

**Republic of India**  
**State of Haryana, Department of Horticulture**

**THE PREPARATORY SURVEY  
ON  
HARYANA SUSTAINABLE  
HORTICULTURE PROMOTION  
PROJECT  
IN  
REPUBLIC OF INDIA**

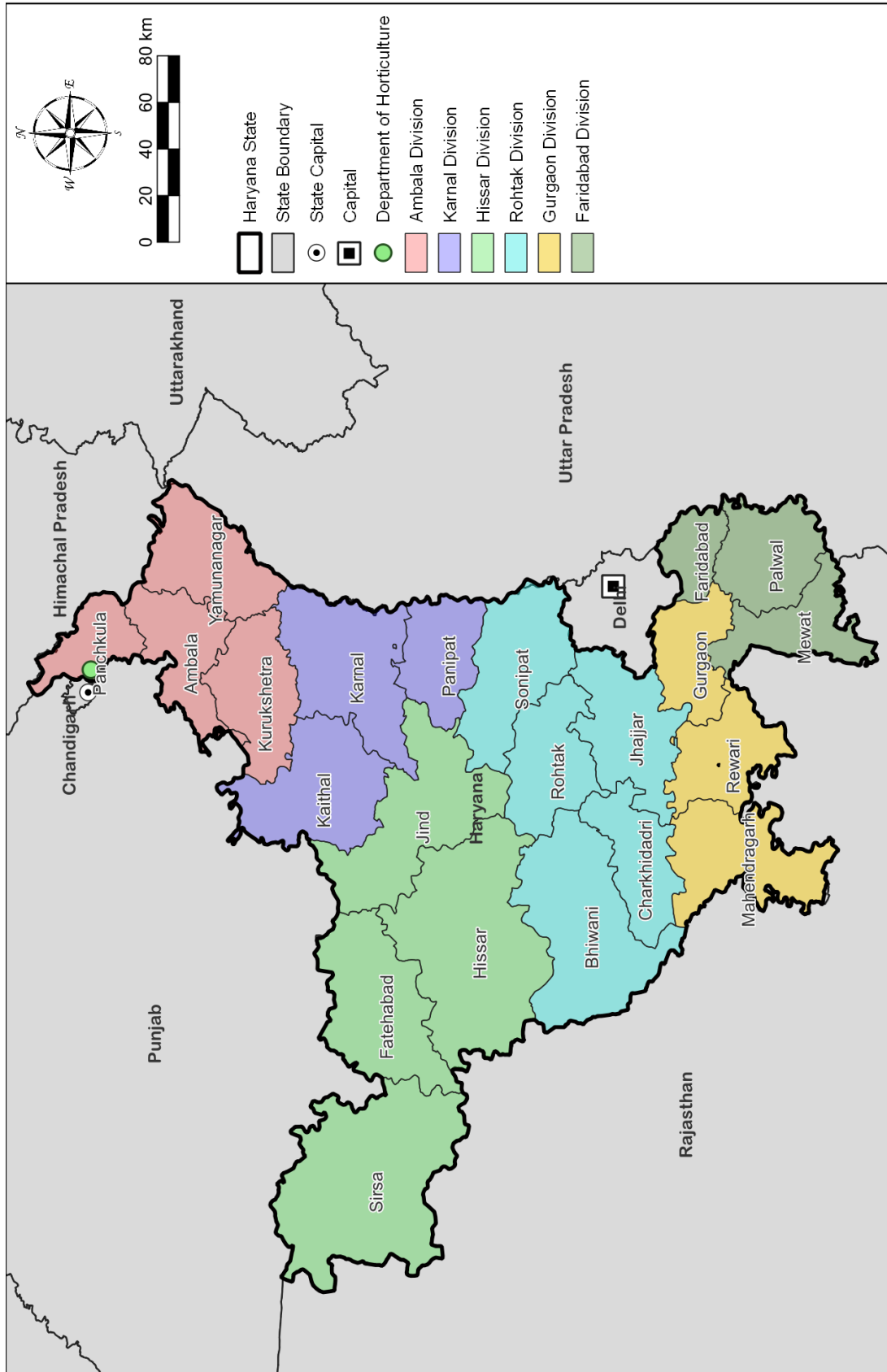
**FINAL REPORT  
(Advanced Version)**

**February 2024**

**JAPAN INTERNATIONAL COOPERATION AGENCY  
(JICA)**

**NIPPON KOEI CO., LTD.**





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**Project Location Map**

**-Photographs-**

**Horticultural Cultivation Techniques/Crop Diversification**

	
<p>Nursery of Watermelon and Muskmelon raised in the poly pots. (Sonipat district, 2<sup>nd</sup> March 2023)</p>	<p>Transplanting technique followed by the farmers for Watermelon and Muskmelon's seedlings (3-5 seedlings in one hole) (Sonipat district, 2<sup>nd</sup> March 2023)</p>
	
<p>Cucumber crop in the field, very narrow spacing between the plants (Sonipat district, 2<sup>nd</sup> March 2023)</p>	<p>SNIATTE of CCSHAU for the trainings to the farmers (Hisar district, 28<sup>th</sup> February 2023)</p>
	
<p>Field prepared by using mulching sheet for the transplanting of Tomato. (Kurukshetra district, 7<sup>th</sup> February 2023)</p>	<p>Tomato nursery grown. (Kurukshetra district, 7<sup>th</sup> February 2023)</p>

Source: JICA Survey Team



**-Photographs-**

**Horticultural Cultivation Techniques/Crop Diversification**



Thermocol sheets used for planting Seedlings to provide support to young plants, CoE, Gharaunda (Karnal district, 5<sup>th</sup> November.2022



Thermocol sheets used for planting Seedlings to provide support to young plants, CoE, Gharaunda 2, (Karnal district, 5<sup>th</sup> November.2022



High-density polyethylene (HDPE) sheet used for Mulching, CoE, Gharaunda, (Karnal district, 5<sup>th</sup> November.2022)



The Micro Irrigation System with Automation installed in the CoE of Sub-Tropical Fruits in Ladwa. (Kurukshetra district, 10<sup>th</sup> February.2023)



Stubble burning near Chhapra Village, (Kurukshetra district, 4<sup>th</sup> November.2022)



Plantation of Watermelon by marginal farmer, Gyaspur, (Sonipat district, 2<sup>nd</sup> March.2023)

Source: JICA Survey Team



**-Photographs-**

**Private Sector Partnership for FPO/FPC**

	
<p>Kinnow sorting machine at M/s Kharisureran FPC Ltd. (Sirsa District, 19<sup>th</sup> January.2023)</p>	<p>Kinnoworchardat M/s Kharisureran FPC Ltd. (Sirsa District, 19<sup>th</sup> January.2023, )</p>
	
<p>Manual potato sorting at M/s Crown Fruits &amp; Vegetables FPO (Kurukshetra District, 31st January 2023)</p>	<p>Potato sorting machineat M/s Crown Fruits &amp; Vegetables FPO (Kurukshetra District, 31st January.2023)</p>
	
<p>Transportation of lettuce with ice battery 1 (Kullu district in Himachal Pradesh, 27th August.2023)</p>	<p>Transportation of lettuce with ice battery 2 (Kullu district in Himachal Pradesh, 27th August.2023)</p>
	
<p>Ice battery which was used for the pilot project (Kullu district in Himachal Pradesh, 27th August.2023)</p>	<p>Mango puree storage at Sahyadri Farms (Nashik, Maharashtra, 26th August 2023, JICA survey team)</p>

Source: JICA Survey Team

**-Photographs-**

**Farmer Organization and Gender Mainstreaming**

	
<p>Interview to the board members of the M/s Kharisureran FPC Ltd. (Sirsa district, 19<sup>th</sup> January 2023)</p>	<p>The building of Food Technology Lab, Kurukshetra (Kurukshetra District, 30th January 2023)</p>
	
<p>The poster of Bawania Women Farmers Producer Co. Ltd. (Mahendragarh district, 3rd February)</p>	<p>The entrance of Shri Swami Rama, NGO (Ambala district, 10th February)</p>
	
<p>Women from nearby villages segregating Potato at Integrated Pack House, Grow Smart FPO (Kurukshetra district, 4th.November.2022)</p>	<p>Interview of the women labourer, Rijul Farmer Producer Company Ltd., (Kurukshetra district 7th January,2023)</p>

Source: JICA Survey Team



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**The Preparatory Survey**  
**on**  
**Haryana Sustainable Horticulture Promotion Project**  
**in**  
**India**

**Final Report**  
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## **Abbreviations**

ABY	Atal Bhujal Yojana
ADO	Agriculture Development officer
AEZ	Agroecological Zones
AEPS	Aadhaar Enabled Payment System
AH	Animal Husbandry
AHRD	Attracting and Holding of R&D
AI	Artificial Intelligence
AICRIP	All India Coordinated Rice Improvement Programme
AIF	Agriculture Infrastructure Fund
AIO	Activities, Interests, and Opinions
AMC	ATMA Management Committee
APC	Agro Processing Cluster
APD	Additional Project Director
APEDA	Agricultural and Processed Food Products Export Development Authority
APIs	Application Programming Interface
APMC	Agricultural Produce Marketing Committee
APMR Acts	Agricultural Produce Market Regulation Acts
APPO	Assistant Protection Officer
ARI	Agricultural Research Institute
ASCI	Agricultural Skill Council of India
ATIC	Agricultural Technology Information Centre
ATM	Assistant Technology Managers
ATMA	Agricultural Technology Management agency
AWC	Anganwadi Centre
AWPB	Annual Work Plan and Budget
AWW	Anganwadi Workers
BAOs	Block Agriculture Officers
BAPs	Block Action Plans
BBY	Bhavantar Bharpayee Yojana
B/C	Cost-Benefit Ratio
BDPO	Block Development and Panchayat Officer
BDPO	Block Development and Panchayat Office
BIRD	Bankers Institute of Rural Development
BMI	Body Mass Index
BOD	Biochemical Oxygen Demand
BODs	Board of Directors
BPKP	scheme Bhartiya Prakratik Krishi Padhati
BPL	Below Poverty Line
BTM	Block Technology Manager
BTT	Block Technology Team
CA	Chartered Accountant
CACP	Commission for Agricultural Costs and Prices
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CBBO	Cluster-Based Business Organizations
CBIA	Community-Based Impact Assessment
CCABC	Crop Cluster Agribusiness Centre
CCDP	Crop Cluster Development Programme
CCS HAU	Choudhary Charan Singh Haryana Agricultural University
CDP	Cluster Development Programme
CEF	Centre of Excellence for Fruits
CEG	Centre of Excellence for Guava
CEO	Chief executive officer
CETPs	Common Effluent Treatment Plants
CEV	Centre of Excellence for Vegetable

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CGM	Continuous Glucose Monitoring
CGWA	Central Ground Water Authority
CGWB	Central Ground Water Board
CINADCO	Centre for International Agricultural Development Cooperation
CM	Chief Minister
CNNS	Comprehensive National Nutrition Survey
COE STF	Centre of Excellence for sub-tropical fruits
COEs	Centre of Excellences
COVID-19	Coronavirus Disease 2019
CPC	Cluster Project Coordinator
CPCB	Central Pollution Control Board
CRM	Customer Relationship Management.
CSSRI	Central Soil Salinity Research Institute
CSTF	Centre of Sub-Tropical Fruits
DAC	Digital to Analogue Converter
DAC&FW	Department of Agriculture, Cooperation & Farmers' Welfare
DAH&D	Department of Animal Husbandry & Dairying
DARE	Department of Agricultural Research and Education
DBT	Direct Benefit Transfer
DCCB	District Co-operative Central Bank
DCMC	District Coordination and Management Committee
DDA	Deputy Director Agriculture
DDH	Deputy Director Horticulture
DDO	Drawing and Disbursing Officer
DDU-GKY	Deen Dayal Upadhyaya Grameen Kaushalya Yojana
DFI	Doubling of Farmers Income
DFR	Draft Final Report
DG	Director General
DHO	District Horticultural Officer
DIC	District Industry Centre
DISCOMs	Distribution Companies
DISTT	District
DIU	District Implementation Unit
DLMC	District Level Monitoring Committee
DMI	Directorate of Marketing and Inspection
DOA	Department of Agriculture
DOAFW	Department of Agriculture & Farmers Welfare
DOH	Department of Horticulture
DOs	District Officers
DPD	Deputy Project Director
DPMU	District Level Project Management Unit
DPR	Detailed Project Report
DSR	Direct Seeded Rice
DX	Digital Transformation
EC	Electric Conductivity
EC	Environmental Clearance
EEIs	Electronic Export Information
EGCGS	Equity Grant and Credit Guarantee Fund Scheme
EIA	Environment Impact Assessment
EIRR	Economic Internal Rate of Return
e-NAM	National Agriculture Market
EP	Environmental Permission
EPR	Extended Producer Responsibility
ESAF	
ESRI	Environmental Systems Research Institute, Inc.
ETPs	Effluent Treatment Plants
FAA	Federal Aviation Administration

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FAC	Farmers Advisory Committee
FAIC	Farm Information and Advisory Center
FAO	Food and Agricultural Organisation
FC	Farmers Cooperative
F/C	Foreign Currency
FCO	Fertilizer (Control) Order
FFBs	Fresh Fruit Bunches
FGD	Flue-Gas desulfurization
FGD	Focused Group Discussions
FHEL	Fresh and Healthy Enterprises Ltd.
FIAC	Farm Information and Advisory Centre
FICS	Farmers Information and Communication Service
FIGs	Farmer Interest Groups
FIRR	Financial Internal Rate of Return
FIs	Financial Institutions
FMDA	Faridabad Metropolitan Development Authority
FPC	Farmer Produce Company
FPOs	Farmer Producer Organizations
FRI	First Revised estimates
FSSAI	Food Safety & Standards Authority of India
FT	Food Technology, Sericulture Branch: Panchkula, Ambala, Yamuna Nagar
FW	Farmers Welfare
FY	Financial Year
FYM	Farm Yard Manure
GAP	Good Agricultural Practices
GAP	Gender Action Plan
GDP	Gross Domestic Products
GHG	Green House Gases
GI	Geographic Indications
GIS	Geographical Information System
GMDA	Gurgaon Metropolitan Development Authority
GMP	Good Manufacturing Practices
GoHR	Government of Haryana
GOI	Government of India
GSPD	Gross State Domestic Product
GST	Goods and Services Tax
GSVA	Gross State Value Added
GW	Ground Water
HAIC	Haryana Agro Industries Corporation Limited
HAMETI	Haryana Agricultural Management & Extension Training Institute
HARCO	Haryana State Co-operative Apex Bank Ltd.
HAU	Haryana Agricultural University
HDO	Horticulture Development Officer
HES	Horticulture Extension Services
HNRLM	Haryana National Rural Livelihoods Mission
HOPP	Haryana Operational Pilot Project
HP	Himachal Pradesh
HQ	Head quarters
HR	Haryana
HREDA	Haryana Renewable Energy Development Agency
HSAMB	Haryana State Agriculture Marketing Board
HSAMB	Haryana State Agricultural Marketing Board
HSCFDC	Haryana Scheduled Castes Finance and Development Corporation
HSHP	Haryana Sustainable Horticulture Promotion Project
HSIIDC	Haryana State Industrial and Infrastructure Development Corporation
HSSCA	Haryana State Seed Certification Agency
HTI	Horticulture Training Institute

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HWRA	Haryana Water Resource Authority
I&PGD	Institution and PG Development
IAP	Integrated Action Plan
IARI	Indian Agricultural Research Institute
IAs	Intermediate of Arts
IBDC	Integrated Beekeeping Development Centre
ICAR	Indian Council of Agricultural Research
ICMR	Indian Council of Medical Research
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICTs	Information and Communication Technologies
ID	Identification
IDC	Interest During Construction
IDR	Irrigation Done Right
IE	Infrastructure Engineer
IEC	International Electrotechnical Commission
IHD	Integrated Horticulture Development
IHDC	Integrated Horticulture Development Centre
IHDS	Integrated Horticulture Development Scheme
IJCR	International Journal of Current Research
IMR	Infant Mortality Rate
INR	Indian Rupee
IoP	Internet of Plants
IPA	Information-technology Promotion Agency
IPPC	International Plant Protection Convention
IQF	Individual Quick Freezing
ISAM	Integrated Schemes for Agricultural Marketing
ISO	International Organization for Standardization
IST	India Standard Time
IT	Information Technology
IWMP	Integrated Watershed Management Programme
JDH	Joint Director General Horticulture
JICA	Japan International Cooperation Agency
JIO	Joint implementation opportunity
JLGs	Joint Liability Groups
JPY	Japanese Yen
JST	Japan Standard Time
KII	Key Informant Interviews
KCC	Kisan Credit Card
KPI	Key Performance Indicator
KVKs	Krishi Vigyan Kendras
LBW	Low Birth Weights
L/C	Local Currency
LCB	Local Competitive Bidding
LEDP	Livelihood Entrepreneurship Development Programme
LGP	Length of Growing Period
LINAC	Laxmanrao Imandar National Academy for Cooperative Research & Development
LM	Lactating Mothers
LOI	Letter of Intent
LUP	Land Use Planning
M&E	Monitoring and Evaluation
MACP	Maharashtra Agricultural Competitiveness Project
MAFF	Ministry of Agriculture, Forestry and Fisheries, Japan
MASHAV	Israel Ministry of Foreign Affairs Agency for International Development Cooperation
MBBY	Mukhyamantri Bagwani Bima Yojana
MCs	Market Committees

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MCM	Million Cubic Metre
MEDP	Micro Entrepreneurship Development Programme
MFMB	Meri Fasal Mera Byora
MHU	Maharana Pratap Horticultural University, Karnal
MIDH	Mission of Integrated Development of Horticulture
MIS	Market Intervention Scheme
MIS	Management Information System
ML	Machine Learning
MLD	Million Liters Per Day
MMKKSMT	Mukhya Mantri Kisan Khet Sadak Marg Yojana
MNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MOA	Ministry of Agriculture
MOEFCC	Ministry of Environment, Forest and Climate Change
MOFPI	Ministry of Food Processing Industries
MoRD	Ministry of Rural Development
MOUs	Memorandum of Understandings
MOVCDNER	Mission Organic Value Chain Development in North East Region
MPI	Multidimensional Poverty Index
MPMV	Mera Paani, Meri Virasat Scheme
MQC	Marketing and Quality Control
MSME	Directorate of Micro Small, Medium Enterprises
MSP	Minimum Support Price
MT	Metric Ton
NA	Not Available
NABARD	National Bank for Agricultural and Rural Development
NAFED	National Agricultural Cooperative Marketing Federation of India Ltd.
NBFIs	Non-Banking Financial Institutions
NBHM	A National Beekeeping and Honey Mission
NBSS	National Bureau of Soil Survey
NCBC	National Cooperative Development Corporation
NCC	National Cadet Corps
NCCD	National Centre for Cold-chain Development
NCDC	National Cooperative Development Corporation
NCDEX	National Commodity and Derivatives Exchange
NCIP	National Crop Insurance Portal
NCR	National Capital Region
NE	North Eastern
NFHS	National Family Health Survey
NFSM	National Food Security Mission
NFSM	National Food Security Mission
NGOs	Non-governmental Organisations
NGRCA	National Gender Resource Centre in Agriculture
NGT	National Green Tribunal
NHB	National Horticulture board
NHM	National Horticulture Mission
NHRDF	National Horticulture Research and Development Foundation
NIC	National Information Centre
NIFTEM	National Institute of Food Technology, Entrepreneurship and Management
NITI	National Institute for Transforming India
NMAET	National Mission on Agriculture Extension and Technology
NMEOOP	National Mission on Edible Oils-Oil Palm
NMSA	National Mission for Sustainable Agriculture
NOCs	No Objection Certificates
NPV	Net Present Value
NRLM	National Rural Livelihood Mission
NSFDC	National Scheduled Castes Finance and Development Corporation
NSKFDC	National Safari Karamcharis Finance and Development Corporation

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NSSO	National Sample Survey Office
NW	North West
OC	Organic Carbon
OC	Organochlorine
OP	Organophosphate
ODA	Official Development Assistance
PACS	Primary Agriculture Cooperative Society
PANIT	National Policy on Nutritional Farming
PD	Project Director
PDAC	Angola Commercial Development Project
PDCA	Plan-Do-Check-Act
PDMC	Per Drop More Crop
PEAs	Project Execution Agencies
PEC	Project Executive Committee
PFMS	Public Financial Management System
PG	Producer Group
PGC	Project Governing Council
PGDAEM	Post Graduate Diploma in Agriculture Extension Management.
PGWM	Participatory Groundwater Management
PH	Pack House
PHD	Progress Harmony Development
PHL	Post-Harvest Loss
PHED	Public Health and Engineering Department
PHM	Post-Harvest Management
PKVY	Paramparagat Krishi Vikas Yojana
PLFS	Periodic Labour Force Survey
PM	Prime Minister
PM	Particulate Matter
PMC	Project Management Consultant
PMFBY	Pardhan Mantri Fasal Bima Yojana
PMFME	Pradhan Mantri Formalisation of Micro food Processing Enterprises
PMKSY	Pradhan Mantri Krishi Sinchai Yojana
PM KISAN	Pradhan Mantri Kisan Samman Nidhi
PMU	Project Management Unit
PNB	Punjab National Bank
POCs	Proof of Concepts
PODF	Producers Organization Development Fund
PODF-ID	Producers Organization Development Fund-Interest Differential
POSHAN	Prime Minister's Overarching Scheme for Holistic Nourishment
PPP	Public Private Partnership
PPR	Preliminary Project Report
PRODUCE	Producers Organizations Development Upliftment Corpus
PSUs	Public Sector Undertakings
PTC	Potato Technology Centre
PV	Photovoltaic
PW	Pregnant Women
QCI	Quality Control Inspector
QPM	Quantitative Project Management
QR	Quick Response
QSRs	Quick Service Restaurants
RDA	Recommended Dietary Allowances
RFI	Request For Information
RKVY	Rashitriya Krishi Vikas Yojana
RTI	Right to Information
RTS	Right to Simulation
SAMETI	State Agricultural Management and Extension Training Institute
SAs	State Authorities

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SAU	State Agricultural University
SBI	State Bank of India
SBPL	State Below Poverty Line
SC	Schedule Caste
SCF	Standard Conversion Factor
SCO	Soil Conservation Officer
SCSP	Scheduled Caste Sub-Plan
SCWM	Microsoft Security Configuration Wizard
SDAOs	Sub Divisional Agriculture Officers
SDGs	Sustainable Development Goals
SDP	Skill Development Programme
SEAC	State Expert Appraisal Committee
SEIAA	State Environmental Impact Assessment Authority
SEWPs	State Extension Work Plans
SFAC	Small Farmers Agribusiness Consortium
SFACH	Small Farmers Agribusiness Consortium Haryana
SHCs	Soil Health Cards
SHEP	Smallholder Horticulture Empowerment & Promotion
SHGs	Self-Help Groups
SMAM	Sub-Mission on Agricultural Mechanization
SMS	Subject Matter Specialist
SMSEs	Small and Medium Sized Enterprises
SN	Serial Number
SNIATTE	Saina Nehwal Institute of Agricultural Technology, Training and Education
SP	Synthetic Pyrethroids
SPCB	
SPMU	State Level Project Management Unit
SPV	Special Purpose Vehicle
SRE	Second Revised Estimates
SREP	Strategic Research and Extension Plan
SS	State Scheme
SSD	Sub Surface Drainage
STPs	Sewage Treatment Plants
SW	South Western
TCP	Technical Cooperation Project
THI	Temperature-humidity Index
TOR	Terms of Reference
TPDS	Targeted Public Distribution System
TSG	Technical Support Group
TV	Television
TWW	Treated Wastewater
U5MR	Under-five Morality Rate
UFID	Unique Farmer Identity
UFSI	Unified Farmers Service Interface
UGPL	Underground Pipeline
UI	User Interface
ULB	Urban Local Body
ULPIN	Unique Land Parcel Identification Number
UPSC	Union Public Service Commission
USD	US Dollar
UT	Union Territories
UTEIAA	Union Territory Level Environmental Impact Assessment
UTPCC	
UV	Ultraviolet
VC	Value Chain
VCA	Value Chain Analysis
VOs	Village officers

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VS	Vegetable Specialist
WCD	Women and Child Development Department
WHO	World Health Organization
WRIS	Water Resource Information System
WYC	Western Yamuna Canal

### **Measurement Units**

#### **Area**

cm <sup>2</sup>	= Square-centimetre(s)
m <sup>2</sup>	= Square-metre(s)
km <sup>2</sup>	= Square-kilometre(s) (1,000,000 m <sup>2</sup> )
ha	= Hectare(s) (10,000 m <sup>2</sup> )
acre	= Acre(s) (4,046.8 m <sup>2</sup> or 0.40468 ha.)

