
1	Bee keeper	10000	10500	11025	11576	12155	13371
2	Mushroom grower	1500	1575	1654	1736	1823	2005
3	Vermi-compost Producer	10000	10500	11025	11576	12155	13371
4	Plant Tissue Culture Technician	200	210	221	232	243	267
5	Makhana Grower cum Processor	1000	1050	1103	1158	1216	1338
	Sub-Total	**22700**	**23835**	**25027**	**26278**	**27592**	**30351**
ix	Upcoming fields and advanced technologies						
1	FPO management	2500	2500	2500	2500	2500	2500
2	Organic/Natural farming under horticulture	3500	3500	3500	3500	3500	3500
3	Drones	1400	1400	1400	1400	1400	1400
	Sub-total	**7400**	**7400**	**7400**	**7400**	**7400**	**7400**
x	Horticulture processing						
1	Plant manager and Sr. Plant manager	360	389	420	453	490	529
2	Personnel looking after Sourcing, Production (Line in-charges/supervisors of various products, Quality analysts) & marketing	800	864	933	1008	1088	1175
3	Plant worker (for Loader and Unloader, Helper, Cleaning and pre-processing)	1520	1596	1676	1760	1848	1940
4	Supervisor	160	168	176	185	194	204
5	Packaging operator	720	756	794	833	875	919
6	Machine operator	200	210	221	232	243	255
	Sub-total	**3760**	**3983**	**4220**	**4471**	**4738**	**5022**
xi	Academia and officials						
1	Students	2000	2000	2000	2000	2000	2000
2	Faculty	200	200	200	200	200	200
3	Officials	500	500	500	500	500	500
	Sub-total	2700	2700	2700	2700	2700	2700
xii	**Grand total**	**850061**	**912660**	**980185**	**1053037**	**1131656**	**1222901**

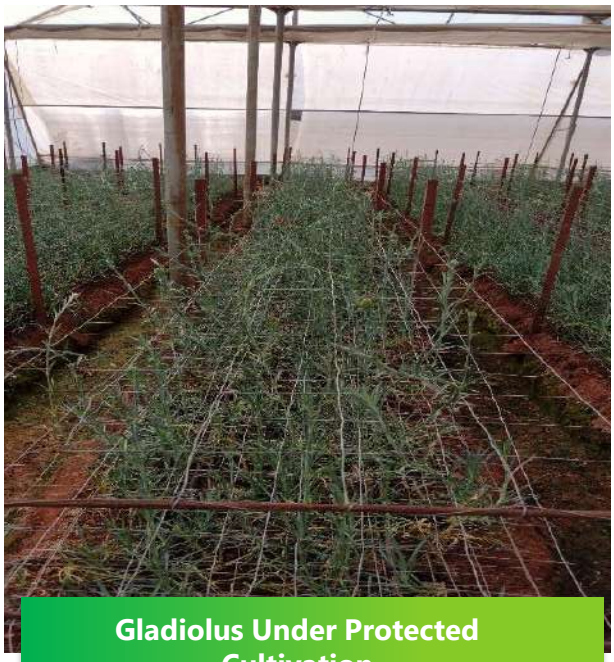


CONCLUSION AND RECOMMENDATIONS

8. Conclusion and Recommendations

The horticulture sector covers a variety of fruits, vegetables including root/tuber crops, flowers, aromatics and medicinal crops, honey, mushrooms, spices and plantation crops and has witnessed sustained growth and evolved as one of the major growth engines of Indian agriculture in past two decades. India is the leading producer of fruits and vegetables. The sector plays a critical role by providing an opportunity for diversification, improvement in farm income and better returns per unit area. Further, as a source of healthy and nutritious food, it boosts immunity. It is a labour-intensive sector and has the potential to create employment opportunities for wider sections of the population. The horticulture sector has emerged as an important player in the Indian economy contributing to around one-fourth of the value of output at constant prices from the total value of agricultural output. Horticulture crops also have high export potential.

NFT System of Protected Cultivation



Gladiolus Under Protected Cultivation

However, the sector is dominated by small and marginal farmers and the skill base in the horticulture sector is very low. More attention is needed on the skill development of the workers for improving the productivity of horticultural crops, raising income levels, efficiently using inputs for cost-cutting and also an increasing share in global trade. The efforts to raise productivity coupled with skill up-gradation of the horticulture workforce will yield the intended results. Even within this low-skill base of the sector, women are particularly disadvantaged in terms of access to formal skill training. Women constitute a large share of the horticulture workforce and therefore, the skill development of women needs special attention.

Agricultural households who are accessing technical advice at all India level was 48.7% in the kharif season and 42.2% during the rabi season in the country. The States in which the Agricultural households accessing technical advice are below the national average (48.7%) are Meghalaya, Arunachal Pradesh, Manipur, Assam, Nagaland, Tripura, Uttarakhand, Jharkhand, Bihar, Punjab, Rajasthan, Gujarat, Chhattisgarh, Madhya Pradesh, West Bengal, Karnataka and these states need special attention.

Secondly, there is a trend of increasing commercialisation, market-oriented and organised production which will create more employment opportunities for skilled labour. Several States have taken progressive initiatives like area expansion, FPOs promotion, encouragement of upcoming technologies such as protected cultivation, hydroponics, mechanization and drones, post-harvest management and cold chain, etc. through subsidies. Such initiatives will also generate demand for skilled labour.