#### **Length**

mm	= Millimetre(s)
cm	= Centimetre(s)
m	= Metre(s)
km	= Kilometre(s) (1,000 m)

#### **Currency**

US\$	= United State Dollars
	US\$1.0 = Yen 145 = INR 82.86
	(as of September 2023)
Yen	= Japanese Yen
INR	= Indian Rupee

#### **Volume**

cm <sup>3</sup>	= Cubic-centimetre(s)
m <sup>3</sup>	= Cubic-metre(s)
L	= Litre(s) (1,000 cm <sup>3</sup> )
MCM	= Million Cubic Metre (s)

#### **Weight**

g	= Gram(s)
kg	= Kilogram(s) (1,000 gr.)
tonne	= Metric Tonne(s) (1,000 kg)
t	= Metric Tonne(s) (in Table)

#### **Time**

sec	= Second(s)
min	= Minute(s) (60 sec.)
hr	= Hour(s) (60 min.)

#### **Indian Numbering**

Lakh(s)	=	Hundred Thousand (100,000)
Crore(s)	=	Ten Million (10,000,000) or 100 lakhs

## **Summary**

### **Chapter 1 : Introduction**

1. This final report was created according to the contract terms between Japan International Cooperation Agency (JICA) and Nippon Koei Co., Ltd., which was signed on 21st October 2022. The report presents the results from the Survey Works conducted between October 2022 to August 2023 for the Haryana Sustainable Horticulture Promotion Project in India. The preparatory survey for the Project will be done in Japan and India over seventeen months, starting from October 2022. This project is to be funded by JICA's Official Development Assistance (ODA) loan. The aim is to gather information for the ODA loan assessment and enhance the Preliminary Project Report prepared by Haryana's Department of Horticulture. The survey will assess challenges in India and Haryana's agricultural sectors, evaluate past ODA loan projects, review project components, schedules, procurement, construction, costs, environmental and social aspects, and gauge its economic/financial viability.

### **Chapter 2 : Natural and Socio-Economic Status of the Survey Area**

2. Overview of Haryana

Haryana, located in northern India, spans 44,212 km<sup>2</sup> and had a 2011 census-reported population of 25.4 million, up from 21.1 million in 2001. It borders Punjab, Himachal Pradesh, Rajasthan, and the Delhi region and is divided into 22 districts. Chandigarh is its capital. Over 70% of its population works in agriculture, producing crops like wheat, rice, and sugarcane. However, recent years have seen growth in manufacturing and services, especially in cities like Faridabad and Gurugram. The 2011 census highlighted a skewed sex ratio, especially in rural areas, with 878 females per 1000 males. The state's dominant religion is Hinduism, with significant Muslim populations in regions like Nuh. In 2017, the Haryana government released "Government of Haryana Vision 2030", focusing on ten sectors: agriculture, education, health, industry, infrastructure, power, skill development, sports, tourism, and urban development, aligned with the UN's Sustainable Development Goals (SDGs) 2015. The vision also promotes job creation, improved social infrastructure, and community empowerment. The following are goals in the agriculture section.

- Encouraging farmers to adopt high-value horticulture crops with necessary training.
- Promoting modern technologies, like drip irrigation, for increased crop productivity.
- Creating horticulture clusters and providing facilities like cold storage and packaging units.
- Encouraging private investments through incentives and fostering public-private partnerships in the horticulture sector.

Haryana's economy steadily grew from 2015 to 2022, with a temporary dip during the 2020 to 21 COVID-19 pandemic. The industry sector showed significant growth, while the agriculture sector slowed down.

3. Climate of Haryana

Haryana has many plains at altitudes of 200-1100 m and the climate varies from hot and dry areas in the south-west to warm and humid areas near the Himalayas. The average annual temperature is 29.13°C, which is 0.89°C higher than the average temperature of the country as a whole.

The year is divided into five seasons: winter (December-February), spring (March-April), summer (May-June), monsoon (July-September) and post-monsoon (October-November). Summers are extremely hot, with temperatures reaching around 45°C (113°F). Rainfall in Haryana varies from less than 300 mm in the southwest to more than 1000 mm in the Shivalik Hills; when annual rainfall

for 2015-2019 is compared with the state average, only four districts (Faridabad, Hisar, Kaithal, Yamuna Nagar) are above the state average.

Haryana is bifurcated into two primary agro-climatic zones: Northeastern (NE) Zone: Encompassing the semi-arid to sub-humid regions of 15 districts including Ambala, Gurugram, and Faridabad. Southwestern (SW) Zone: Predominantly arid areas, covering seven districts like Sirsa and Bhiwani.

Agro-ecological zones (AEZs) are areas that share common characteristics such as soil type, rainfall and temperature that affect agriculture. The National Soil Survey and Land Use Authority has divided India into 20 AEZs. Each AEZ has different soil types and cropping patterns, adding to the diversity of agriculture in Haryana.

Haryana is separated into four agro-ecological zones (a to d) based on the suitability for fruit tree growth. The Eastern Region includes:

- (a) Sub-humid more rainfall area : Where fruits like peach, plum, and mango are grown,
- (b) Semi-arid medium rainfall areas: Which yield citrus fruits, guava, grapes, and papaya. The Western Region consists of:
- (c) semi-arid medium to low rain-fall areas: Producing citrus fruits, grapes, and guava,
- (d) Dry and rain fed or low rainfall areas: Suited for fruits like ber, bel, aonla, and citrus. Over 5 years, the cultivated fruit area in Haryana increased 1.5 times from 3,082ha to 4,649ha.

#### 4. Land use of Haryana

Land use categories in India are categorised as small-scale (less than 1.0 ha), small-scale (1.0-2.0 ha), semi-medium-scale (2.0-4.0 ha), medium-scale (4.0-10.0 ha) and large-scale (10.0 ha or more).

Land use categories in India are defined as marginal-scale for less than 1.0 ha, small-scale for 1.0-2.0 ha, semi-medium-scale for 2.0-4.0 ha, medium-scale for 4.0-10.0 ha and large-scale for 10.0 ha and above. Small and marginal farmers in Haryana have smaller land per capita compared to that of the whole of India. However, semi-medium, medium, and large farmers have very large land per capita compared to that of the whole of India.

Based on the 2011 Census of India, the distribution of farm size in Haryana across various provinces varies significantly. For example, the proportion of marginal farmers with less than 1.0 ha of land is 38% in Ambala as against 52% in Nuh; the proportion of large farmers with more than 10.0 ha is 3.9% in Ambala as against 1.6% in Nuh.

For land utilisation, the Agricultural Census of 2010-11 depicts land use in Haryana. The state's land use patterns across different ownership size classes are consistent: about 46% is net area sown, around 4% is under current fallows, nearly half is net cultivated area, and a small fraction (1-2%) is uncultivated.

#### 5. The economic and social situation of Haryana

Haryana's largest sector in terms of establishments is "Agriculture, forestry, and fishing," holding 36.6% of the total establishments. Although the agricultural sector contributes to around 17% of GSVAs, a significant number of people are involved in it. District-wise employment data revealed that rural employment remains vital in most Haryana districts, but urbanization is evident in districts close to the National Capital Region (NCR).

Per capita income in Haryana has been on the rise since 2011, with Gurugram having the highest and Nuh having the lowest income per capita in 2019. Generally, districts in the NCR region have a higher income compared to others.

In Haryana, as is the trend across India, women earn lower wages than men in both formal/salaried and informal work. Also, the urban-rural wage gap Urban workers earn more than their rural counterparts.

Haryana has relatively low poverty levels compared to other Indian states. Poverty is measured using the Multidimensional Poverty Index (MPI), which considers aspects like health, education, and living standards. District-wise data reveals that Nuh, Rohtak, and Palwal have higher poverty levels, while districts like Rewari and Faridabad fare better.

### **Chapter 3: Present Condition of Horticulture Sector in the Survey Area**

#### 6. Horticultural sector policy

Agriculture, the foundation of India's economic growth, is projected to grow by 3% in 2020-21 by NITI Aayog, a leading policy think-tank of the Government of India and the driving force behind the country's development agenda. In 2016, Prime Minister Modi announced the Income Doubling Plan, an agricultural policy that aims to double the real income of farmers by 2022. In 2016, Prime Minister Modi announced the Income Doubling Plan, an agricultural policy that aims to double farmers' real income by 2022. An Inter-Ministerial Committee was formed in 2016 to strategize this goal. Key identified income growth sources include:

- Increasing crop and livestock productivity.
- Enhancing resource use efficiency.
- Raising cropping intensity and diversifying into high-value horticulture.
- Guaranteeing remunerative prices for farmers' produce.
- Shifting surplus manpower to non-farm occupations.

To realize this, several principles and strategies have been adopted, focusing on increasing output, reducing production costs, ensuring remunerative prices, managing risks effectively, and adopting sustainable technologies. Various policies and schemes implemented to boost farmers' incomes include:

- PM KISAN scheme, direct financial support to farmers to reduce the cost burden of purchasing materials, etc.
- Pradhan Mantri Fasal Bima Yojana (PMFBY) offering crop insurance.
- Kisan Credit Card : Providing easy and fast access to credit for farmers
- Fixing Minimum Support Price (MSP) at profitable rates. Set guaranteed minimum prices for grain pulses and oilseed crops
- Promoting organic farming nationwide.
- Per Drop More Crop scheme for efficient water use.
- Creation of a Micro Irrigation Fund.
- Promotion of Farmer Producer Organisations (FPOs).
- Launch of the National Beekeeping and Honey Mission (NBHM).
- Boosting agricultural mechanization.
- Providing Soil Health Cards to farmers.
- Setting up of the National Agriculture Market (e-NAM) platform.
- Launch of the National Mission for Edible Oils.
- Introduction of the Agri Infrastructure Fund (AIF).
- Launch of Kisan Rail for agri produce logistics.
- CDP- Cluster Development Programme for horticulture.
- Promoting agricultural start-ups.

- Achieving significant growth in the export of agri commodities.

Mera Paani, Meri Virasat Scheme (MPMV) : Initiative to promote economic sustainability through groundwater table conservation and agricultural diversification. A programme that encourages farmers to switch from rice, which uses more water, to crops that use less water, and provides incentives to farmers who do switch.

## 7. The competent authorities

The Department of Agriculture & Farmers Welfare plays a pivotal role in the agricultural sector, overseeing various activities for achieving targeted production. Their vision involves diversifying traditional farming, harnessing ecological niches, and increasing farm income through improved productivity. The organizational structure includes roles such as Director, Additional Directors, and Joint Directors. To disseminate the latest agricultural technology, they use magazines, newspaper advertisements, and radio jingles. The department has undertaken several initiatives to tackle challenges like soil health degradation, groundwater depletion, and promoting quality seeds and farm mechanization.

Haryana's policy-making powers are vested in the Agriculture and Farmer Welfare Minister, Government of Haryana and the Additional Chief Secretary, Government of Haryana are the policy making authorities in the state. The Department of Horticulture (DOH) is headed by the Director General, Horticulture, with its headquarters at Panchkula, Haryana. Assisting the Director General of Horticulture are the Additional Directors and Deputy Directors.

The Department of Horticulture (DOH) in Haryana manages the cultivation and maintenance of fruits, vegetables, flowers, and various other plants. The Haryana Government separated the DOH from the Agriculture Department in 1990-91 to further promote horticulture. Their vision is to make Haryana a leading state in domestic and export markets for horticulture products, aiming to diversify from agriculture to horticulture and to double horticulture production. The administrative hierarchy includes various officers, such as the Director General, Additional Directors, and Deputy Director of Horticulture. The DOH also conducts multiple schemes under central government initiatives, such as Integrated Development of Horticulture and Promotion of Advance National & International Technology in Horticulture. The state has thirteen Centres of Excellence that focus on improving horticultural crop production.

As of 2022/11, the DOH has a headquarters staff and a provincial staff. The Horticulture Development Officer (HDO, Horticulture Development Officer) in the provincial office prepares extension plans and the Horticulture Extension Service provides farmers with farming guidance. There are 127 posts in the headquarters, 81 are filled and 46 are vacant at various levels, including the Director General, Mission Director and other technical and managerial positions. In the county offices, a total of 836 technical and 549 administrative staff have been recruited, with 287 vacancies.

## 8. Agriculture Extension

Horticultural technology dissemination is carried out by Horticulture Development Officers (HDOs) deployed in each province, who advocate and introduce farmers to various new technologies and specific issues. Farmers can receive free horticultural technical assistance from HDOs and the following training institutions.

The Agricultural Technology Management Agency (ATMA) is an autonomous institution in the district aiming at sustainable agricultural development. It connects with all stakeholders involved in agricultural activities and focuses on disseminating technology, farmer training, and facilitating farmer-scientist interactions.

Haryana Agricultural Management & Extension Training Institute (HAMETI) is an autonomous institute focused on training extension workers in agriculture. It offers courses in various management areas and provides consultancy in agricultural extension management. HAMETI aims to improve the agricultural extension services, organize training, and provide consultancy in project planning and management. The institute emphasizes Integrated Nutrient Management, Soil Health, Communication skills for farmers, and Market-led Extension, among others. Multiple training



sessions were conducted, such as Bio-fortification training for staff and Refresher Courses on cotton cultivation. HAMETI boasts facilities including an auditorium, conference hall, IT lab, a library with 1,200+ books, and a trainees' hostel with 32 rooms.

Haryana State Agriculture Marketing Board (HSAMB) seeks to enhance agricultural incomes by implementing efficient, knowledge-based marketing systems. Key goals include improved agricultural service delivery, technological interventions, and enforcing agricultural standards. Operating under the Punjab Agricultural Produce Markets Act of 1961, HSAMB manages 107 Market Committees across Haryana, each equipped with facilities such as auction platforms, storage, and rest houses. Haryana's major vegetable markets are in Azadpur (Delhi), Chandigarh, Ambala City, and Ludhiana, each handling significant quantities of various vegetables. Different markets source vegetables from varied states, e.g., APMC Azadpur receives a large portion of its tomatoes from Madhya Pradesh.

Haryana houses the Chaudhary Charan Singh Haryana Agricultural University in Hisar and the Maharana Pratap Horticultural University in Karnal, both pivotal in agricultural research and education.

Haryana's agricultural and horticultural research and training institutions are outlined below.

- ICAR-Central Soil Salinity Research Institute, Karnal: Focuses on salinity management and the use of poor-quality irrigation waters.
- ICAR-Indian Institute of Wheat and Barley Research, Karnal: Dedicated to wheat and barley research and enhancement.
- Central Fertilizer Quality Control & Training Institute, Faridabad: Ensures the quality control of fertilizers and provides training.
- National Horticulture Board, Gurugram: Aims for the development of hi-tech commercial horticulture and related infrastructure.
- Central Insecticide Board & Registration, Faridabad: Oversees plant protection strategies, quarantine measures, and pest management.
- Extension Education Institute, Nilokheri: Offers training for various departments including Agriculture and Horticulture.
- Northern Region Farm Machinery Training and Testing Institute, Hisar: Provides training and testing for farm machinery.
- Horticulture Training Institute, Karnal: Aims at diversifying land use towards horticulture crops for improved returns and nutrition.
- Centre of Excellence for Vegetables in Karnal: Demonstrates protected cultivation technology for high-quality vegetable production.
- Excellence for Flower Cultivation and Seed Production Technology, Munimpur: Encourages floriculture and horticulture for better economic returns to farmers.
- Centre of Excellence for Semi-Arid Horticulture, Gignow: Dedicated to developing sustainable farming practices in semi-arid regions.
- Integrated Bee Keeping Development Centre (Indo-Israel Agriculture Project): Provides infrastructure and training for beekeepers, promoting honey production and its related benefits.
- International Centre of Excellence in Food Safety and Quality, Sonipat: Works on food safety, quality, and the development of new food processing techniques.

## 9. Farmers' Organization

Various organizations have been formed among farmers such as cooperative societies, farmer producer organizations (FPOs), self-help groups (SHGs), etc. which could be target of the Project and it is called Producer Groups (PGs) under the Project. Through the government initiatives such

as the CSS for "Formation and Promotion of 10,000 FPOs", 747 FPOs have been so far registered in Haryana as of August 2023, out of which 574 FPOs in horticulture clusters (HCs). Regarding self-help group (SHG) which is usually composed of around 15 women members, 55,600 SHGs have been formed in all blocks of Haryana by February 2023 under NRLM. With SHG-Bank Linkage Programmes by NABARD, 71,528 SHGs had saving linked, and 50,394 SHGs had credit linked as of the end of March 2021.

#### 10. Irrigation System

For water Resources Utilization and Irrigation System, the 2020-21 statistical abstract of Haryana showcases district-wise net area under different water resources. Haryana primarily relies on government canals and tubewells for irrigation, with an impressive irrigation rate of 95.35%, one of the highest among all Indian states.

#### 11. Horticulture Production

Haryana predominantly grows vegetables such as potato, onion, radish, and spinach, along with fruits like mango, guava, and citrus fruits. Different regions have specific recommendations for vegetable cultivation; for instance, the Eastern Region is recommended for onion, potato, and radish, while the Western Region is suited for carrots, cauliflower, and cucumber.

Haryana saw a decline in vegetable production from 5,731,250 Tons in 2021 to 5,284,759 Tons in 2022, attributed to COVID-19 and climate change impacts. In the long term, the production of horticultural crops more than doubled between 2004 and 2020, from 3.31 million ton to 7.18 million ton.

Fruit production also saw a rise, increasing more than 2.7 times from 22,159ton to 60,556ton in the five years to 2022. . The surge in production is attributed to higher yields from crops like grapes, aonla, and peach, particularly due to the introduction of new varieties such as An-e-Shahi Grapes and low-chilling peach varieties. The primary fruit-producing districts include Sirsa, Fatehabad, and Yamuna Nagar, with predominant fruits being citrus, mango, and ber.

#### 12. The challenges of horticulture in Haryana

Water-Saving Irrigation Facilities: Haryana's irrigation system, primarily through canals and tubewells, covers 95% of its area but leads to falling water tables and soil salinity. Introducing micro-irrigation (drip or sprinkler) could enhance vegetable and fruit quality by controlling water use. Water harvesting is suggested to prevent further depletion of the water table, with a call for horticultural departments to guide and train farmers in these practices.

Deterioration of Soil Condition: Soil and groundwater salinity, particularly in southern and central Haryana, is exacerbated by excessive fertilizer use. Drip irrigation and mulch can mitigate soil salinity, and planting salt-absorbing plants offers an ecological and economic solution. Emphasis is on adopting drip irrigation, mulching, and cultivation of salt-absorbing plants alongside technical training.

Modernisation of Horticulture: Addressing the needs of smallholder farmers (70% of farming households), policies should facilitate access to suitable machinery, improve training, promote group purchasing, and provide market access. Introducing efficient, small-scale Japanese machinery and targeted training at KVKs and Centers of Excellence can enhance farming efficiency.

Climate Change: Haryana faces changing weather patterns, including rising temperatures and altered rainfall, impacting horticulture. Strategies include early pest outbreak alerts, preventive measures over reactive solutions, and suitable crop selection for vulnerable areas, alongside water-saving technologies to mitigate the impact of increased monsoon rainfall.

Lack of Infrastructure for Postharvest Management: The expansion in horticultural crops area has not been matched by adequate storage facilities, leading to significant postharvest losses. The project aims to address this gap by providing necessary infrastructure, which is vital for sustaining Haryana's position as a leading horticultural state and promoting sector growth.

#### 13. The supply-chain of horticulture crops

India's agricultural produce supply chain is segmented and multilayered, with vegetables and fruits going through 5 to 6 different distribution channels on average before reaching consumers. Here's a breakdown based on the information from a survey:

- **APMC (Agricultural Produce Market Committee):** Role is A government body regulating wholesale markets. Farmers are required to sell their crops here. Value Addition is Provides stable markets and aims for fair pricing for farmers.
- **Commission Agents:** Role is Middlemen between farmers and buyers, facilitating sales for a commission. Value Addition is Connects farmers to large buyers and handles negotiations.
- **Village Aggregator:** Role is Collects produce from various small farmers and sells in bulk. Value Addition is Assists small farmers in selling without going individually to markets.
- **Wholesaler:** Role is Buys in bulk and sells to urban retailers. Value Addition is Distributes produce to urban consumers.
- **Intermediate Trader:** Role is Buys from agents or wholesalers and sells to different markets. Value Addition is Distributes to areas not directly served by APMC or wholesalers.

The Haryana State Government introduced the Crop Cluster Development Programme (CCDP) to boost farmer income. Since 2016, 393 horticulture clusters encompassing 1763 horticulture villages have been identified. The objective is to have neighboring progressive farmers form Farmer Producer Organisations (FPOs) or Farmer Producer Companies (FPCs) to organize their production and marketing efficiently.

In the 1960s and 70s, India enacted the Agricultural Produce Market Regulation Acts (APMR Acts) to regulate agricultural markets. By 2003, the Government of India (GOI) introduced a Model Agriculture Produce Market Committee (APMC) Act, focusing on regulating and controlling the agricultural market. The APMC Act aims to provide transparency, proper pricing, and facilities for farmers. Commission Agents charge a fee for their services, typically 1-2.5% for food grains and 4-8% for fruits and vegetables. Not all states have implemented this act. Currently, Haryana has 214 APMC market yards trading in various crops.

APMC Azadpur Mandi, located in Delhi, is one of India's largest agricultural produce markets. Table 3.4.1 displays the fluctuating wholesale prices of horticultural crops. Ladyfinger, for instance, has a substantial seasonal price difference of Rs 98/kg. Mango fetches the highest price at Rs 700/kg, while prices for spices like garlic and ginger remain relatively stable throughout the year.

A comparison of total arrivals of major vegetables in 2014 in APMCs in the suburban cities of Haryana in India (Azadpur, Chandigarh, Ambala City and Ludhiana) shows the following characteristics.

- Azadpur stands out as the largest market in terms of vegetable arrivals, topping all vegetable categories. The highest arrivals in this market are potatoes (428,721 tonnes), onions (355,742 tonnes) and tomatoes (181,014 tonnes).
- Onions and potatoes are the most traded vegetables in all markets.
- Chandigarh, Ambala City and Ludhiana receive lower volumes than Azadpur, but still play an important role in the local vegetable supply chain. For example, Chandigarh receives higher volumes of onions (31,634 tonnes) and potatoes (28,629 tonnes), while Ludhiana receives higher volumes of onions (85,869 tonnes) and potatoes (80,621 tonnes).

The results of the analysis with regard to vegetable sources in the markets of Azadpur, Chandigarh and Ludhiana can be summarised as follows.

- For example, Azadpur has a wide mix of sourcing states across vegetables, indicating its role as a national trading hub, while Chandigarh and Ludhiana source more from neighbouring states.
- Each vegetable market has a state that is a major sourcing source. For example, Rajasthan is the major supplier of onions to Azadpur, accounting for 46% of onion supply.

- Supply patterns suggest that certain regions supply certain vegetables. For example, Punjab is an important source of peas and potatoes, especially for markets close to Punjab such as Chandigarh and Ludhiana.
- Reflecting the diversity of vegetable supply and dependence on several states, supply destinations are also distinctive. For example, Uttar Pradesh supplies 65% of its potatoes to Azadpur, making it highly dependent on the state for potato procurement.
- There are also some states that seem to have formed production areas specialising in certain vegetables, such as Karnataka's 92% contribution to ginger in Azadpur.

The demand for agricultural crops is predicted by examining data over the past decade, including consumption rates, GDP per capita, and population. Forecasting relies on correlating trends in GDP and population growth, but obtaining accurate consumption data is challenging due to a lack of systematic record-keeping by states. The FAOSTAT database provides consumption data for select crops. Based on the data, population in India increased roughly 13% between 2010-2020. Per Capita GDP surged approximately 70% in the same period. Consumption of all vegetables (excluding potatoes) and fruits grew, but growth appears to plateau after 2014. Consumption of tomatoes and onions rose with income growth, with modest growth in recent years. Consumption trends of all vegetables paralleled population growth, whereas fruit consumption fluctuated with a minor overall increase. Demand forecasts were based on future population and per capita consumption trends.

In 2014-15, the Government of India announced the National Agriculture Market (NAM) to form an integrated market for agriculture commodities. e-NAM, an electronic trading platform connecting APMCs, was launched in 2016. It provides real-time pricing and removes disparities between buyers and sellers. e-NAM bypasses local commission agents, streamlining transactions. 108 out of 114 APMC mandies in Haryana use eNAM, with about 70% transactions conducted through it. e-NAM has quality standards for 203 commodities, but there are no penalties for non-compliance. Testing is mainly physical, based on DMI standards.

#### 14. Post-harvest losses

Post-harvest losses range from 3.08% to 15.88% across various crops in India, with fruits and vegetables experiencing the highest losses. For example, guava faces the highest loss at 15.88%, while tomato has a loss of 12.44%. The majority of these losses occur in the middle stages of the value chain. Vegetable losses in Haryana are moderate compared to other states. Bihar, Assam, Uttar Pradesh, and Jharkhand have the highest losses, while Punjab, Haryana, and Maharashtra have lower losses. Factors contributing to these losses include poor harvesting practices, inadequate infrastructure, lack of modern technology, climate-related challenges, and market demand pressures.

#### 15. Digital Transformation

In Haryana, the agribusiness landscape is diverse and dynamic. It embraces Digital Transformation and has a robust Equipment & Materials sector. The state's proximity to the National Capital Region, combined with its adoption of technology, provides a competitive edge to its market. Notably, there's an emphasis on the distribution of high-quality seeds. Haryana has significantly enhanced its food processing sector through initiatives such as the Mega Food Park Scheme. The food industry is experiencing growth, driven by rapid urbanization and platforms like Zomato. Furthermore, the state boasts numerous cold storage facilities, with companies like ITE IceBattery offering advanced solutions. The retail sector in Haryana is a blend of traditional markets and modern chains like Reliance Fresh and Safal. Additionally, the J-Method Farming, a Japanese initiative, is making strides in showcasing cutting-edge agricultural technologies.

The digital transformation market in India is one of the fastest growing and most promising sectors in the country. The digital transformation market in India is also segmented by region, enterprise size, and vertical. Among the regions, the North region accounted for the largest revenue share in 2018, followed by the South, West, and East regions. The North region includes the states of Delhi, Haryana, Punjab, Uttar Pradesh, and others. The state of Haryana is witnessing a rapid digital

transformation in various sectors including agriculture. The Online marketplace kind of digital platform to all farmers, buyer-sellers, and Government Authorities to operate trading activities of crops and farming products with various of services related with on real time and anytime anywhere basis with geographical limitation. The Agricultural digital transformation utilisation is being promoted in India integrated management of agricultural information based on digital platforms, such as the AgriStack, project, are being developed under central government initiative. The Agristack is an ecosystem for facilitating the delivery of digital services to farmers by Government as well as by AgriTech, Agri Startups, FPOs and the "Agristack is a collaborative system of various Databases, Policies, Data Sharing, IT systems - Centre, State, and other private service providers and Regulators etc. There are also some challenges that need to be overcome for digital transformation to succeed in Indian agriculture. Some of these challenges are:

- Scalability and sustainability, as many digital solutions and initiatives may face challenges in reaching and serving a large and diverse population of farmers and consumers, and in generating viable business models and social impact.
- Fragmentation and coordination, as the Indian agriculture sector involves multiple stakeholders, such as farmers, input providers, aggregators, processors, traders, consumers, and government agencies, who may have different interests, incentives, and capacities to participate in digital platforms and ecosystems.
- Low digital literacy and awareness among farmers, especially smallholders, who may not have the skills, knowledge, or trust to adopt and use digital technologies effectively.
- Lack of infrastructure and connectivity, such as reliable electricity, internet, and mobile networks, which are essential for enabling and supporting digital technologies and services.
- Regulatory and policy issues, such as data privacy, security, ownership, and sharing, which may create uncertainty and barriers for digital innovation and adoption.

#### 16. Gender mainstream

Gender related issues in agriculture in Haryana: Most of women farmers are engaged in farming in supplemental ways with such labor-intensive works as sowing, weeding, harvesting, etc. Thus, shifting from cereals to horticultural (vegetable) cultivation may increase the workload particularly for women. With various scheme/programs, trainings are provided for both male and female farmers. While male farmers tend to participate in crop-cultivation related trainings, female ones tend to participate in training related to post-harvest, preserving and processing. Measures to encourage/facilitate female farmers to participate in crop cultivation trainings as well as implement trainings related to gender sensitization and mainstreaming should be considered. Few incentives have been taken to facilitate women's participation in FPO activities, thus their participation seems to be still limited. Neither units are set nor personnel are assigned in DOH for addressing gender mainstreaming issues. Officers of DOH have not received trainings on gender sensitization and mainstreaming, thus they do not seem very gender conscious.

#### 17. Nutritional improvement

Main health issues and concerns of the Nation and State can be summarised as follows: 1) Increasing population of obesity and consequent life-style diseases, 2) One in every ten children seem not taking enough nutrient for their growth, 3) Every second woman of reproductive age in the country is anaemic; Two in every three children of age 5 years are anaemic. Causes of this malnutrition can be summarised as follows: change in diet among adults and lack of knowledge, access and data. Given these situations, constitutional, legislative policy, plan and programmatic commitments have been conducted. There are various government interventions working towards improving the nutritional status of the Indian population. Although DOH in Haryana hold "Enhance horticulture production, augment farmers, income and strengthen nutritional security" as one of the objectives in Mission for Integrated Development of Horticulture (MIDH), there are almost no state scheme targeting nutrition improvement itself in DOH and DOA Haryana is also the same.

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### **Chapter 4: Result of Subcontract Survey and Pilot Project**

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18. Groundwater Depletion and Soil Degradation Survey provides valuable insights on the current status of groundwater depletion and soil degradation in Haryana state. The challenges and corresponding interventions are as follows.

Topic	Challenges	Interventions
<b>Soil Salinity</b>	<ul style="list-style-type: none"> <li>- Salinity issues arising from saline groundwater, waterlogging, and the use of irrigation water with high salt content in Haryana.</li> <li>- Soil degradation in multiple states.</li> </ul>	<ul style="list-style-type: none"> <li>- Implementation of Sub Surface Drainage (SSD) system.</li> <li>- Haryana Operational Pilot Project (HOPP) supported by Netherland Government.</li> <li>- Surface drainage, vertical drainage, bio-drainage, and sub-surface drainage depending on the issue.</li> </ul>
<b>Land Use and Cropping Pattern</b>	<ul style="list-style-type: none"> <li>- Decrease in forested areas due to urbanization and industrialization.</li> <li>- Decline in certain land categories like barren and uncultivated land.</li> </ul>	<ul style="list-style-type: none"> <li>- Planning at the district level for balanced agricultural growth.</li> <li>- Incentivizing farmers to adopt agronomic measures and cropping patterns that enrich soil with organic matter.</li> </ul>
<b>Waterlogging</b>	<ul style="list-style-type: none"> <li>- Rise in water table leading to salinity and water logging in regions of Haryana.</li> </ul>	<ul style="list-style-type: none"> <li>- Use of Sub Surface Drainage (SSD) system to tackle waterlogging and salinity</li> <li>- Reclamation of affected areas within 2-3 years through SSD technology.</li> </ul>
<b>Use of Pesticides</b>	<ul style="list-style-type: none"> <li>- High usage of pesticides leading to groundwater contamination and soil degradation.</li> </ul>	<ul style="list-style-type: none"> <li>- Regular monitoring of pesticide residues in soil and water.</li> <li>- Educate farmers on the risks and encourage the use of organic and sustainable farming practices.</li> </ul>
<b>Groundwater Depletion</b>	<ul style="list-style-type: none"> <li>- Overexploitation of groundwater resources in Haryana leading to depletion in 53% of the state's area.</li> <li>- Increased water draw from groundwater sources.</li> </ul>	<ul style="list-style-type: none"> <li>- Rainwater harvesting.</li> <li>- Water conservation measures.</li> <li>- Recharge wells.</li> <li>- Implementing Direct Seeded Rice (DSR) and Drip irrigation.</li> <li>- Promote the "Mera Pani Meri Virasat" program.</li> <li>- Laser leveling and changing sowing dates of paddy to conserve water.</li> </ul>
<b>Cultivation Method Conversion Costs</b>	<ul style="list-style-type: none"> <li>- Decline in water tables leading to salinity issues.</li> <li>- Resource-poor farmers cannot afford personal tube wells, affecting their irrigation.</li> </ul>	<ul style="list-style-type: none"> <li>- Subsidizing the construction of secondary reservoirs for drip irrigation.</li> <li>- Provide farmers with deep tube wells and more canal water or rainwater diversion options.</li> </ul>
<b>Shift from Cereal to Horticultural</b>	<ul style="list-style-type: none"> <li>- Decline in production of pulses due to the Green Revolution's focus on cereals.</li> <li>- Increased irrigation needs for paddy-wheat rotation.</li> </ul>	<ul style="list-style-type: none"> <li>- Promote district-level agricultural planning for balanced growth.</li> <li>- Increase area under horticulture by replacing paddy-wheat rotation, as horticultural crops require less water.</li> </ul>
<b>Countermeasures for Groundwater Depletion</b>	<ul style="list-style-type: none"> <li>- Overexploitation of groundwater leading to resource depletion and environmental issues.</li> <li>- Excessive groundwater draw in certain areas of the state.</li> </ul>	<ul style="list-style-type: none"> <li>- Rainwater harvesting.</li> <li>- Water conservation initiatives.</li> <li>- Groundwater recharge through wells.</li> <li>- Direct Seeded Rice (DSR) for reduced water requirement.</li> <li>- Drip irrigation for optimal water use.</li> <li>- Laser leveling and changing paddy sowing dates.</li> <li>- Implementing the "Mera Pani Meri Virasat" program.</li> </ul>

19. Value Chain Survey on Horticulture Crops

The Horticulture Crop Supply Chain Study in Haryana, which covered seed production of mango, watermelon, chilli, cauliflower and green peas as target crops, examined 1) actors in the supply chain, 2) issues related to value addition and its enhancement at different stages of the supply chain, 3) benefit sharing mechanisms among actors in the supply chain, and 4) needs/demands of high-end markets. The challenges and proposed actions identified by the study are as follows

Topic	Challenges	Interventions
Pre-harvest	<ul style="list-style-type: none"> <li>• Technology gaps</li> <li>• Availability of superior materials</li> </ul>	<ul style="list-style-type: none"> <li>• Adoption of modern irrigation and agricultural technologies</li> </ul>

Topic	Challenges	Interventions
	<ul style="list-style-type: none"> <li>• Climate change impacts</li> <li>• Lack of market information</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthening of agricultural support systems</li> <li>• Introduction of climate resilient agriculture</li> <li>• Establishment of information centres</li> </ul>
Harvesting and post-harvest	<ul style="list-style-type: none"> <li>• Inefficient harvesting methods</li> <li>• Lack of Post-harvest Infrastructure and Post-harvest losses</li> <li>• Inefficient monitoring and advice</li> <li>• Gender pay gap</li> </ul>	<ul style="list-style-type: none"> <li>• Improved post-harvest technology</li> <li>• Strengthening agricultural support systems</li> <li>• Packhouse for Storage and processing facilities and technologies</li> </ul>
Marketing and distribution	<ul style="list-style-type: none"> <li>• Dependence on intermediaries</li> <li>• Limited access to markets</li> <li>• Lack of market information</li> </ul>	<ul style="list-style-type: none"> <li>• Upgrading of processing facilities</li> <li>• Investment in efficient transport systems</li> <li>• Establishment of information centres</li> </ul>
Policy and regulation	<ul style="list-style-type: none"> <li>• Financial support for farmers</li> <li>• Reliance on loan sharks</li> </ul>	<ul style="list-style-type: none"> <li>• Support measures for small farmers</li> <li>• Standardisation of quality control</li> <li>• Gender pay equality</li> </ul>

## 20. Pilot projects

Pilot projects were executed to explore the potential benefits and challenges of incorporating private companies into a yen-loan project. The main aim was to enhance the horticulture business's impact and value addition through digital transformation and services/products offered by private companies. Three companies were involved in the pilot projects: Agribazaar, ITE, and EPSON. Agribazaar, an Indian digital platform, provides an online marketplace for farmers and traders. The pilot project with Agribazaar aimed to reduce the commission to middlemen and explore new sales channels. The results indicated potential savings and the possibility to expand sales channels. ITE focuses on cold chain logistics. The pilot project aimed to measure moisture retention during transportation and analyze the difference in wholesale prices when using cold storage. Results showed that cold storage maintained product freshness, reduced weight loss, and fetched higher market values. EPSON provided a portable projector for agricultural training. The projector was used for training sessions to convey technical knowledge. Feedback showed that there's demand for such visual aids in training.

To facilitate the involvement of the private sector, following ideas are suggested. Pilotfarm shall be established as a Vegetable Center of Excellence's facility. Pilotfarm serves as a focal point for innovative agricultural practices in Haryana, offering hands-on learning experiences and allowing for localized adaptation of new technologies. The "Village of Excellence" concept is introduced, aiming to decentralize knowledge dissemination by establishing localized hubs in rural areas. Public-Private Partnerships (PPPs) are crucial for the success of such projects. To accelerate PPPs, a mix of online and offline initiatives is suggested, including webinars, networking platforms, field days, and investor meets.

## **Chapter 5: Lesson Learn from Similar Project**

### 21. Lessons learned from The Small Farmers Agri-Business Consortium (SFAC)

The Small Farmers Agri-Business Consortium (SFAC) is an initiative by the Government of India, supports small farmers by promoting agribusiness ventures and fostering market connections. SFACH, a segment of SFAC in Haryana, was established in 2008, focusing on enhancing small and marginal farmers' incomes through agribusiness. SFACH aids in the development of Farmers' Producers Organizations (FPOs) and provides training, capacity building, and linkage to various market stakeholders. It comprises various state departments, with a blend of ex-officio and nominated members from financial institutions, NGOs, and FPOs. SFACH offers assistance in compliance, market outreach, and coordination with institutions. Emphasis is placed on both backward linkages, i.e. support focused on the pre-production stages of crop production, such as seed selection, provision of farming techniques and supply of production inputs, and forward linkages, i.e. activities aimed at improving processes such as post-harvest handling, processing, marketing, distribution, and branding, and improving market access.

SFACH played a key role in setting up and promoting FPOs, which acted as a collective platform for farmers, enabling them to raise funds for joint purchases and shipping, and increasing their bargaining power. However, during the process of forming FPOs, there was a lack of organisational awareness among farmers and some farmers were not cooperative in their participation. In such cases, it is important to show successful examples of the benefits of organised farming. In addition, it takes at least two months from the application for an FPO to its formation, and delays in the process are mainly due to incomplete documentation. This can be effectively addressed by simplifying the documentation process and establishing a support window..

22. Lessons learned from The Crop Cluster Development Programme (CCDP)

The Government of Haryana launched The Crop Cluster Development Programme (CCDP) in collaboration with ICRISAT to boost sustainable agriculture and increase the income of small farmers. It emphasizes crop diversification, value addition, and market connections. The program identifies specific crop clusters in Haryana, pushing for crops with greater market value, providing farmers with training, and facilitating market linkages. Haryana is aiming to diversify its agriculture sector, especially towards horticulture. They have identified around 400 horticulture crop clusters and formed 700 Farmer Producer Organizations. With a budget of Rs. 510.35 crore, the CCDP focuses on on-farm Integrated Packhouses through FPOs, aiming to modernize the entire supply chain. CCDP Achieved 33 integrated packhouses have been established, with a target of 100 by the end of March 2024. 37 Agri Sector Companies have partnered with FPOs, resulting in trading of horticulture commodities valued at over Rs. 14 crores, expected to rise to Rs. 200 crores. Challenges are that progress has been slowed due to FPOs' lack of funds, administrative delays, and underutilized warehouses. Efficiently connecting with forward markets is essential for the program's success.

Key Lessons from the Projects are followings:

Challenges	Proposed measures
<ul style="list-style-type: none"> <li>• Lack of expert support for cultivation and packhouse operations.</li> <li>• Farmers are very cautious about adopting new technologies.</li> </ul>	<ul style="list-style-type: none"> <li>• There is a need to provide professional support in the provision of agricultural technology, assistance in accessing markets, access to quality seeds, fertilisers and other agricultural inputs, and advice on farm management and financial planning.</li> <li>• New technologies can be promoted by demonstrating their benefits and increasing exposure to familiar success stories.</li> </ul>
<ul style="list-style-type: none"> <li>• The main harvesting season is a few months a year and packhouses are not used for the rest of the year.</li> <li>• Currently, few women participate in the operation of packhouses.</li> </ul>	<ul style="list-style-type: none"> <li>• The various types of training currently provided in training institutions will be conducted in the packhouses to increase farmers' productivity and livelihoods.</li> <li>• Packhouses will be used as a training platform, providing not only agricultural knowledge but also nutritional information and forming market links.</li> <li>• Empowering women, as it is expected that women's participation will increase as the training takes place within their living areas.</li> </ul>
<ul style="list-style-type: none"> <li>• Packhouses require ongoing investment, such as maintenance, but no financial support is provided by the government.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a network of financial institutions that will address the specific financial needs of farmers, provide them with products that meet their needs and improve their financial literacy.</li> </ul>
<ul style="list-style-type: none"> <li>• Currently there is no system in place for DOH to monitor the operation of the packhouses once they have been handed over.</li> </ul>	<ul style="list-style-type: none"> <li>• Establish a regular monitoring system to ensure that packhouses are being operated properly.</li> <li>• Continue to build long-term cooperative relationships with counterparts and exchange information on a sustained basis to achieve sustained results.</li> </ul>

**Chapter 6: Outline of the Proposed Project Scope**

23. Outline of the Proposed Project:

- (1) Executing Agency: Department of Horticulture (DoH), Haryana State Government.
- (2) Location of the Project: The target area of the Project is all districts in Haryana.
- (3) The objective of the Project is to promote sustainable horticulture and improve farmer's income by promoting the production and marketing of horticulture crops through the support



of crop diversification and infrastructure development as well as capacity development for strengthening value chain, thereby contributing to economic and social development in Haryana state.