Given the facts that among a large section of workers knowledge and skills are transmitted through informal methods including hereditary and self-learning. There are large numbers of small producers for whom attending long-duration courses at a stretch is difficult and such people can be catered to through the promotion of short-term courses and recognition of prior learning through NSQF certificates to increase the responsiveness of the workers towards skill training and to reach out to a large section of the population within a short period. A sizeable number of the horticulture workforce are trained in traditional ways, learned skills on the job, and through various informal ways. Sufficient arrangements should be made for upskilling/ reskilling of these traditional labour for better productivity and incomes.

Quality Control Lab

The employability and skills of graduate/diploma students coming out of horticulture colleges/polytechnics are not matching with the expectations of the industry/workplace and hence, industries have established their own skilling centres as per their standards and requirements. It would be advantageous if apprenticeships/internships and associated certifications is carried out through the NSQF skilling framework and promoted for all students related to the horticulture sector to enhance their employability.

Working under PPP mode for skilling initiatives by ASCI, directing a few of the CSR funds for skilling in horticulture, and collaboration between 'Academia, Industry and ASCI' to keep pace with emerging technological trends for development of skills would enhance the skilling environment in horticulture. There should be mechanisms for collaboration in research, development, and skill requirements to address evolving needs.

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ANNEXURE

ANNEXURE. I

State-Wise Area and Production of Horticulture Crops for 2017-18

S.No.	States	Horticulture produce		Honey
		Area (000 Ha)	Production (000 MT)	Production (000 MT)
1	Andhra Pradesh	1487.9	24755.4	1.9
2	Arunachal Pradesh	62.5	211.3	
3	Assam	660.3	6004.9	1.2
4	Bihar	1145.5	21060.5	10.0
5	Chhattisgarh	777.5	9984.9	0.8
6	Gujarat	1655.1	2256.3	0.6
7	Haryana	534.0	8091.7	4.5
8	Himachal Pradesh	330.5	2431.3	5.5
9	Jammu & Kashmir	442.2	3614.4	2.1
10	Jharkhand	409.1	4577.5	1.4
11	Karnataka	2109.7	21309.9	2.1
12	Kerala	1641.2	10853.30	3.0
13	Madhya Pradesh	1849.7	26530.9	2.3
14	Maharashtra	1740.2	24855.0	1.7
15	Manipur	104.7	824.0	
16	Meghalaya	126.1	959.9	0.3
17	Mizoram	140.0	62.34	0.2
18	Nagaland	97.8	1026.1	0.6
19	Odisha	1380.2	11781.0	1.4
20	Punjab	381.4	6956.2	15.5
21	Rajasthan	1621.0	4022.3	8.5
22	Sikkim	99.3	367.6	0.4
23	Tamil Nadu	1257.0	17196.0	1.9
24	Telangana	440.9	5389.1	
25	Tripura	121.1	1421.5	
26	Uttar Pradesh	2477.0	39249.0	18.9
27	Uttarakhand	294.8	1712.9	2.7
28	West Bengal	1860.9	32472.4	16.5
29	Others	192.8	876.1	1.5
30	All India T1otal	25431.4	311714.2	105.0

Source: *Horticulture statistics at a glance, 2018, MoAFW, GoI*

ANNEXURE. II

State-Wise Fruits and Vegetable Processing Units and Personnel

S.No.	States	No. of Units	Total Personnel	Workers	Supervisory, Managerial and other employees
1	Andhra Pradesh	138	6700	5777	896
2	Arunachal Pradesh	-	-	-	-
3	Assam	38	1835	1066	759
4	Bihar	14	174	145	17
5	Chhattisgarh	-	-	-	-
3	Delhi	8	983	659	323
7	Gujarat	166	7385	5531	1814
8	Haryana	38	2749	2076	667
9	Himachal Pradesh	24	904	627	277
10	Jammu & Kashmir	10	245	188	50
11	Jharkhand	5	210	163	45
12	Karnataka	116	7638	5524	2100
13	Kerala	59	1168	851	305
14	Madhya Pradesh	27	2023	1510	507
15	Maharashtra	159	14480	10017	4435
16	Manipur	4	86	64	17
17	Meghalaya	-	-	-	-
18	Mizoram	3	17	14	0
19	Nagaland	-	-	-	-
20	Odisha	35	358	304	54
21	Punjab	92	9819	8242	1568
22	Rajasthan	19	1682	1447	231
23	Sikkim	-	-	-	-
24	Tamil Nadu	169	9978	7949	1997
25	Telangana	33	957	789	166
26	Tripura	13	31	14	16
27	Uttar Pradesh	69	3359	2561	782
28	Uttarakhand	48	3258	2461	796
29	West Bengal	39	1587	851	734
30	All India Total	1298	77810	59011	18555

Source: *Annual Survey of Industries, 2019-2020*

ANNEXURE. III

Existing Capacity and Future Requirement of Cold Chain

S. No.	Component	Existing Capacity (2015)	Approximate Requirement in next 5 years	Funds required for five years as Government support in Rs. Crores.
1.	Integrated Pack Houses	250 numbers	14,000 numbers	2450.00
2.	Cold Room	--	20000	1050.00
3.	Cold Stores (Bulk & distribution hubs)	32.5 million tonnes	2.5 million tonnes	700.00
4.	Reefer Trucks	<10,000 numbers	20,000 numbers	1850.00
5.	Ripening Chambers	800 numbers	4000 numbers	56.00
	Total			**6106.00**

Source: *NABCONS study on Cold chain, 2015*

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