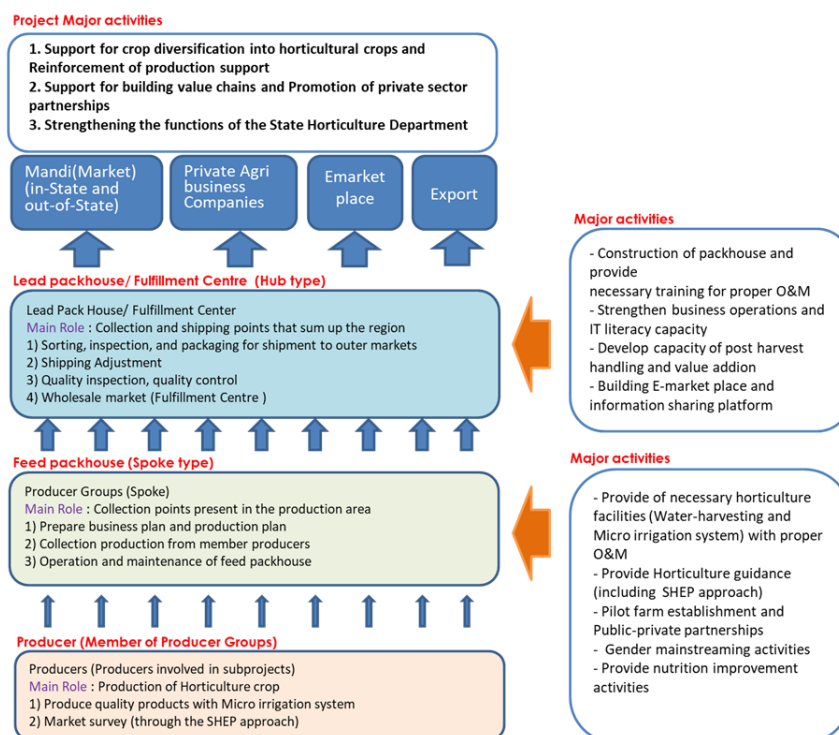
- (4) Scope of Works: The project component is broadly divided into i) Support for crop diversification into horticultural crops and Reinforcement of production support, ii) Support for building value chains and Promotion of private sector partnerships, and iii) Strengthening the functions of the State Horticulture Department. Under the project components, the scope of works is arranged as shown below.

### Scope of Works

Component 1	Support for crop diversification into horticultural crops and Reinforcement of production support
1.1	Formation and strengthening of PGs
1.2	Water-harvesting and Micro irrigation system
1.3	Horticulture guidance
1.4	Pilot farm establishment and Public-private partnerships
Component 2	Support for building value chains and Promotion of private sector partnerships
2.1	Infrastructure development for building value chains
2.2	Building an E-market Place and an information-sharing platform
2.3	Branding
Component 3	Strengthening the functions of the State Horticulture Department
3.1	Installation of PMU and DPMU
3.2	Strengthening the capacity of DOH
3.3	Strengthening the capacity of horticulture extension services
3.4	Baseline Studies and Impact Assessment

Source: JICA Survey Team

24. General Approach to the Project: Typical supply chain proposed under cluster approach is depicted in the following figure.



Source: JICA Survey Team

### Typical Supply Chain under Cluster Approach

The hub-spoke model proposed here consists of a central collection point (hub) and collection points (spokes) that deliver agricultural products to the hub. In this model, produce collected at the spokes is collected at the hub, stored and processed, and then efficiently delivered to the consumption area. This provides logistical efficiencies, cost savings and quality control, and gives smallholder farmers access to larger markets.

25. Project component 1: Crop Diversification for Sustainable horticulture and Raising the Farmers' Income

The component will support crop diversification to achieve the project's objective of promoting sustainable agriculture to mitigate groundwater over-exploitation and increase farmers' incomes by marketing relatively high-value crops such as vegetables and fruits. Farmers will be encouraged to develop marketing and cultivation skills and to shift from cereal crops to more profitable horticultural crops such as vegetables and fruits by promoting off-season cultivation, introducing high-value crops and changing post-harvest handling and marketing practices. It also includes strengthening the capacity of PGs to support 500 PGs.

26. Project component 2: Value Chain Infrastructure Enhancement

This component includes infrastructure for the development of the value chain, such as processing plants, and the establishment of an electronic marketplace (e-marketplace) for the exchange of distribution data. The digital system will be integrated with the physical market to provide a comprehensive approach to distribution in the value chain.

The value chain development infrastructure is divided into five categories for packhouses provided to PGs, as shown in the table below.

Categories	Estimated Proposed Unit	PG member	Function
Category-1	280	Up to 20	Aggregation
Category-2	36	Minimum 20	Aggregation and sorting/Grading
Category-3	36	Minimum 50	S&G and Packing and either selling direct to market or send it to Lead Packhouse
Category-4	36	Minimum 75	Same as above but bigger volume
Category-5	14	Minimum 125	Long term storage and Arbitrage marketing (mostly potato)

27. Project component 3: Capacity development of the Department of Horticulture

The project focuses on enhancing the Department of Horticulture's (DoH) capabilities rather than relying on external consultants. This involves assessing the project plan, procuring necessary equipment, organizing workshops, and offering hands-on vegetable cultivation training. By boosting the government agency's operational skills, the goal is to promote sustainable agriculture based on internal expertise and best practices, ensuring the horticulture sector's self-sustained and enduring growth.

28. Outline of Activity for Formation and Strengthening of PGs (Component 1.1)

**Outline of Activity**

Activity	Purpose	Target Audience	Implementers	No of beneficiaries
Technical Support Group	Providing technical assistance and financial support (PGs management costs)	PGs	Technical Support Group	500 PGs

Source: JICA Survey Team

The below table shows lists of supports for formation and strengthening PGs—Technical Support Group (TSG) to be selected and contracted with the PMU. TSG will either provide direct support for the eligible PGs or coordinate with other concerned parties who could provide support for these PGs.

**Supports for forming and strengthening PGs**

#	Item	Details
1.	Sensitization the potential PGs and individual farmers	- TSG undertakes the sensitization of the potential farmers for working together for the farming, Post-harvest management and marketing.

#	Item	Details
2.	Training to CEO	<ul style="list-style-type: none"> <li>- TSG undertakes organizational capacity building for PGs through lecture mode (inviting concerned persons as lecturers and dispatching representatives of PGs to concerned institutes, etc.) and On the Job Training mode on a day-to-day basis for CEO and board members.</li> <li>- Assumed topics to be covered by the lectures are: i) the role of PGs in integrated horticultural Development, ii) By-laws and membership (including the participation of women farmers), iii) organizational structure, iv) roles and responsibilities of the Executive Committee, v) roles and responsibilities of general members, vi) holding meetings, vii) financial management, viii) record-keeping, ix) networking &amp; resource mobilization, etc.</li> </ul>
3.	Market survey with SHEP concept	<ul style="list-style-type: none"> <li>- TSG supports PGs to prepare business plan from the viewpoint of market needs, which is the basic concept of the SHEP approach for sustainable and effective implementation of business plans.</li> <li>- Representatives from both board and general members (about 30 are assumed) of PGs will visit destinations with potential market opportunities to understand demands and qualification of markets, and possibilities of having linkages.</li> <li>- TSG will support holding planning sessions where SHEP concept is explained to PG members and destinations of market visits are decided.</li> <li>- TSG will make necessary arrangement for market visits.</li> </ul>
4.	Business planning	<ul style="list-style-type: none"> <li>- PGs will prepare business plan in consideration of the results of market survey, with confirming marketing strategy and possible market linkages, necessary facilities and their operation, and technical training needs for member farmers. Financial plan and management arrangement for implementing business plan are also included.</li> <li>- TSG will support business planning through series of discussions with PG core members.</li> </ul>
5.	Implementation of business plan	<ul style="list-style-type: none"> <li>- For effective and smooth implementation of business plans by PGs, TSG under supervision of PMU as well as Project Management Consultant (PMC) will assist PGs in adequately managing their organizations and financial issues, procuring inputs, adopting good agricultural practices, aggregating produces, managing their quality, processing, and packaging, developing supply chain and market linkages, etc. through providing necessary guidance and coordinating with concerned parties and market-related actors in the private sector.</li> </ul>
6.	Supports for building facilities	<ul style="list-style-type: none"> <li>- Subsidies for building facilities (feed packhouses) will be provided by the Project (Component 2.1). TSG will seisitize potential PGs and individual farmers to form new PGs to apply for supports for building facilities such as micro irrigation facilities and Packhouses etc and support PGs in preparing all necessary documents and arrangements in contacting concerned parties.</li> </ul>
7.	Provision of technical training	<ul style="list-style-type: none"> <li>- Technical training for member farmers of eligible PGs will be planned and conducted by the Human Resources Development Unit of PMU and District extension workers (Component 1.3).</li> <li>- In consideration of the technical training needs of PG members, TSG will make necessary arrangements for farmers to receive necessary training by coordinating with HRD and PG motivators (Horticulture Extension Service).</li> </ul>
8.	Covering management costs of PGs	<ul style="list-style-type: none"> <li>- PMU will provide financial support to PGs for five years to cover such costs as salaries for CEO and Accountant, office rent, utility charges, minor equipment, travel and meetings, other miscellaneous expenses, etc to the eligible PGs from category 2 - 5.</li> <li>- The amount of financial support will be a similar level to that applied for under the "10,000 FPOs" scheme and be different depending on the scales and characteristics of PGs.</li> </ul>

Source: JICA Survey Team

29. Outline of Water-harvesting and Micro irrigation system activities are followings (Component 1.2).

- Water-harvesting Facilities Summary: The project aims to implement a micro-irrigation system, ensuring water sources through the creation of 500 large and 500 small ponds. Initial assessments will be conducted by DPMU with the Technical Support Group to evaluate site-

specific factors like water resources and topography. In Haryana, given the abundant sunlight, Photovoltaic (PV) systems will be set up to power water pumps, with 500 solar pumps planned for both pond sizes. Maintenance of these facilities is crucial, with training for proper O&M to be provided by PMU under PMC guidance. This project component will address water scarcity issues faced by farmers by offering water-harvesting facilities paired with solar pumps, also helping conserve groundwater in regions with depletion concerns. An annual cultivation plan based on water usage is also suggested.

- **Micro Irrigation Systems Summary:** This component focuses on promoting water-conservation in agriculture. It will provide horticultural facilities, particularly micro-irrigation systems, for those transitioning from cereal to horticultural crop cultivation in line with the "Mera Paani, Meri Virasat" initiative. The combination of drip irrigation with mulch is planned, benefiting water savings, reduced fertilizer use, labor savings, and earlier harvests. Different irrigation methods, like mini sprinklers and drip irrigation, will be introduced. Water use will be monitored through flow meters to gauge efficiency. Before any on-farm irrigation developments, water source verification will be done. The project will only support water-saving irrigation systems, like drip and micro-sprinkler methods. All eligible farmers under the project without micro-irrigation can receive these facilities provided they have or plan to secure a water source. Selected beneficiaries must contribute 15% towards the irrigation facility costs. Proper management of these facilities by farmers is mandatory, with training and maintenance support provided by the supplying entity.

### 30. Training in agricultural technology for PG members (Component 1.3)

The project will provide training to PG members in necessary agricultural techniques and collaborate with agricultural training institutions, agricultural colleges, and center of excellence to upgrade the skills of farmers through training programs and workshops focusing on improving cultivation techniques.

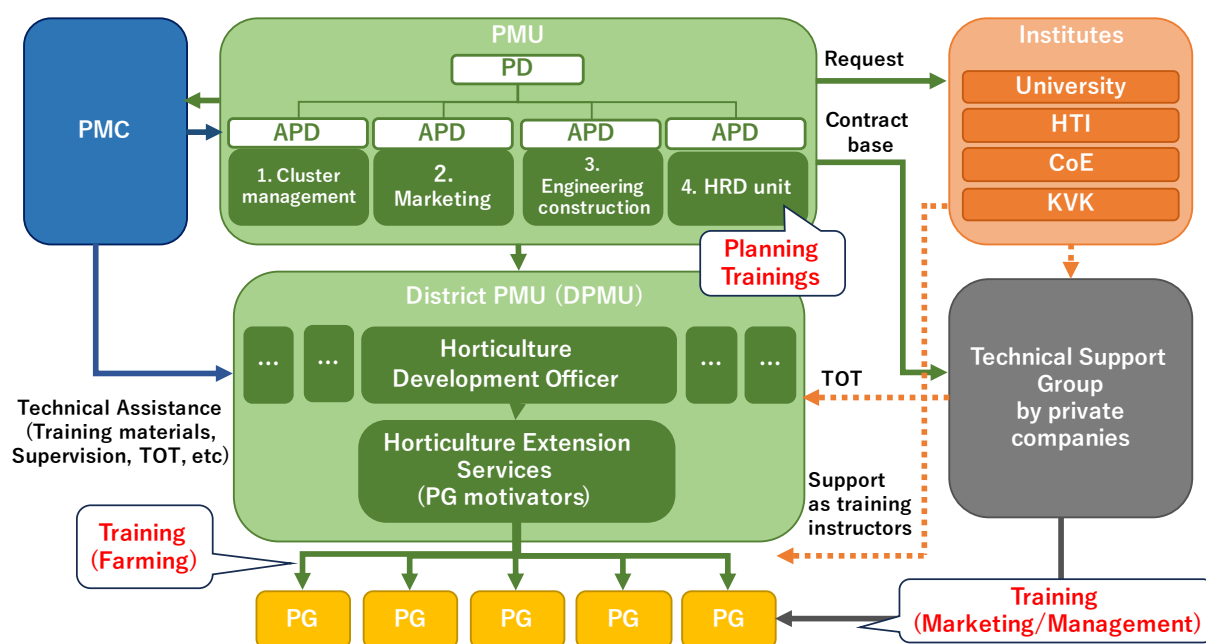
#### **Outline of the agricultural techniques training (Component 1.3)**

	Outline of the training	Target/ Participants/ Contents	Trainer	Duration and No of Participants
1	Climate-smart horticulture on vegetables (general)	<p>Target:</p> <ol style="list-style-type: none"> <li>1. PGs members (Preference should be given to PGs member, in particular women)</li> <li>2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target)</li> </ol> <p>Contents:</p> <ul style="list-style-type: none"> <li>- Agronomical practices (sowing, harvesting etc)</li> <li>- General horticulture guidance. Training content will be determined according to PG's request.</li> </ul>	District Extension officer and TSG, and PMC	40 persons in 2 times of trainings per batch, 3 days, Each 500 PGs i.e if average member per PGs is considered 100 so total beneficiaries would be 50,000
2	Climate-smart horticulture on fruits (general)	<p>Target:</p> <ol style="list-style-type: none"> <li>1. PGs members (Preference should be given to PGs member, in particular women)</li> <li>2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target)</li> </ol> <p>Contents:</p> <ul style="list-style-type: none"> <li>- General horticulture guidance such as modern technique of establishment of plantation crop.</li> <li>- Training content will be determined according to PG's request.</li> </ul>	District Extension officer and TSG, and PMC	40 persons per batch, 3 days, 2 times, Each 500 PGs i.e max average member per PGs is considered 80 so total beneficiaries 40,000
3	Climate-smart horticulture on exotic vegetables	<p>Target:</p> <ol style="list-style-type: none"> <li>1. PGs members (Preference should be given to PGs member, in particular women)</li> <li>2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target)</li> </ol>	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 600 for focal 5 district (Ambala, Yamunanagar, Panchkula, Gueugram, Faridabad)

	Outline of the training	Target/ Participants/ Contents	Trainer	Duration and No of Participants
		Contents: - Horticulture guidance such as package and practices on exotic crops - Training content will be determined according to PG's request. (Preference: Ambala, Yamunanagar, Panchkula, Gurugram, Faridabad)		
4	Climate-smart horticulture on fruits	Target: 1. PGs members (Preference should be given to PGs member, in particular women) 2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target) Contents: - Training on introduction of fruits crops such as Dragon fruits, Apple ber, Strawberry - Training content will be determined according to PG's request. (Preference: Sirsa, Hisar, Biwani)	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 360 for focal 3 district (Sirsa, Hisar, Biwani)
5	Cultivation techniques on floriculture	Target: 1. PGs members (Preference should be given to PGs member, in particular women) 2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target) Contents: - Training on the protected floriculture. - Training content will be determined according to PG's request. (Gurugram, Faridabad)	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 240 for focal 2 district (Gurugram, Faridabad)
6	Cultivation techniques on spices, medicinal and aromatic plants	Target: 1. PGs members (Preference should be given to PGs member, in particular women) 2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target) Contents: - Training on package practices - Training content will be determined according to PG's request. (Ambala, Kaithal, Palwal, Bhiwani, Mahendragarh, Yamunanagar)	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 720 for focal 6 district (Ambala, Kaithal, Palwal, Bhiwani, Mahendragarh, Yamunanagar)
7	Cultivation techniques on mushrooms	Target: - Landless farmers in the cluster - The preference should be given to women Selection criteria: - Farmers in pre-existing pockets/cluster of mushroom identified by PMU - In and around catchment area of processing unit Contents: - Training on cultivation under the control condition and Value addition - Training content will be determined according to PG's request. (Sonipat, Panipat, Kurukshetra)	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 360 for focal 3 district (Sonipat, Panipat, Kurukshetra)
8	Beekeeping techniques in focal areas	Target: - Landless farmers in the cluster - The preference should be given to women Selection criteria: - Farmers in pre-existing pockets - In and around catchment area of processing unit	Centre of Excellence, District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 240 for focal 2 district (Sonipat, Gurugram)

	Outline of the training	Target/ Participants/ Contents	Trainer	Duration and No of Participants
		Contents: - Training on rearing of bees and by product and value addition - Training content will be determined according to PG's request. (Sonipat, Gurugram)		
9	Nutrition improvement	Target: 1. PGs members (Preference should be given to PGs member) 2. FIGs in the cluster (the Project will not exclude FIGs as a target) 3. Preference should be given to Women and Child	PMU gender expert and TSG, and PMC	40 persons per batch, 2 days, 1 time, Each 500 PGs i.e max average member per PGs is considered 40 so total beneficiaries 20,000

Source: JICA Survey Team



Source: JICA survey team

**Figure Agricultural Extension System**

### 31. Agricultural Extension System

In this Project, as shown in the diagram above, the Project Management Consultant (PMC) will provide technical transfer on farming techniques to District extension workers or technical support groups, and District extension workers or technical support groups will teach farming techniques to the eligible PGs, FIGs and individual farmers in the clusters in a cascade approach to farm extension activities. The PMU will request training instructors from cooperating training institutions, as shown in the figure (e.g., University, HTI, CoE, and KVK). The Cooperating Institutions will provide training to the PGs as requested by the PMU, collaborating with a technical support group.

### 32. Gender main streaming

Horticultural crops are more labour-intensive to farm than grain crops. And the work is often done by women. Therefore, in order to reduce the amount of work done by women, farming instruments (Weeder, seeder, etc.) will be provided to PG.

### 33. Nutrition Improvement activities

### Outline of Nutrition Improvement

	Outline of the training	Target/ Participants/ Contents	Trainer	Duration and No of Participants
1	Nutrition Improvement Program	Target: PGs members (Preference should be given to women and child in the eligible PGs) Contents: - Basic Principles of Nutrition - Dietary Planning and Assessment	District Extension officer and TSG, and PMC	20 persons in 2 days, Each 500 PGs i.e so total beneficiaries would be 10,000
2	Sensitization of nutrition sensitive intervention	Target: PGs members (Preference should be given to women and child in the eligible PGs) Contents: - Health worker visits to measure blood pressure and weight.	District Extension officer and TSG, and PMC	Once a year, each 500 PGs i.e average member per PGs is considered 100 so total beneficiaries 50,000
3	Dissemination of kitchen garden for nutrition improvement	Target: PGs members (Preference should be given to female members in the eligible PGs) Contents: - Teaches about home garden. - Teaches how to use Seed, Shade net, Poly-frame for small tunnel, Water can, Sprayer, Fertiliser, Insecticide and Fungicide.	District Extension officer and TSG, and PMC	20 persons in 2 days, 2times, Each 500 PGs i.e so total beneficiaries would be 20,000
4.	Dissemination of recipes using nutritious ingredients	Target: PGs female members Contents: - Hold competition. - Provision of Printed materials	District Extension officer and TSG, and PMC	50 persons in 1 days, 4times, Each 500 PGs i.e so total beneficiaries would be 100,000

Source: JICA Survey Team

#### 34. Pilot farms and public-private partnerships (Component 1.4)

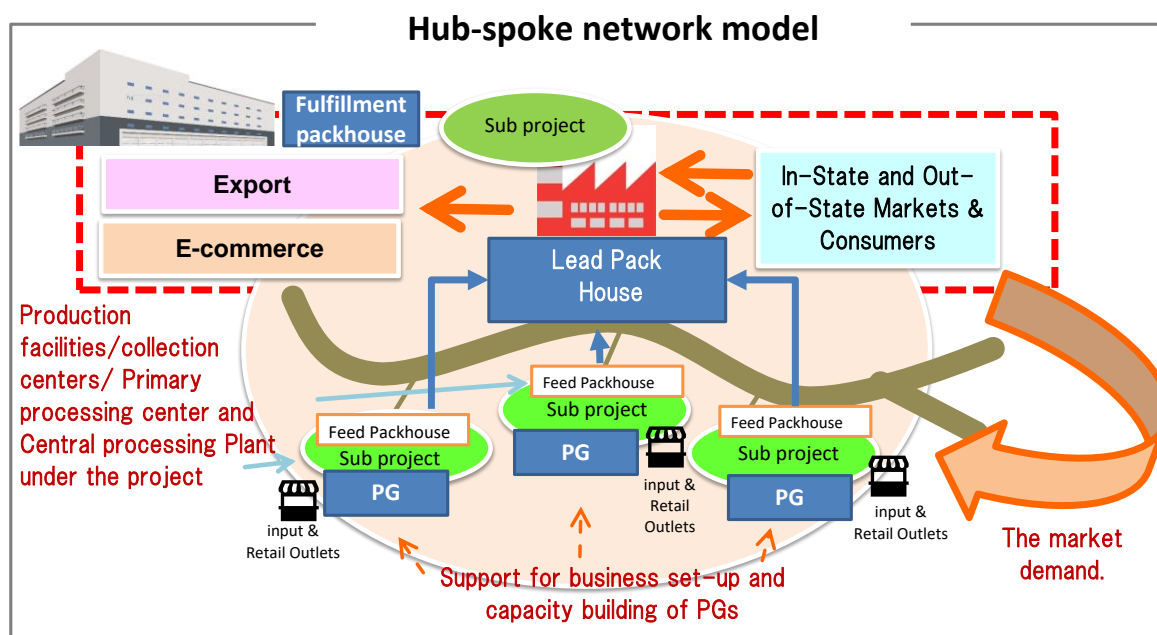
Pilot farm Establishment under Centre of Excellence: A pilot farm serves as a focal point for innovative agricultural practices in Haryana, offering hands-on learning experiences and allowing for localized adaptation of new technologies. It acts as a safeguard, letting farmers and extension workers test methods on a smaller scale, minimizing the risk of larger failures. Such hands-on experiences not only inspire farmers but also provide invaluable feedback to technology developers, ensuring rapid iterations. This approach ensures cost-effectiveness and relevance to local socioeconomic and climatic conditions. Functionally, the pilot farm acts as a training and resource hub, hosting workshops and providing access to essential farming resources, which also helps networking among farmers.

Village of Excellence: Some farmers in rural areas are difficult to access to Centre of Excellence, and it creates gaps in knowledge among farmers. To improve the situation, the concept of a "Village of Excellence" is proposed. Village of Excellence serves as a localized hub in rural areas, acting as an extension of the pilot farm and bringing the advancements and knowledge right to the doorsteps of farmers who might find it challenging to access centralized facilities. By leveraging the expertise and leadership of benevolent farmers, this model focuses on peer-to-peer learning, ensuring that knowledge dissemination is effective and relatable.

The Farmer Producer Organization (FPO) Initiative has led to a notable rise in vegetable production across various States, thanks to support from State Governments. Despite this, the marketing of vegetables remains problematic due to inadequate post-harvest management infrastructure. This lack particularly affects small and marginal farmers, as even with partial financial aid from the Government of India, there's still a considerable gap in accessing essential resources.

#### 35. infrastructure development for building value chains (Component 2.1)

Component 2 focuses Support for building value chains and Promotion of private sector partnerships, Infrastructure development for building value chains include the establishment of packhouses. The Project aims to provide financial support to help these Producer Groups with post-harvest management infrastructure, given the importance of post-harvest systems in realizing crop value. This includes the construction of four types of packhouses to strengthen horticultural value chains, following the criteria set by the CCDP. A core proposal is the hub-spoke network model, a centralized system used to optimize product flow and reduce costs. In agriculture, it can enhance product distribution by consolidating goods at hubs and distributing them efficiently. Implementing this model requires strategic planning concerning hub and spoke locations and necessary facilities. Additionally, the integration of an e-market function within packhouses is suggested.



Source: JICA Survey Team

### Image of Hub- Spoke network model

#### 36. E-market Place and an information sharing platform (Component 2.2)

Building an E-market Place and an information sharing platform: This component will create an e-marketplace to facilitate the sharing of distribution information, including market prices and direct transaction status, as well as a platform to promote cooperation and information sharing among PGs, aiming to improve operations by sharing best practices. E-markets will be built along with HUB-SPOKE model infrastructure facilities (e.g., processing plants with cold storage and logistics) that will be established to support value chain building. The physical market will function in sync with the digital system (DX) that incorporates all the services proposed in the E-market.

#### 37. Branding (Component 2.3)

Support the Development of a brand called "Haryana Fresh" to promote Haryana horticultural crops to aid local farmers by boosting their market value and consumer awareness, thereby contributing to the local economy. In the step of Branding Strategy, the Brand Strategy Section will be launched. The section will define brand positioning, identify target markets, and create a pricing strategy. The Development of the Sales Strategy steps include organizing pop-up events and produce markets, setting up online sales, and using Geographical Indications (GI) tags. The Development of the Promotion Strategy step will encompass planning social media marketing, organizing collaborations with influencers, participating in exhibitions and trade fairs, developing a packaging and labelling strategy, and designing and adopting the 'Haryana Fresh' logo and mark.

#### 38. Establishment of PMUs and DPMUs (component 3.1)



The establishment of Project Management Units (PMUs). A central PMU and 22 district-level DPMUs will be set up. The state PMU, overseen by a Project Director, will include an Additional Project Director and various supporting staff and specialists, such as experts in fruits, vegetables, and post-harvest management. Meanwhile, each DPMU will be led by a Deputy Project Director and will feature professionals in horticulture extension, marketing, infrastructure engineering, and other related fields. All these appointments will be made by the Department of Horticulture (DOH). The envisaged SPMU and DPMU structure is as follows.

### PMU structure

PMU (State Level)		
No.	Name of Position	No. of Personnel
1	Project Director (PD)	1
2	Additional Project Director (APD)	4
3	Administrative Officer	1
4	Planning officer	1
5	Superintendent	3
6	Assistants	6
7	SMS	
7-1	Fruits Expert	1
7-2	Vegetable Expert	1
7-3	Post Harvest Management Expert	1
7-4	Packhouse/Infrastructure Development Expert	4
7-5	Institution Development	1
7-6	Financial Management	1
7-7	Monitoring and Evaluation	1
7-8	Tender and Procurement	1
7-9	Branding and Marketing and Public Private Partnership	1
7-10	Food Processing and Quality Control	1
7-11	Dx expert	1
7-12	GIS-MIS Expert	6
7-13	Gender and Nutrition	1
8	Drivers	4
9	Computer Operator	1
10	Private Secretary	1
11	Personal Assistant	6
12	Office Attendant	6
13	Peon	6
<b>Total</b>		<b>45</b>

Source: JICA Survey Team

### DPMU structure

DPMU (District Level)		
No.	Name of position	No. of Personnel
1	Deputy Project Director	22
2	Horticulture Extension Services (HES)	22
3	Marketing and Quality Control (MQC)	22
4	Institution and PG Development (I&PGD)	22
5	Infrastructure Engineer (IE)	22
6	Horticulture Development Officer	44
7	Environmental and Social management / monitoring	22
8	Accountant	44
9	Computer Assistant	22
10	Office Attendant	22
11	Peon	22
<b>Total</b>		<b>286</b>

Source: JICA Survey Team

#### 39. capacity enhancement of DOH (component 3.2)

The activity of Strengthening the capacity of DOH is mainly aims to strengthen the capacity of DOH necessary for project implementation. The contents are capacity building of PMU staff, Review of an overall project implementation plan, and procurement of necessary materials and

equipment. As for the content of the workshop/training, first, orientation workshops will be conducted, and the outline of the purpose and components will be explained. The Project will strive to have a common understanding among the PMU staff and other stakeholders through this orientation workshop. After that, the PMU staff will be provided with knowledge of project cycle management and basic knowledge of managing the Project in the PDCA cycle and necessary technical knowledge to carry out the Project. The contents of the capacity development workshops and trainings are as follows.

### Outline of State-level workshop

Outline of the workshop/Training	Target/ Participants	Duration and No of Participants
Orientation Workshop	Target/Participants: SPMU staff	1 time
	Target/Participants: DPMU staff	22 times (in each District)
Workshops on utilization of PDCA cycle and progress Review	Target/Participants: SPMU staff	10 times (Intermittently) No of Participants is as per the no of project staff.
	Target/Participants: DPMU staff	220 times (10 times in each District)
HRD training on Team building, leadership, motivation, and stress management	Target/Participants: PMU	6 times (Intermittently)

Source: JICA Survey Team

#### 40. Capacity strengthening of horticultural extension services (Component 3.3)

The component of Strengthening the capacity of horticulture extension services aims to enhance the capacity of the Department of Horticulture (DOH) staff through various training programs and workshops. Activities encompass state and district-level workshops focused on planning, monitoring, and introducing the SHEP approach. Training will also be provided on vegetable cultivation techniques. Additionally, overseas training sessions will be organized in Japan to expose staff to advanced agricultural practices and policies, enabling them to glean insights from Japanese government consultations and private entities with cutting-edge agricultural technologies.

#### 41. Baseline studies and impact assessment (Component 3.4)

The Project will have 2 baseline surveys. 1) Before identifying the eligible PGs (under DoH's budget) The contents of baseline survey which is to be conducted by DoH is to establish the availability of horticulture crops, potential for the diversification, potential for the introduction of micro irrigation and farmer's willingness in horticulture clusters. 2) After the identifying the eligible PGs (under the budget of JICA ODA Loan). The contents of the baseline survey and impact assessment are as follows.

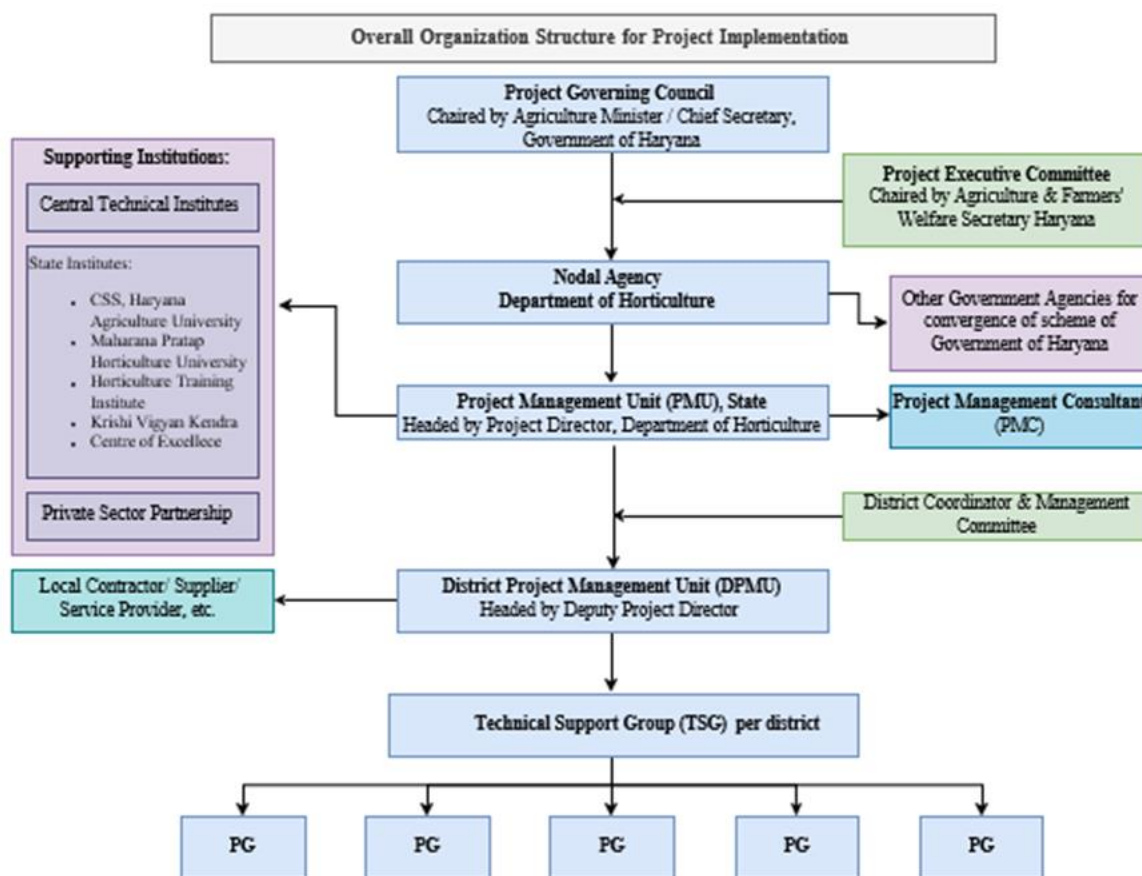
### Outline of Baseline Survey and Impact Assessment

Survey	Contents	Remarks
<b>Baseline survey</b>	- A household survey in approximately 30 households per the eligible PGs (402 PGs)	Survey to be carried out by resource agency, supervised by District PMU at each site, under the overall coordination of State PMU with technical and managerial support by project consultant and TSG for TOR preparation, selection of survey contractors, field execution, analysis & evaluation, report preparation, and dissemination. Through the process of these activities, we will strengthen the capacity of PMU and DOH staff.
<b>Mid-line survey</b>	A household survey in approximately 30 households per the eligible PGs (402 PGs)	• Survey to be carried out by resource agency, supervised by District PMU at each site, under overall coordination of State PMU. Through the process of these activities, we will strengthen the capacity of PMU and DOH staff.
<b>End-line survey</b>	A household survey in approximately 30 households per the eligible PGs (402 PGs)	• Survey to be carried out by resource agency, supervised by District PMU at each site, under the overall coordination of State PMU. Through the process of these activities, we will strengthen the capacity of PMU and DOH staff.

Source: JICA Survey Team

## Chapter 7: Implementation Plan

42. The overall project organisation structure is proposed as shown below.



Source: JICA Survey Team

### Overall Organisation Structure for Project Implementation

43. Project Governing Council

The Department of Economic Affairs will be the nodal agency at the GOI level to review and monitor the project progress of the JICA-funded HRSHP.

GoHR will establish a State Level Project Governing Council (PGC) chaired either by the Agriculture Minister or Chief Secretary which will be decided by the Government of Haryana. The Secretary of Agriculture and Farmers Welfare will be the Secretary of this Committee. The PGC will meet once in six months to review progress, provide overall guidance and policy support and to facilitate inter-departmental coordination. The members of the PGC will include: (i) Secretary, Finance; (ii) Secretary, Agriculture and Farmers Welfare; (iii) Secretary, Rural Development; (iv) Secretary, Planning; (v) Secretary, of MSME / Industry; (vi) Secretary, Cooperatives, (vii) Secretary, Irrigation, and (viii) Project Director of HRSHP.

44. Project Executive Committee

The Government of Haryana (GoHR) will establish a Project Executive Committee (PEC) headed by the state Secretary of Agriculture and Farmers Welfare, with members from various government departments, JICA representatives, and special invitees like Farmer's representatives. The PEC will convene quarterly to approve annual plans, review progress, address implementation issues, and ensure alignment with other government activities. For project management, the Project Management Unit (PMU) will organize meetings, handle reporting to JICA, and manage knowledge related to the project. Financially, the PMU will integrate budget requirements, manage the project account, maintain fund utilization records, prepare financial statements, and oversee the submission of audit reports.

45. District Coordination and Management Committees (DCMCs)

Each district involved in the project will have a District Coordination and Management Committee (DCMC) led by the District Magistrate and co-chaired by the District Panchayat Development Officer. Key members include officers from various district departments and Farmer's representatives. This committee will facilitate project execution at the district level and ensure cooperation between the project and other governmental bodies, meeting on a quarterly basis. The Department of Horticulture (DoH) will oversee the project through the Project Management Unit (PMU) and District Project Management Unit (DPMU). They will appoint skilled officers assisted by experts hired for the project duration.

46. The Project Management Unit (PMU)

The Project Management Unit (PMU) oversees daily project operations, including coordination, planning, partnerships, monitoring, reporting, and financial management. The Project Director (PD) leads the PMU and is responsible for its overall performance, supervising activities, overseeing field operations, managing project accounts, staffing, procurement, and ensuring necessary audits align with JICA requirements. The PD ensures the PMU functions according to the Project Agreement and receives adequate funding.

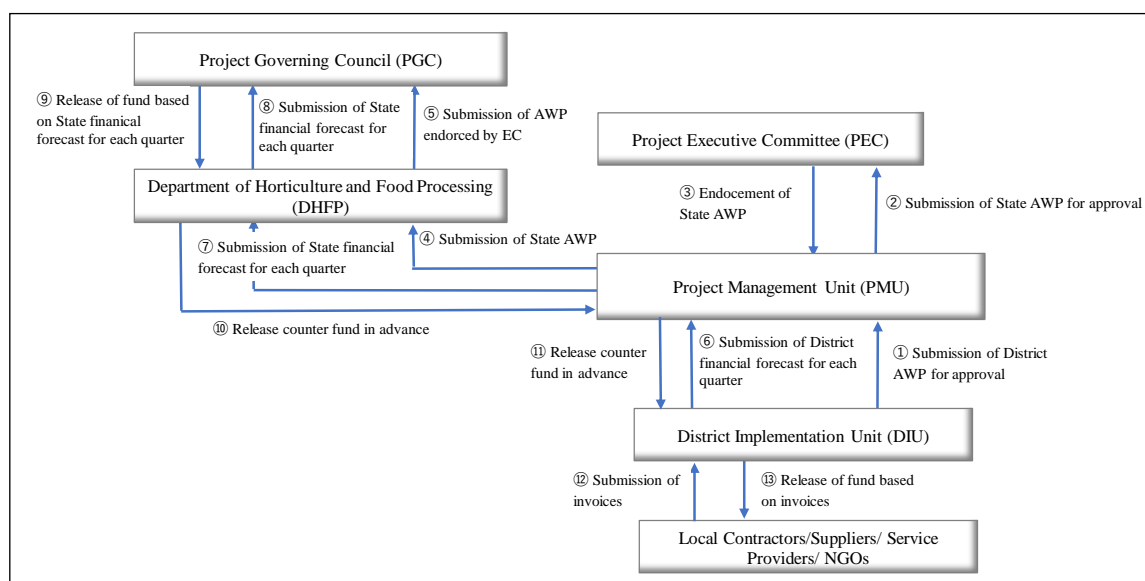
The PMU will set up District Project Management Units (DPMU) in each district. DPMUs, guided by their Deputy Project Director, will handle activities such as establishing district and cluster offices, devising and funding horticulture plans, improving the horticulture supply chain, ensuring funding for PGs, overseeing project activities, and partnering with service providers for effective implementation.

47. Project Management Consultant (PMC)

The Project Management Consultant (PMC) will be procured by the PMU to reinforce the implementation capacity of the PMU particularly to ensure technical and management support of the Project. The PMU will assist PMU and DIUs in the improvement of process and procedures for project implementation at state, district and block levels.

48. Overall Fund Flow

The financial year of the Project is from 1st April of the year to 31st March of the next year. As shown in the following figure, the project funding procedure will start with submission to and approval of annual work plan (AWP) from PGC, and the same for financial forecast for every quarterly, and then fund will be released to PMU's account in advance.



Source: JICA Survey Team

**Overall Fund Flow**

#### 49. Procurement plan

The Project intends to procure construction, goods, such as office equipment, transportation tools, farm machinery, and laboratory equipment, and services from PMC, NGOs, or universities. The PMU will prepare detailed plans and descriptions for these, adhering to international or national technical standards. Environmental legislation will be respected in procurement descriptions, and a committee will oversee the tender process. Multiple procurement methods, including international and local competitive bidding, quotations, and direct undertakings, will be used. Local procurement will primarily follow Haryana Procurement Rules.

#### 50. Implementation Schedule

Implementation Schedule of the Project: The project implementation period will be nine years starting at 2024.

##### Brief Implementation Schedule of the Project

No.	Work Item	Fiscal Year (April to March)										
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
0	Project Preparation Stage											
	Appraisal		▲									
	Pledge		▲									
	Signing of Loan Agreement		▲									
	Establishment and function of PMU/DPMU											
	Selection of PMC											
1	Support for crop diversification into horticultural crops and Reinforcement of production support											
	1.1) Formation and strengthening of PGs											
	1.2) Water-harvesting and Micro irrigation system											
	1.3) Horticulture guidance											
	1.4) Pilotfarm Establishment and Public-private partnerships											
2	Support for building value chains and Promotion of private sector partnerships											
	2.1) Infrastructure development for building value chains											
	2.2) Building an E-market Place and a information sharing platform											
	2.3) Branding											
3	Institutional development for Project Management											
	3.1) Installation of PMU and DPMU											
	3.2) Strengthening the capacity of DOH											
	3.3) Strengthening the capacity of horticulture extension services											
	3.4) Baseline Studies and Impact Assessment											
4	Consulting Services											

Source: JICA Survey Team

### **Chapter 8: Project cost.**

51. The total project cost will be INR 27,384 million (approximately JPY 47,921 million).

### **Chapter 9: Project Evaluation**

#### 52. Project Benefits

Project Benefits and Economic Evaluation: The project benefit is generated on a monetary basis by value addition of horticulture crop and reduction of Post-harvest Loss by utilizing packhouses to be achieved from the implementation of project components. It is concluded that the Project is economically feasible with an economic internal rate of return (EIRR) of 12.6% and a B/C of 1.87. Intangible benefits are the increase of farm household income in project area, strengthening of management capacity of PGs, capacity development of government institutions.

#### 53. Operational indicators for Project Monitoring

Operational indicators are 1) area of horticultural crops expanded, 2) area of crop diversification, 3) groundwater use in the project area, 4) income of target farmers, 5) food loss rate (vegetables and fruit) between harvest and market, 6) sales performance of horticultural crops, and 7) percentage of women-focused producer group.

#### 54. Risk Management

Risk Management: Risks of the Project are identified and assessed from the viewpoints of 1) stakeholder risk, 2) executing agency risk, and 3) project risk based on JICA's Risk Management Framework, and each treatment for risks to be conducted by the Project are proposed.

### **Chapter 10: Environmental and Social Considerations**

55. The project needs to ensure appropriate environmental and social considerations in accordance with the JICA Guidelines for Environmental and Social Considerations (promulgated in January 2022). The JICA survey team conducted a review of the relevant instruments such as the Indian national laws and the EIA Rules as prescribed by the State of Haryana. A stakeholder analysis was also carried out to identify stakeholders and their role in the environmental and social assessment process. As the project is classified as FI, the following environmental and social aspects were reviewed: (1) environmental and social policy; (2) screening, categorisation and review procedures; (3) environmental and social organisational structure and staffing; (4) monitoring and reporting procedures; (5) environmental and social management performance; and (6) capacity building and improvement needs. An environmental and social management system (ESMS) checklist was developed and analysed. Based on the analysis of the checklist, an Environmental and Social Impact Assessment Framework (ESAF) and monitoring forms were developed to fill in the gaps. In preparing the framework and monitoring forms, the potential environmental and social impacts specific to the project were assessed, in particular the development of value chain facilities (feed pack houses, lead pack houses, fulfilment centres, retail outlets, etc.), the construction of new buildings for the PMU or other new buildings, the potential impacts associated with land acquisition where required, the development of water saving irrigation facilities, the use of pesticides, and human wildlife conflict, among others. In addition, an Environmental Management Plan (EMP) and an Environmental Monitoring Plan (EMoP) were prepared for the project to establish an environmental and social monitoring system and appropriate safeguards.

### **Chapter 11: Recommendations**

56. Supervision of project implementation

In order to ensure proper and smooth implementation and supervision of the project, the DOH considers it essential to appoint PMU / DPMU staff, procure office equipment, establish a project monitoring system, conduct a comprehensive market survey in major markets and a detailed study of existing FPOs before commencing the PMC procurement process. We consider this essential.

Existing PGs are the target group for this project. With regard to the involvement of PGs in the project, it is expected that it will take time to familiarise PGs with the project concept, build consensus among PG members and mobilise farmers from the surrounding area to join the PGs. The TSG is responsible for supporting this PG involvement in the project. It is therefore proposed that the selection of TSGs be accelerated at the start of the project and that the selection requirements for TSGs include whether they have a track record of developing PGs.

57. Strengthening horticultural extension

Water-efficient irrigation and soil degradation control: Water-efficient horticultural facilities exist in Haryana, but further improvement in water use efficiency is needed. To learn about efficient use of facilities, DOH extension workers should visit developed areas in India and abroad. One candidate is the state of Rajasthan. Rajasthan has long suffered from groundwater depletion and soil degradation, and it is suggested that reference should be made to small-scale irrigation using artificial reservoirs and solar pumps, rainwater harvesting irrigation and soil salinity management.

Access to quality seed: Haryana is capable of producing high quality horticultural crops due to its climate and proximity to the metropolis of Delhi, but faces challenges in accessing quality seed. The availability of seedlings in Haryana is very limited, especially for varieties such as the popular seedless kinnow. The neighbouring state of Punjab is a major producer of kinnow, but in order to compete with Punjab, it is essential that the project supports the matching of farmers and equipment suppliers (private sector). It is also recommended that joint research and development be

undertaken between universities and research centres in Haryana and foreign seed companies and agricultural universities, including those in Japan, for the production of quality seeds.

**Flower production:** Since Haryana procures flowers from other states like Rajasthan, it is recommended to reduce dependence on procurement from other states by increasing flower production in the state.

**Medicinal plants and spices:** Medicinal plants and spices are in high demand abroad and India is a major producer. The area under cultivation in Haryana is negligible, but it is suggested that the necessary processing facilities for export be set up to facilitate exports in the future.

#### 58. Sustainable agriculture

The project contributes to the reduction of greenhouse gases through the shift from rice to horticultural crops. It is therefore encouraged to consider the purchase of carbon credits in the future.

As the project component includes the promotion of farming practices that emphasise sustainable production processes, such as water-saving irrigation and micro-irrigation, certification for agricultural sustainability, such as eco-labelling, could also be considered. In the future, it is proposed to create a market for the branding and sale of agricultural products as having been produced by environmentally friendly agriculture.

#### 59. Industry-government-academia cooperation

**COE, establishment of a pilot farm at the Agricultural University:** As the post-harvest COE envisaged in this project has already been established with UK support, the project proposes instead to establish a vegetable COE and a pilot farm at the Agricultural University, to be piloted by the private sector. The project proposes instead to establish a vegetable COE and a pilot plot at the Agricultural University, which could then be used by the private sector to develop pilot projects.

In order to promote partnerships with the private sector, it is proposed that the pilot plots to be established at the COE and the University of Agriculture will be used to implement further public-private partnership activities through the following activities.

- **Online initiative Webinars & Virtual Workshops:** both public and private stakeholders will present their perspectives, solutions and requirements.
- **Online initiative Online hackathons:** organise events where investors, agricultural experts and companies work together to solve challenges faced by farmers.
- **Field days:** set aside days when private actors can visit pilot farms and good farming villages to see demonstrations and interact with the local community.
- **Participation in and organisation of exhibitions:** attract potential private partners by opening or having stands at agricultural fairs to showcase technologies, methods and achievements.

#### 60. Gender mainstreaming.

Rural women have limited access to jobs, training and decision-making power. The project proposes awareness-raising activities to increase women's participation in Producer Groups (PGs), provide agricultural tools to reduce workload and promote gender awareness in the DOH. These activities are detailed in the Gender Action Plan. On nutrition, it is recommended to include nutrition information in PG horticulture training, promote home gardens to address micronutrient deficiencies, and post nutrition information in highly visible community spaces to further disseminate this knowledge.

#### 61. Convergence

As part of strengthening transparency and accountability, consideration should be given to increasing transparency and accountability through regular reporting and evaluation by all

stakeholders. To this end, it is suggested that a project management system be implemented and that an online dashboard or other system be used to track project progress and individual results.

#### 62. Vendor selection in Digital Transformation

As the system design to be implemented in this project is large and complex, the selection of vendors should be based on more comprehensive evaluation criteria than just price. In preparation for the tender, it is essential to conduct a detailed survey to clarify the system content and specifications, and communication with potential vendors is essential in this process. It is therefore important to obtain information on available technologies and products through a Request For Information (RFI<sup>1</sup>), to accurately convey the requirements of the implementing organisation and to clarify the functional and performance requirements of the system. System requirements cover a wide range of aspects such as user interface, data definition, processing volume, response time and information security. In addition, an RFI should be used to establish in detail the applicability, construction and maintenance costs of the system. The tendering process must also be carefully managed to ensure both impartiality and confidentiality.

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<sup>1</sup> The purpose of an RFI is to gather detailed information on available options, technologies, products, etc. and use this information to prepare a more specific Request for Proposal (RFP). The purpose of an RFI is to gather detailed information on available options, technologies, products, etc. and to use this information to prepare a more specific Request for Proposal (RFP).

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## **Chapter 1 Introduction**

### **1.1 Applied Contract Terms**

This final report is prepared following the terms of reference (TOR) of the contract agreement between the Japan International Cooperation Agency (JICA) and Nippon Koei Co., Ltd. signed on 21st October 2022 for Preparatory Survey on Haryana Sustainable Horticulture Promotion Project. This report presents the survey outputs of Works from October 2022 to February 2024.

### **1.2 Background of the Survey**

The Survey will be conducted in Japan and India for seventeen months, starting from October 2022. The interim report is for the preparatory survey (hereinafter referred to as "the Survey") on Haryana Sustainable Horticulture Promotion Project (hereinafter referred to as "the Project") to be funded under JICA Official Development Assistance (ODA) loan. The objective of the Survey is to provide the necessary information and data for an ODA loan appraisal and make the required proposal to refine the Preliminary Project Report (PPR) prepared by the Department of Horticulture (DOH) executing agency in the state government of Haryana. The Survey will analyse the issues in India and Haryana's agricultural sector. Also, the Survey will extract lessons learned from the preceding ODA loan project, review the proposed PPR, validates the project components, implementation schedule and organization, procurement procedure, construction method, and plan, project cost, the environmental and social consideration of the project, economic/financial feasibility and operation/effect index, etc.

### **1.3 The Objective of the Survey**

The survey aims to review the project details described in PPR, focusing on technical and economic feasibilities and eligibility to be implemented as an ODA loan project through field study at the Project site, interviews with the stakeholders, and discussion with the implementation agency, DOH, supported with JICA.

### **1.4 Survey Area**

The target survey area is the whole 22 districts of the state of Haryana (Ambala, Bhiwani, Charkhi Dadri, Faridabad, Fatehabad, Gurugram, Hisar, Jhajjar, Jind, Kaithal, Karnal, Kurukshetra, Mahendragarh, Nuh, Palwal, Panchkula, Panipat, Rewari, Rohtak, Sirsa, Sonipat, Yamuna Nagar). The survey area is illustrated in the survey map on the first page of this report.

### **1.5 Scope of the Survey**

The scope of this survey is to undertake the survey works to achieve the objectives stipulated in 1.3. While conducting the survey, the survey team shall consider the survey approach and points, prepare reports as scheduled in the work plan, and explain and discuss the methods to achieve the objectives with the implementation agency.

### **1.6 Work Schedule of the Survey**

The survey will be conducted from October 2022 to February 2024 for 17 months. The outline of the work schedule is indicated in Table 1.6.1

**Table 1.6.1 Work Schedule**

Works	2022			2023												2024	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
<b>1st Home Country Works</b>																	
(1) Collection and Analysis of the Available Reference Materials	■																
(2) Preparation of subcontract survey instructions	■																
(3) Discussion on SHEP Approach	■																
(4) Preparation and Review of Inception Report	■																
<b>1st Field Survey Works</b>																	
(1) Explanation of Inception Report			■														
(2) Validation of the background and necessity of the project and analysis of core Issues			■														
(3) Supply Chain Survey on Horticulture Crops			■														
(4) Demand Forecast of Horticulture Crops			■														
(5) Analysis of the existing situation of crop diversification			■														
(6) Confirmation of Current Situation on Groundwater Depletion and Soil Degradation as well as Impact Assessment on Alleviation of Environmental Load				■													
(7) Interview with the Private companies					■												
(8) Discussion on Brand Development						■											
(9) Consideration of cooperation measures with experimental stations (Centers of Excellence) and research institutes							■										
(10) Visits to advanced producer organisations								■									
(11) Review of the Project Plan									■								
(12) Analysis of Issues and Preparation of Outline of the Project plan										■							
<b>2nd Home Country Works</b>																	
(1) Preparation and Submission of Interim Report																	
(2) Explanation of the second field survey response policy to JICA																	
(3) Planning of Japanese Invitation Program																	
<b>2nd Field Survey Works</b>																	
(1) Explanation of Interim Report and Work Plan in Second Field Survey to JICA and DOH																	
(2) Formulation a detailed project plan																	
(3) Preparation of the Project Implementation Schedule																	
(4) Project Cost Estimate																	
(5) Project Organization System for Implementation and Monitoring																	
(6) Procurement Plan																	
(7) Development of Specific Action Plan																	
(8) Environmental and Social Considerations																	
(9) Project Effects																	
(10) Impact of Climate Change to Agriculture and Irrigation																	
(11)Preparation of the TOR for the Consulting Service																	
(12)Risk Management																	
(13)Implementation of the pilot project																	
<b>3rd Home Country Works</b>																	
(1) Implementation of the Japanese Invitation Program																	
(2) Preparation of Draft Final Report																	
(3) Update DPR based on survey results																	
<b>3rd Field Survey Works</b>																	
(1) Discussion toward Preparation of Final Report																	
<b>4th Home Country Works</b>																	
(1) Preparation of Final Report																	
<b>Others</b>																	
(1) Reports			△ IC/R														
(2) Fact Finding Mission													△		△	△	
(3) Overseas Training in Japan																	△
(4) Pilot Activities																	△

Legend: ■ Field Survey Works □ Home Country Works

Source: JICA Survey Team

## **Chapter 2    Natural and Socio-Economic Status of the Survey Area**

### **2.1    Area and Demography**

#### **2.1.1    General**

Haryana is a state in northern India that is bordered by the states of Punjab, Himachal Pradesh, and Rajasthan, as well as the national capital region of Delhi. It covers an area of 44,212 sq. km and has a population of approximately 25.4 million people in 2011 according to the latest census of India (2011 Census). An increase from figure of 21.1 million in 2001 census. The population of Haryana forms 2.09 percent of India in 2011. In 2001, the figure was 2.06 percent. Haryana has 22 districts, namely, Charkhi Dadri, Panchkula, Faridabad, Rewari, Kaithal, Gurugram, Mahendragarh, Jhajjar, Hissar, Sonapat, Rohtak, Jind, Fatehabad, Bhiwani, Palwal, Kurukshetra, Sirsa, Karnal, Ambala, Nuh, Yamuna Nagar, and Panipat. The state's capital city is Chandigarh, which is a Union Territory and serves as the capital of both Haryana and Punjab.

Haryana has a predominantly agricultural economy, with over 70% of its population engaged in agriculture and related activities.<sup>1</sup> The state is known for its production of wheat, rice, sugarcane, cotton, and mustard, among other crops. In recent years, the state has also witnessed significant growth in the manufacturing and service sectors, with several large-scale industries located in cities like Faridabad, Gurugram, and Panipat.

The section below describes the socioeconomic district-wise features of the state.

#### **2.1.2    Administrative Structure**

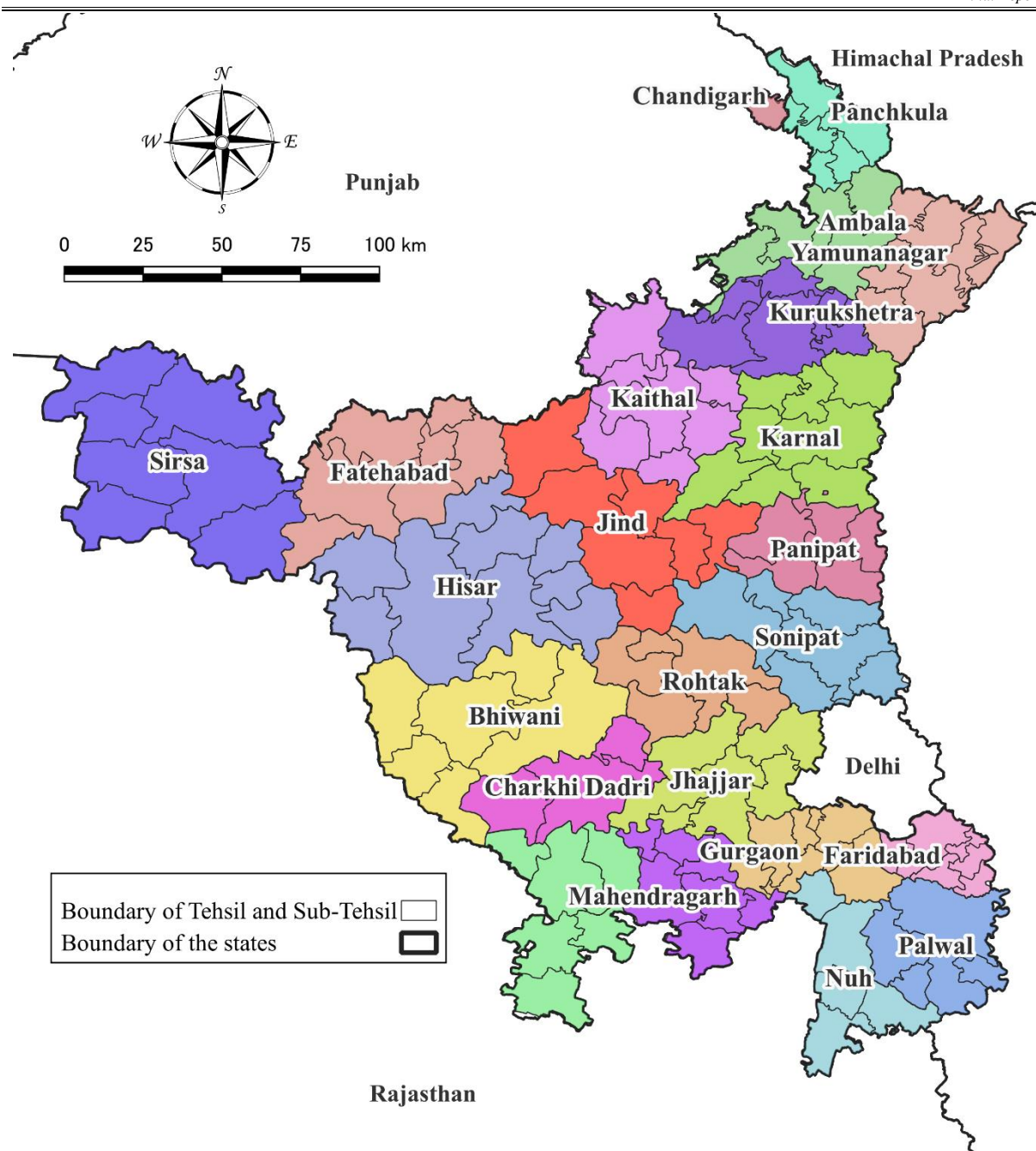
The state is governed by a Chief Minister and a Council of Ministers, who are responsible for the administration of the state's affairs. The state's legislative branch is composed of a unicameral legislature, the Haryana Vidhan Sabha, which consists of 90 members elected by the people of the state. Vidhan Sabha is the legislative assembly of the state of Haryana in India. It is a unicameral legislature and the only house of the state's parliament. The assembly has a total of 90 members who are elected for a term of five years through regular elections. The constituencies for the elections are demarcated based on the population density of the state.

The Vidhan Sabha has the power to make laws and approve budgets for the state government, and also scrutinize and approve the policies and budgets proposed by the government. The members of the Vidhan Sabha can also ask questions and make suggestions to the government. The Haryana state government consists of three important branches: the Executive, which includes the Chief Minister and other members of the government; the Judiciary, which includes the Haryana High Court; and the Legislature, which includes the Vidhan Sabha.

The name and structure of administrative divisions may vary from state to state. Each state is divided into several districts. Each district is further subdivided and includes administrative units such as Tehsils, Sub-Tehsils, and Blocks. These administrative units typically manage geographic areas and provide administrative services. Each block further subdivides a particular area. A block includes several villages and is responsible for administration, especially in rural areas. Haryana state is divided into six divisions for administrative purposes; they are Ambala, Faridabad, Gurugram, Hisar, Rohtak and Karnal. Within these divisions there are 22 districts, 47 sub-divisions, 67 tehsils, 45 sub-tehsils and 116 blocks. There is total 81 cities and towns in Haryana and 6,759 villages. Cities and towns are dotted throughout the district and are densely populated and highly urbanized areas. The main difference between a City and a Town is related to population size, which is defined according to Indian law. There is total 81 cities and towns in Haryana and 6,759 villages. Below are the 22 Districts of Haryana state.

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<sup>1</sup> <http://agriharyana.gov.in/>



Source: Prepared by JICA Survey Team

**Figure 2.1.1 Survey Area**

Haryana is divided into 22 districts, each of which is further divided into blocks and villages. Divisions: Haryana is divided into six divisions. Each division consists of several districts. Each district is composed of several Sub-Divisions, which are composed of Tehsil or Sub-Tehsil. Each Tehsil/Sub-Tehsil consists of multiple Blocks. Village Panchayats: Each Block consists of several Village Panchayats. Horticultural Extension Officers are employees of the Horticulture Department of the Government of Haryana works to disseminate agricultural technology and information to farmers in the region. Horticultural Extension Officers are located in each District and Sub-Division.

Specifically, one to several extension agents is assigned to each Sub-Division to provide information on new agricultural technologies, cultivation methods, pest control, etc. to farmers and rural residents in the area. Agricultural extension agents are attached to the Block Development and Panchayat Office (BDPO), a sub-organization of the District's Horticultural Division.

Thus, the local administrative divisions in Haryana are stratified from larger areas to smaller areas, with the smallest Village Panchayats functioning as village-level municipalities.

Haryana has 6 administrative divisions, 22 districts, 54 sub-divisions, 64 tehsils, 33 sub-tehsils, 109 blocks, 6,841 villages and 158 towns and 18 cities.

Table 2.1.1 shows the overview of the administrative units of the Haryana by districts.

**Table 2.1.1 Number of Administrative Units by District**

Division	District	Sub-Divisions	Tehsil	Sub-Tehsil	Blocks	Villages			Town*	City*
						Total	Inhabited	Uninhabited		
Ambala	Ambala	3	4	2	5	470	461	9	15	1
	Kurukshetra	2	2	1	5	415	407	8	5	1
	Panchkula	1	1	0	2	219	206	13	8	1
	Yamuna Nagar	2	3	1	5	636	611	25	12	1
Faridabad	Faridabad	2	2	1	3	149	144	5	3	1
	Nuh	2	2	1	3	439	412	27	2	0
	Palwal	2	2	1	3	280	268	12	6	0
Gurugram	Gurugram	5	5	3	5	242	229	13	9	1
	Mahendragarh	3	4	2	6	370	369	1	5	1
	Rewari	3	3	1	5	403	389	14	9	1
Hisar	Fatehabad	2	3	1	6	245	245	0	4	0
	Hisar	3	5	3	9	269	268	1	11	1
	Jind	2	3	1	5	306	302	4	6	1
	Sirsa	2	3	1	6	330	327	3	5	1
Karnal	Kaithal	2	2	2	5	269	267	2	4	1
	Karnal	2	3	2	6	434	417	17	8	1
	Panipat	2	2	1	4	186	176	10	12	1
Rohtak	Bhiwani	3	4	2	9	444	442	2	6	1
	Charkhi Dadri	2	2	1	3	0	0	0	1	0
	Jhajjar	3	3	2	4	260	247	13	5	1
	Rohtak	3	3	2	5	143	136	7	5	1
	Sonipat	3	3	2	5	332	319	13	8	1
	<b>Total</b>	<b>54</b>	<b>64</b>	<b>33</b>	<b>109</b>	<b>6841</b>	<b>6642</b>	<b>199</b>	<b>158</b>	<b>18</b>

Note: Urban places with less than 1,00,000 population are referred to as "town", while urban places with 1,00,000 or more population are referred to as "city".

Source: Website of Haryana state <https://haryana.gov.in/> and 2011 Census

### 2.1.3 Demographic Feature

#### (1) Population

Total population of Haryana as per latest census data is 24,933,492 of which males and females are 13,277,962 and 11,655,530 respectively. And the projected population for 2023 accounted to 29,401,364. The population density of the whole state is 565 persons per sq. km, with a range from the highest of 2442 in Faridabad district to the lowest of 303 in Sirsa District. The overall decennial growth rate of the population was 17.91% during 2001-2011. There is a remarkable disparity in growth rate by district as shown in Table 2.1.2.

**Table 2.1.2 Area, Density and Decennial Growth of Population by District**

District	Area in sq. km.	Total Population			Decennial Growth (2001-2011)	Decennial Growth (2011-2023) (Projected)	Density per sq. km. (2011 Census)
		2001 Census	2011 Census	2023 (Projected)			
Ambala	1,574	1,014,411	1,128,350	1,255,087	113,939	126,737	717
Kurukshetra	1,530	825,454	964,655	1,127,330	139,201	162,675	630
Panchkula	898	468,411	561,293	672,593	92,882	111,300	625
Yamuna Nagar	1,768	1,041,630	1,214,205	1,415,372	172,575	201,167	687
Faridabad	741	1,990,719	1,809,733	936,594	(625,254)	(428,871)	2,442
Gurugram	1,258	870,539	1,514,432	2,634,580	643,893	1,120,148	1,204
Mahendragarh	1,899	812,521	922,088	1,046,430	109,567	124,342	486
Rewari	1,594	765,351	900,332	1,059,119	134,981	158,787	565
Fatehabad	2,538	806,158	942,011	1,100,758	135,853	158,747	371

District	Area in sq. km.	Total Population			Decennial Growth (2001-2011)	Decennial Growth (2011-2023) (Projected)	Density per sq. km. (2011 Census)
		2001 Census	2011 Census	2023 (Projected)			
Hisar	3,983	1,537,117	1,743,931	1,978,571	206,814	234,640	438
Jind	2,702	1,189,827	1,334,152	1,495,983	144,325	161,831	494
Sirsa	4,277	1,116,649	1,295,189	1,502,276	178,540	207,087	303
Kaithal	2,317	946,131	1,074,304	1,219,841	128,173	145,537	464
Karnal	2,520	1,274,183	1,505,324	1,778,395	231,141	273,071	597
Panipat	1,268	967,449	1,205,437	1,501,969	237,988	296,532	951
Bhiwani	4,778	1,425,022	1,634,445	1,874,645	209,423	240,200	342
Jhajjar	1,834	880,072	958,405	1,043,710	78,333	85,305	523
Rohtak	1,745	940,128	1,061,204	1,197,873	121,076	136,669	608
Sonipat	2,122	1,279,175	1,450,001	1,643,640	170,826	193,639	683
Total	44,149	21,144,564	24,933,492	29,401,364	3,788,928	4,467,872	565

Note: Nuh, Palwal, Charkhi Dadri were officially notified as districts of Haryana by the Government of Haryana state in 2005, 2008, 2016 respectively. Hence the data is not available.

Source: JICA Survey Team based on the data in Office of the Registrar General & Census Commissioner, India 2001, 2011 Census (<https://censusIndia.gov.in/>)

Looking into the population distribution in the rural and urban areas, 64.7% of the population lives in the rural setting. In Faridabad 79.5% are living in the urban area.

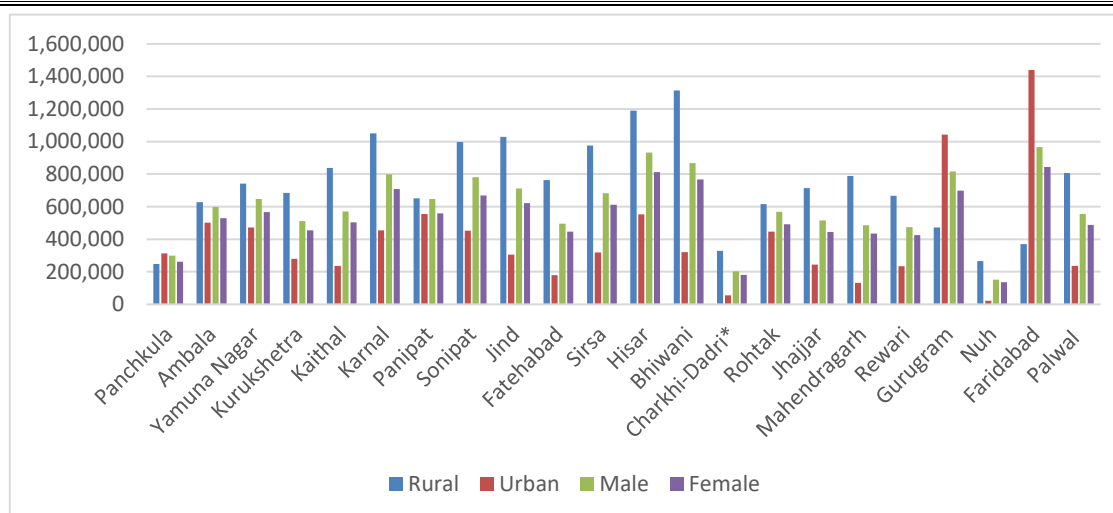
According to the Indian Census, the ratio of women to men was very low in some districts of Haryana, especially in rural areas of Haryana, where the preference was to have male children with 878 females per 1000 males, while the national average is 940. especially in rural areas of the state, where the preference was to have male children. In every district, the female population is below the male population.

**Table 2.1.3 Sex and Rural-Urban Population - 2011 Census**

District	Population					Females per '000 Males
	Total	Rural	Urban	Male	Female	
Panchkula	561,293	248,063	313,230	299,679	261,614	873
Ambala	1,128,350	627,576	500,774	598,703	529,647	885
Yamuna Nagar	1,214,205	741,376	472,829	646,718	567,487	877
Kurukshetra	964,655	685,430	279,225	510,976	453,679	888
Kaithal	1,074,304	838,293	236,011	571,003	503,301	881
Karnal	1,505,324	1,050,514	454,810	797,712	707,612	887
Panipat	1,205,437	650,352	555,085	646,857	558,580	864
Sonipat	1,450,001	996,637	453,364	781,299	668,702	856
Jind	1,334,152	1,028,569	305,583	713,006	621,146	871
Fatehabad	942,011	762,423	179,588	495,360	446,651	902
Sirsa	1,295,189	975,941	319,248	682,582	612,607	897
Hisar	1,743,931	1,190,443	553,488	931,562	812,369	872
Bhiwani	1,634,445	1,313,123	321,322	866,672	767,773	886
Charkhi-Dadri*	384,192	327,855	56,337	203,158	181,034	891
Rohtak	1,061,204	615,040	446,164	568,479	492,725	867
Jhajjar	958,405	715,066	243,339	514,667	443,738	862
Mahendragarh	922,088	789,233	132,855	486,665	435,423	895
Rewari	900,332	666,902	233,430	474,335	425,997	898
Gurugram	1,514,432	472,179	1,042,253	816,690	697,742	854
Nuh	287,101	265,114	21,987	151,232	135,869	898
Faridabad	1,809,733	370,878	1,438,855	966,110	843,623	873
Palwal	1,042,708	806,164	236,544	554,497	488,211	880
Total	24,933,492	16,137,171	8,796,321	13,277,962	11,655,530	878

Note: Charkhi-Dadri was recognized as a district in 2016, so this data is from the region's predecessor municipality.

Source: JICA Survey Team based on the data in Office of the Registrar General & Census Commissioner, India 2011 Census (<https://censusIndia.gov.in/>)



Source: JICA Survey Team based on the data in Office of the Registrar General & Census Commissioner, India 2011 Census (<https://censusindia.gov.in/>)

**Figure 2.1.2 Sex and Rural-Urban Population - 2011 Census**

The socio-economic conditions of scheduled castes vary from one district to another district due to various socio-economic and political reasons. This chapter deals with the socio-economic conditions of scheduled castes across districts in Haryana. Haryana has 22 districts and due to diversity of geography and nature, some of districts are developed and some are deprived of even basic infrastructure. Table 2.1.4 indicates the district wise share of scheduled caste population in Haryana. As per census 2011, total population of Haryana state was 24,933,492 and out of this, 19,809,066 were non-scheduled castes and 5,124,426 were scheduled castes. In case of scheduled castes, Hisar has the largest percentage share of scheduled caste population (7.98 percent) followed by Sirsa (7.56 percent) and Bhiwani (6.66 percent) whereas, the lowest percentage of scheduled caste population was living in Nuh (0.35 per cent) followed by Charkhi Dadri (1.33 percent) and Panchkula (1.99 percent). It is well-known fact that the largest proportion of scheduled castes are living in rural areas. The districts Fatehabad and Sirsa are very backward, and urbanization process has been very slow. On the other hand, Gurugram and Faridabad comes under national capital region and these districts are highly urbanized as well as developed regions of Haryana but the proportion of scheduled caste living in these districts is lower as compared to other districts. The lowest proportion of scheduled caste population is estimated in Nuh due to a large proportion of Muslim population residing in Nuh, because only Hindu, Sikh and Buddhists are given the status of scheduled caste in India. As per Census 2011, 79.20 percent Muslim population was living in Nuh district.

**Table 2.1.4 Population of Scheduled Castes– 2011 Census**

District	Scheduled Caste			
	Male	Female	Total	% of Total Population
Panchkula	53,868	47,962	101,830	1.99%
Ambala	156,874	139,372	296,246	5.78%
Yamuna Nagar	163,200	143,543	306,743	5.99%
Kurukshetra	113,311	101,817	215,128	4.20%
Kaithal	131,486	116,027	247,513	4.83%
Karnal	179,681	159,923	339,604	6.63%
Panipat	109,695	96,518	206,213	4.02%
Sonipat	144,516	125,419	269,935	5.27%
Jind	150,940	131,411	282,351	5.51%
Fatehabad	149,111	135,246	284,357	5.55%
Sirsa	202,430	184,951	387,381	7.56%
Hisar	217,338	191,447	408,785	7.98%
Bhiwani	181,475	159,687	341,162	6.66%
Charkhi-Dadri	36,194	32,100	68,294	1.33%

District	Scheduled Caste			
	Male	Female	Total	% of Total Population
Rohtak	115,573	101,316	216,889	4.23%
Jhajjar	90,856	79,592	170,448	3.33%
Mahendragarh	82,420	73,894	156,314	3.05%
Rewari	95,571	87,035	182,606	3.56%
Gurugram	104,332	93,605	197,937	3.86%
Nuh	9,412	8,356	17,768	0.35%
Faridabad	119,495	104,304	223,799	4.37%
Palwal	107,741	95,382	203,123	3.96%
Total	2,715,519	2,408,907	5,124,426	100.00%

Note: Charki-Dadri was recognized as a district in 2016, so this data is from the region's predecessor municipality.  
Source: India 2011 Census

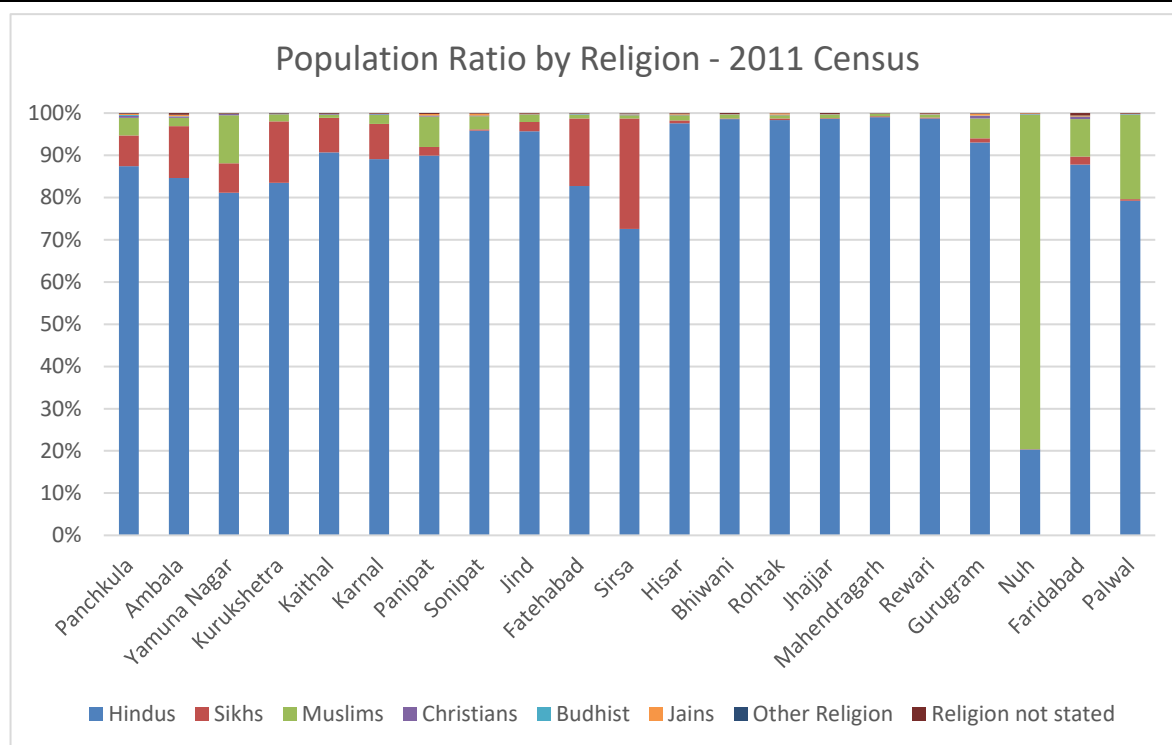
Concerning religion, Hindus are the dominant population in most of the districts. The overall religious population of Haryana is 87.46% Hindu, followed by Muslim at 7.03%, Sikhism at 4.91%, Christianity at 0.18%, Buddhism at 0.01%, Jainism at 0.01%, other religions at 0.40%, and no or unknown religion at 0.01%. Only in Nuh Muslim are majority. Muslims constitutes 79.20% of Nuh population. Table 2.1.5 shows the population ratios by religion for each district.

**Table 2.1.5 Population Ratio by Religion -2011 Census**

District	Hindus	Sikhs	Muslims	Christians	Budhist	Jains	Other Religion	Religion not stated
Panchkula	87.42%	7.30%	4.18%	0.46%	0.18%	0.29%	0.02%	0.16%
Ambala	84.65%	12.25%	1.96%	0.33%	0.03%	0.43%	0.01%	0.34%
Yamuna Nagar	81.12%	6.96%	11.41%	0.30%	0.01%	0.13%	0.01%	0.06%
Kurukshehra	83.47%	14.55%	1.66%	0.20%	0.02%	0.04%	0.01%	0.05%
Kaithal	90.71%	8.15%	0.77%	0.16%	0.02%	0.03%	0.01%	0.14%
Karnal	89.08%	8.38%	2.10%	0.14%	0.04%	0.10%	0.00%	0.15%
Panipat	89.92%	2.08%	7.19%	0.19%	0.02%	0.39%	0.01%	0.21%
Sonipat	95.87%	0.31%	3.11%	0.10%	0.02%	0.42%	0.00%	0.17%
Jind	95.69%	2.18%	1.73%	0.07%	0.01%	0.19%	0.00%	0.12%
Fatehabad	82.72%	16.03%	0.89%	0.11%	0.02%	0.12%	0.06%	0.06%
Sirsa	72.60%	26.17%	0.74%	0.17%	0.03%	0.17%	0.05%	0.08%
Hisar	97.54%	0.70%	1.24%	0.11%	0.02%	0.21%	0.00%	0.17%
Bhiwani	98.57%	0.15%	0.95%	0.05%	0.02%	0.06%	0.00%	0.20%
Rohtak	98.37%	0.37%	0.77%	0.07%	0.02%	0.33%	0.00%	0.07%
Jhajjar	98.67%	0.11%	0.86%	0.08%	0.01%	0.07%	0.00%	0.20%
Mahendragarh	99.04%	0.19%	0.61%	0.03%	0.01%	0.07%	0.00%	0.04%
Rewari	98.76%	0.20%	0.63%	0.08%	0.02%	0.17%	0.00%	0.14%
Gurugram	93.03%	1.00%	4.68%	0.64%	0.06%	0.49%	0.02%	0.09%
Nuh	20.37%	0.05%	79.20%	0.11%	0.05%	0.13%	0.00%	0.09%
Faridabad	87.77%	1.91%	8.93%	0.54%	0.04%	0.27%	0.01%	0.53%
Palwal	79.25%	0.38%	20.00%	0.09%	0.03%	0.09%	0.00%	0.16%

Note: Charkhi Dadri was officially notified as 22nd district of Haryana by the Government of Haryana state in 2016. Hence the data is not available.  
Source: India 2011 Census





Source: JICA Survey Team based on the data in India2011 Census

**Figure 2.1.3 Population Ratio by Religion -2011 Census**

The table provides information on the distribution of the workforce by sex in different districts of Haryana as per the 2011 Census. The table shows the number of male and female workers engaged in various occupations such as cultivators<sup>2</sup>, agricultural labour, household industries, and other workers. The data indicates that the majority of workers in these districts are male, and the highest number of workers are engaged in agriculture-related work. The data can be useful for understanding the workforce's composition and employment patterns in Haryana. However, there is no information provided on income levels in this table.

**Table 2.1.6 Distribution of Workforce by Sex – 2011 Census**

District	No. of Total Workers			Cultivators			Agricultural Labour			Household Industries <sup>3</sup>			Other Workers <sup>4</sup>		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Panchkula	164,865	46,614	211,479	2,760	4,324	7,084	2,812	1,385	4,197	684	1,005	1,689	9,914	5,764	15,678
Ambala	320,120	52,019	372,139	1,891	1,056	2,947	12,331	3,840	16,171	1,315	959	2,274	22,517	8,755	31,272
Yamuna Nagar	342,343	46,890	389,233	1,805	855	2,660	14,343	4,865	19,208	962	933	1,895	18,189	8,257	26,446
Kurukshetra	268,556	68,224	336,780	1,909	2,146	4,055	10,276	14,328	24,604	588	968	1,556	11,164	9,497	20,661
Kaithal	292,696	81,203	373,899	5,138	10,392	15,530	18,255	18,163	36,418	1,164	1,351	2,515	18,234	10,539	28,773
Karnal	411,646	104,416	516,062	4,449	6,251	10,700	27,745	23,063	50,808	1,707	1,651	3,358	26,015	13,648	39,663
Panipat	328,667	83,651	412,318	3,588	7,058	10,646	15,227	10,940	26,167	1,339	2,000	3,339	21,773	11,377	33,150
Sonipat	391,085	132,094	523,179	10,438	21,644	32,082	25,615	22,078	47,693	2,381	3,398	5,779	26,121	14,741	40,862
Jind	368,277	155,145	523,422	14,338	43,367	57,705	20,016	25,413	45,429	1,114	1,442	2,556	19,649	12,232	31,881
Fatehabad	263,498	105,585	369,083	5,481	17,885	23,366	14,871	22,069	36,940	646	1,291	1,937	11,311	9,271	20,582
Sirsa	369,462	132,541	502,003	5,866	20,455	26,321	17,988	29,937	47,925	961	1,569	2,530	13,967	12,091	26,058
Hisar	488,321	203,300	691,621	12,357	42,584	54,941	25,820	32,337	58,157	1,619	1,725	3,344	28,015	15,937	43,952
Bhiwani	430,678	192,328	623,006	20,522	57,519	78,041	25,211	25,672	50,883	1,867	3,657	5,524	25,141	17,742	42,883

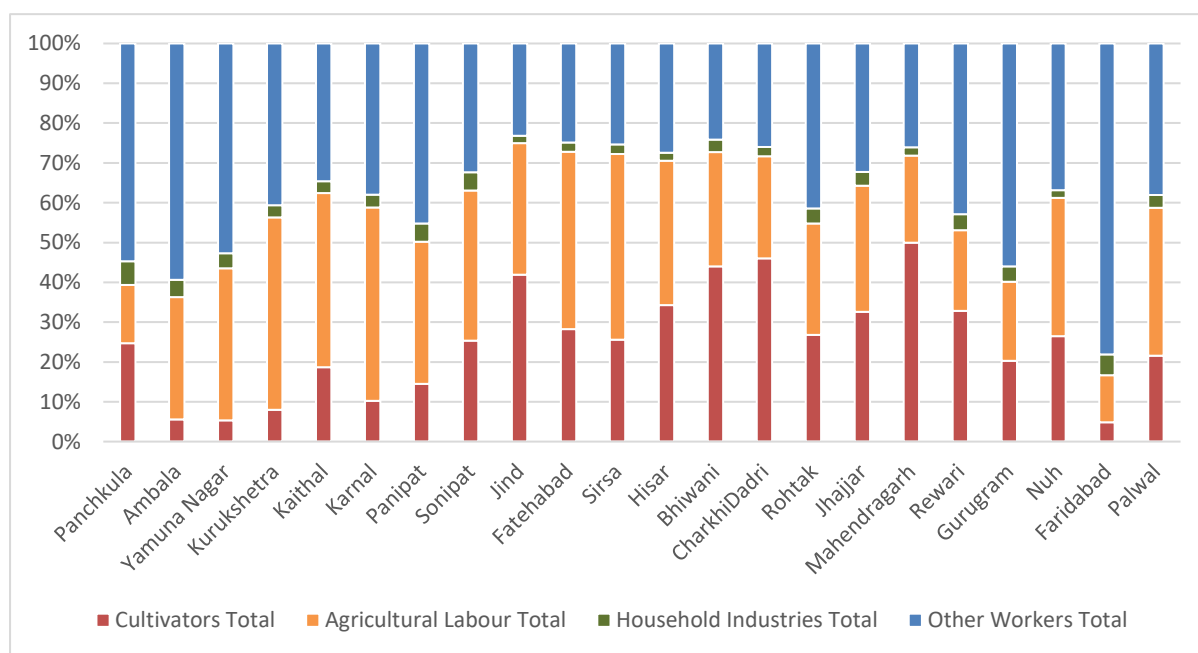
<sup>2</sup> Cultivator refers to a person who engages in agricultural activities on his or her own land or on land owned by a family member, while agricultural laborer refers to a person who performs agricultural labor for the purpose of earning a wage.

<sup>3</sup> "Household Industries" includes handicrafts, small-scale manufacturing, handicraft production, agriculture-related activities in rural areas, textile and other production, and processing.

<sup>4</sup> "Other Workers" includes workers engaged in occupations other than agriculture, such as industrial workers, service workers, professional workers, government employees, and people engaged in a variety of occupations, including commerce, education, health, construction, transportation, and communications.

District	No. of Total Workers			Cultivators			Agricultural Labour			Household Industries <sup>3</sup>			Other Workers <sup>4</sup>		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Charkhi Dadri	99,092	47,060	146,152	5,350	15,882	21,232	5,997	5,827	11,824	410	672	1,082	6,767	5,235	12,002
Rohtak	272,646	73,321	345,967	5,662	9,614	15,276	10,161	5,791	15,952	1,053	1,115	2,168	16,775	6,847	23,622
Jhajjar	250,020	76,514	326,534	10,171	15,905	26,076	15,485	9,927	25,412	1,386	1,348	2,734	17,096	8,759	25,855
Mahendragarh	232,935	105,649	338,584	20,511	42,582	63,093	12,871	14,676	27,547	1,167	1,425	2,592	21,699	11,251	32,950
Rewari	235,326	102,401	337,727	8,038	20,666	28,704	7,582	10,181	17,763	1,010	2,523	3,533	18,126	19,382	37,508
Gurugram	432,456	112,260	544,716	3,623	7,994	11,617	6,506	4,866	11,372	990	1,236	2,226	20,951	11,109	32,060
Nuh	58,493	15,207	73,700	1,933	3,984	5,917	4,457	3,287	7,744	216	211	427	6,675	1,548	8,223
Faridabad	476,933	102,296	579,229	2,372	1,679	4,051	5,994	3,912	9,906	2,444	1,973	4,417	43,620	21,919	65,539
Palwal	241,464	68,099	309,563	7,706	12,260	19,966	17,765	16,691	34,456	1,567	1,383	2,950	25,324	9,935	35,259

Note: Charkhi-Dadri was recognized as a district in 2016, so this data is from the region's predecessor municipality.  
Source: JICA Survey Team based on Census of India 2011-IndiaStateDistSbDistVill



Source: JICA Survey Team based on Census of India 2011-IndiaStateDistSbDistVill

**Figure 2.1.4 Distribution of Workforce by district – 2011 Census**

## (2) Land Holdings

Table 2.1.9 shows number of Operational Holdings and Area Operated by Size Class of Holdings in the Haryana State and all over India (2010-11). The provided data gives us insight into the distribution of agricultural land ownership in Haryana, compared to the overall distribution in India. Here's a brief analysis of what can be inferred from the data:

**Marginal Farmers (less than 1.0 ha):** In Haryana, they represent 49% of the farming population and control 11% of the total farming area. However, at the national level, marginal farmers make up a more significant 67% of the farming population, yet they control just 22% of the total farming area. This discrepancy suggests that the marginal farmers in Haryana have access to less land per capita compared to their counterparts across India.

**Small Farmers (1.0 to 2.0 ha):** In Haryana, they represent 19% of the farming population and control 13% of the total farming area. In contrast, they make up 18% of the farming population nationally and control 22% of the farming area. This could imply that the small farmers in Haryana have less land per capita compared to small farmers across India.

**Semi-Medium Farmers (2.0 to 4.0 ha):** They represent 17% of the farming population and control 22% of the total farming area in Haryana. Nationally, they account for 10% of the farming population and control 24% of the total farming area. This might indicate that semi-medium farmers in Haryana have a higher access to land per capita compared to their counterparts across India.

Medium Farmers (4.0 to 10.0 ha): In Haryana, they make up 12% of the farming population and control a substantial 32% of the total farming area. In contrast, they constitute only 4% of the farming population nationally and control 21% of the total farming area. This indicates that medium farmers in Haryana have significantly more land per capita compared to medium farmers across India.

Large Farmers (10.0 ha and above): They represent a small 3% of the farming population in Haryana but control an impressive 22% of the total farming area. At the national level, large farmers make up an even smaller 1% of the farming population and control no listed percentage of the total farming area. This suggests that large farmers in Haryana have far more access to land compared to their counterparts across India.

Overall, the data suggests that there's a more skewed distribution of land ownership in Haryana compared to the national average, with medium and large farmers controlling a much larger share of the total agricultural area. This could potentially point to issues of land inequality in the region. However, further socio-economic and historical context would be necessary to fully understand the reasons behind this distribution and its implications.

**Table 2.1.7 Number of Operational Holdings and Area Operated by Size Class of Holdings in the Haryana State and All over India (2010-11)**

Area	Categories	Marginal	Small	Semi-Medium	Medium	Large	Total
		less than 1.0 ha.	1.0 to 2.0 ha.	2.0 to 4.0 ha.	4.0 to 10.0 ha.	10.0 ha. and above	All sizes
Haryana	No. of Holding	802,396	313,937	277,972	192,327	41385	1,628,017
	Percentage	49%	19%	17%	12%	3%	100
	Area (Hect.)	391,705	459,439	802,030	1,167,628	787784	3,608,586
	Percentage	11%	13%	22%	32%	22%	100%
All of India	No. of Holding	92,826	24,779	13,896	5875	973	138,348
	Percentage	67%	18%	10%	4%	1%	100
	Area (Hect.)	35,908	35,244	37,705	33,828	0.7	159,592
	Percentage	22%	22%	24%	21%	1%	89%

Source: STATISTICAL ABSTRACT OF HARYANA 2021-22

**Table 2.1.8 Operational Holdings and Area by District (2010-11)**

District	Number of Holdings	Area (ha.)	Average Size of Holdings(ha)
Panchkula	16,773	26,386	1.57
Ambala	51,806	1,02,338	1.98
Yamuna Nagar	66,289	1,27,380	1.92
Kurukshetra	71,206	1,53,360	2.15
Kaithal	73,572	1,85,113	2.52
Karnal	78,265	1,99,517	2.55
Panipat	62,469	1,06,390	1.70
Sonipat	93,722	1,96,201	2.09
Jind	93,831	2,19,316	2.34
Fatehabad	85,935	2,00,447	2.33
Sirsa	1,80,742	5,35,948	2.97
Hisar	1,08,597	2,93,077	2.70
Bhiwani	1,35,050	3,97,272	2.94
Rohtak	65,900	1,23,749	1.88
Jhajjar	75,375	1,29,962	1.72
Mahendragarh	77,058	1,50,210	1.95
Rewari	65,947	1,18,531	1.80
Gurugram	49,307	72,934	1.48
Nuh	68,311	1,13,019	1.65
Faridabad	27,707	43,419	1.57
Palwal	80,153	1,14,019	1.42

Note: Charkhi Dadri was officially notified as 22nd district of Haryana by the Government of Haryana state in 2016. Hence the data is not available.

Source: STATISTICAL ABSTRACT OF HARYANA 2021-22

### (3) Literacy and Education

The table provides information on the sex-wise literacy rate among Scheduled Castes (S.C.) population in different districts of Haryana as per the 2011 Census. The table shows the total population and the number of literate males and females in each district. The literacy rate is higher among males compared to females in most districts, and the overall literacy rate among S.C. population ranges from 41,880 to 2,99,679. Charkhi Dadri has no information on the literacy rate of females.

**Table 2.1.9 Sex-wise Literacy Rate Among Total Population, Scheduled Castes–2011 Census**

District	Total Population			Literacy Rate among S.C. Population		
	Total	Male	female	Total	Male	female
Panchkula	561293	2,99,679	2,61,614	62,637	36,356	26,281
Ambala	1128350	5,98,703	5,29,647	1,89,803	110136	79,667
Yamuna Nagar	1214205	6,46,718	5,67,487	1,94,195	1,13,250	80,945
Kurukshetra	964655	5,10,976	4,53,679	1,23,578	72,583	50,995
Kaithal	1074304	5,71,003	5,03,301	1,23,600	75,620	47,980
Karnal	1505324	7,97,712	7,07,612	1,86,997	1,11,167	75,830
Panipat	1205437	6,46,857	5,58,580	1,18,920	71,887	47,033
Sonipat	1450001	7,81,299	6,68,702	1,63,469	98,994	64,475
Jind	1334152	7,13,006	6,21,146	1,49,472	91,578	57,894
Fatehabad	942011	4,95,360	4,46,651	1,34,229	80,718	53,511
Sirsa	1295189	6,82,582	6,12,607	1,81,260	1,07,371	73,889
Hisar	1743931	9,31,562	8,12,369	2,18,513	1,33,581	84,932
Bhiwani	1634445	8,66,672	7,67,773	1,95,333	1,19,374	75,959
Rohtak	1061204	5,68,479	4,92,725	1,29,067	77,337	51,730
Jhajjar	958405	5,14,667	4,43,738	1,07,861	64,667	43,194
Mahendragarh	922088	4,86,665	4,35,423	99,588	61,012	38,576
Rewari	900332	4,74,335	4,25,997	1,18,758	71,355	47,403
Gurugram	1514432	8,16,690	6,97,742	1,28,580	75,854	52,726
Nuh	287101	1,51,232	1,35,869	41,880	25,808	16,072
Faridabad	1809733	9,66,110	8,43,623	1,31,127	80,242	50,885
Palwal	1042708	5,54,497	4,88,211	1,11,428	70,832	40,596

Note: Charkhi Dadri was officially notified as 22nd district of Haryana by the Government of Haryana state in 2016. Hence the data is not available.

Source: Statistical Abstract of Haryana 2021-22, STATISTICAL ABSTRACT OF HARYANA 2021-22

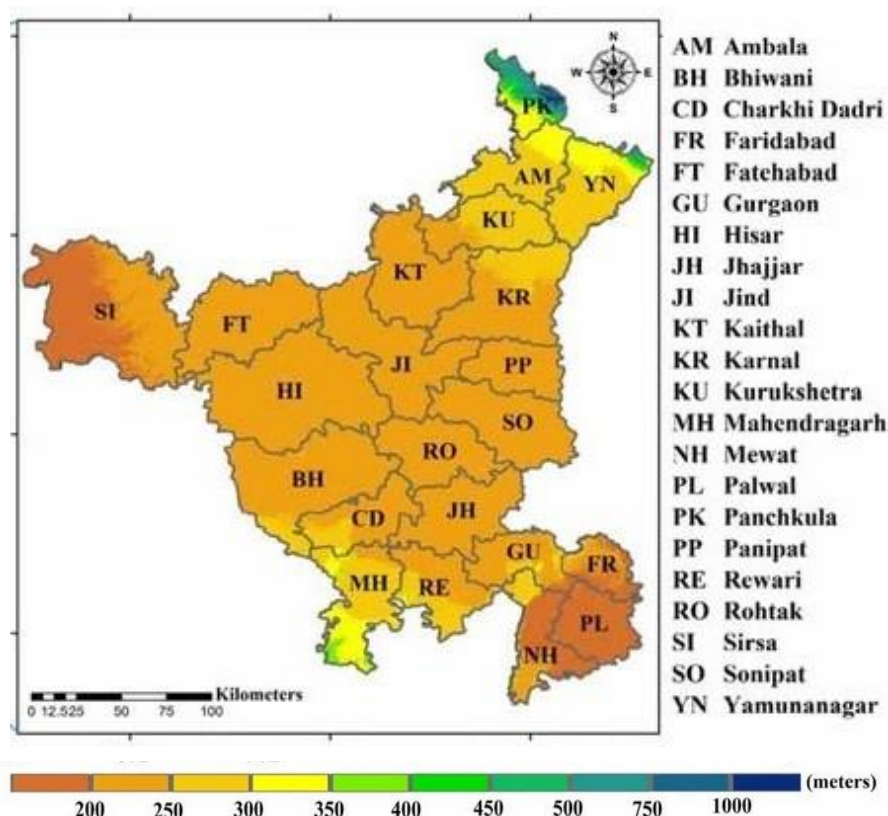
## 2.2 Topography

### (1) Topographic Features

Haryana is a state in northern India, bordered by the states of Punjab to the north, Himachal Pradesh to the northeast, Uttarakhand to the east, Uttar Pradesh to the south, and Rajasthan to the west. The state has an area of 44,212 sq. km and a population of over 28 million people.

In terms of topography, Haryana is mainly flat with some undulating hills in the north-eastern and southern parts of the state. The average elevation of the state is around 200 meters above sea level. The state is located between 27.39°N to 30.35°N latitude and 74.28°E to 77.33°E longitude.

The total geographical area of the state is 4.42 m ha, which is 1.4% of the geographical area of India. The altitude of Haryana varies between 700 to 3600 ft (200 to 1200 metres) above sea level.



Source: <http://www.maphill.com/India/haryana/maps/satellite-map/physical-outside/>

**Figure 2.2.1 Topography of Haryana**

Haryana may be divided into five natural topographic divisions which provide a suitable framework upon which a systematic study of landform environment may be founded. These are:

- The Bagar and the undulating sandy plains-the sand dunes and the tals (230-350 metres)
- The Alluvial Plain or the Ghaggar-Yamuna Plain comprising Bangar, Khadar, Naili and Bet (below 300 metres)
- The Aravali outliers (300-600metres)
- The Shiwaliks-The hills (over 400 metres),
- The Foot Hill Zone-The piedmont plain (300-400 metres).

The state's terrain is characterized by alluvial plains that are drained by the Ghaggar-Hakra River system and its tributaries, including the Yamuna and the Markanda rivers. The state has a subtropical continental climate, with hot summers and cold winters. The monsoon season brings significant rainfall to the state, with the highest rainfall occurring in the southwest monsoon season from July to September.

Haryana is known for its agricultural production, with the state being a major producer of wheat, rice, sugarcane, and cotton. The state is also home to several industries, including automobile manufacturing, textiles, and IT. Haryana is well-connected to the rest of the country by road, rail, and air, with the Indira Gandhi International Airport in Delhi being the nearest international airport.

Overall, Haryana's topography and climate have played an important role in shaping the state's economy, culture, and way of life.

## **(2) Land Resources and Land Utilisation**

Haryana is primarily an agrarian state, and land is the most important natural resource in the state. The state has a total land area of 44,212 sq. km, which about 87% is considered to be cultivable land. Haryana has a high population density and a growing population, which has put significant pressure on the land resources in the state.

In Haryana, agricultural land dominates the landscape, constituting the largest category of land use, covering over 75% of the total land area. This underscores the region's strong emphasis on agriculture, making it the primary industry in the area. In terms of land utilization, the state has made significant progress in recent years. The government has implemented various policies and programs to promote sustainable agriculture and increase productivity. The state is a major producer of wheat, rice, sugarcane, and cotton, and the government has encouraged the adoption of modern agricultural practices and technologies to improve yields and reduce wastage.

The state has also taken steps to promote afforestation and increase forest cover. Forest land in the state covers around 3% of the total land area, and the government has launched various initiatives to increase this number. The state government has also encouraged the adoption of sustainable forestry practices to protect the environment and promote biodiversity.

Non-agricultural land in the state is primarily used for urbanization and industrialization. The state has a rapidly growing economy, and the government has encouraged the establishment of industries in the state. However, there have been concerns about the impact of industrialization on the environment and the health of local communities. The state government has taken steps to address these concerns and promote sustainable industrialization.

Overall, the land resources in Haryana are critical to the state's economy and way of life. The government has recognized the importance of sustainable land use and has implemented various policies and programs to promote responsible land utilization. However, the growing population and demand for land resources will continue to pose challenges in the years to come.

## **2.3 Climate and Rainfall**

### **(1) Climate**

Haryana is located at an elevation of 217.25 meters (712.76 feet) above sea level, Haryana has a humid subtropical, dry winter climate (Classification: Cwa). The state's yearly temperature is 29.13°C (84.43°F) and it is 0.89°C higher than India's averages. Haryana typically receives about 21.34 mm (0.84 inches) of precipitation and has 41.08 rainy days (11.25% of the time) annually.

The climate of the Haryana is subtropical, semi-arid to sub-humid, continental and monsoon type. The average rainfall varies from less than 300 mm in south-western parts to over 1000 mm in the hilly tracks of Shivalik hills (Table 2.3.1). Most of the year, the climate of Haryana is of a pronounced continental character. The climate is arid to semi-arid. A large part of the plains experiences a semi-arid climate, except the northern parts where conditions are sub humid, and in the western part where it is further deteriorating too arid. A major part of the state comes under the fertile Indo-Gangetic belt.

In the state, the year could be divided into five seasons:

- i) Winter season (December to February)
- ii) Spring season (March to April)
- iii) Summer season (May to June)
- iv) Monsoon season (July to September)
- v) Post-monsoon season (October to November)

During the period from December to February, it is markedly cold in Haryana but mild compared to other NW India states. During the spring and post-monsoon season, from March to April and from October to November are pleasant months. During the summer season from May to June, the weather is very hot and dry. Haryana is extremely hot in summer at around 45 °C.

Here is the location of each city and the line graph of low temperature and high temperature at the cities in Haryana and nearby city in Rajasthan.

- i) Bhiwadi (Nearby Rewari district, Border of Haryana and Rajasthan)
- ii) Hisar (Hisar District)
- iii) Panipat (Panipat District)
- iv) Dharuhera (Rewari district)
- v) Karnal (Karnal District)
- vi) Sohna (Gurugram)
- vii) Faridabad (Faridabad District)
- viii) Manesar (Gurugram)
- ix) Gurugram (Gurugram)
- x) Neemrana (Nearby Alwar, Border of Haryana and Rajasthan)



Source: <https://statics.teams.cdn.office.net/evergreen-assets/safelinks/1/atp-safelinks.html>

**Figure 2.3.1** Location map of the cities



## (2) Rainfall (Precipitation)

The annual average rainfall over the state of Haryana is quite uneven. The annual rainfall during 2015 - 2019 of Haryana State when analysed and compared to the normal rainfall, it is observed that only 4 districts namely Faridabad, Hisar, Kaithal and Yamuna Nagar shows excess from their corresponding normal and rest all of districts, shows decline in rainfall from their normal rainfall (Table 2.3.1). It is observed that out of all districts, maximum rainfall 1214.77mm observed during 2015-2019 at Panchkula district and minimum rainfall 169 mm at Fatehabad district. The annual average rainfall of Haryana state during 2015, 2016, 2017, 2018 and 2019 are 463 mm, 418 mm, 452 mm, 524 mm, 454 mm which are less than average normal rainfall (615 mm) in Haryana. Around 29% of rainfall is received during the months from July to September, and the remaining rainfall is received during the period from December to February caused by Western Disturbances. The monsoon rainfall sometimes causes local flooding.

**Table 2.3.1 Annual Rainfall & Normal R/F during (2015-2019) of Haryana State:**

S.No	District	2015 Rainfall (mm)	2016 Rainfall (mm)	2017 Rainfall (mm)	2018 Rainfall (mm)	2019 Rainfall (mm)	Normal Rainfall (mm)
1	Ambala	689.90	518.80	779.10	941.00	790.22	1104.70
2	Bhiwani & Charkhi Dadri*	271.10	361.10	291.40	354.00	273.12	419.50
3	Faridabad	711.30	702.40	666.60	561.00	430.15	697.60
4	Fatehabad	208.30	211.10	169.00	219.00	195.55	364.60
5	Gurugram	466.70	449.00	308.00	426.00	464.13	544.00
6	Hisar	299.00	294.40	287.40	250.00	244.64	401.40
7	Jhajjar	455.60	472.50	428.60	477.00	327.26	489.00
8	Jind	416.80	365.10	395.10	417.00	299.69	509.10
9	Kaithal	291.80	273.10	475.90	613.00	422.63	466.50
10	Karnal	639.70	464.30	654.40	927.00	490.63	714.40
11	Kurukshetra	391.00	228.80	514.10	712.00	484.43	691.40
12	Nuh	520.00	510.00	460.00	526.00	394.45	572.00
13	Mahendragarh	273.70	386.40	378.80	442.00	318.70	476.20
14	Palwal	397.40	450.80	334.90	410.00	331.20	508.10
15	Panchkula	651.20	476.20	527.70	588.00	1214.77	1148.20
16	Panipat	522.00	321.60	377.00	456.00	308.82	624.10
17	Rewari	480.20	605.40	433.10	497.00	420.04	492.20
18	Rohtak	322.30	284.10	297.90	348.00	332.34	618.00
19	Sirsa	305.40	177.90	195.30	266.00	307.33	313.50
20	Sonipat	514.90	307.80	469.90	436.00	363.9	644.20
21	Yamuna Nagar	893.30	918.60	1016.50	1139.00	1116.99	1107.00
Annual Average Rainfall (mm)		463.00	418.00	452.00	524.00	454.00	615.00

Notes: \*The district Charkhi Dadri was separated from Bhiwani district in 2016. Therefore, this data is before separation.

Notes: \*The district was renamed Nuh in 2016 as Nuh is a cultural region which spans the state of Haryana, Rajasthan and Uttar Pradesh.

Source:DOH

District-wise rainfall is shown in Attachment 2.3.2.

Through observation of the district-wise rainfall, it is very clear the dry season and rainy season. In most of the districts, March and April are in dry season, July to September is the typical rainy season. Rainfall peak is observed in January also because of the effect of monsoon. In between of two peaks, November and December are dry spell. These rainfall pattern affect the production of fruits and vegetables.

## 2.4 Economy of State

### 2.4.1 Economic Development Policy of Haryana

Haryana, established in 1966, located in northern India and is known for its strong agricultural and industrial sectors. The government of Haryana has developed a policy document “Government of Haryana Vision 2030” in 2017. The vision focuses on ten key sectors: agriculture, education, health, industry, infrastructure, power, skill development, sports, tourism, and urban development, which is linked with “United Nations Sustainable Development Goals (SDGs) 2015”. The vision aims to transform Haryana into a prosperous, innovative, and knowledge-driven state with sustainable



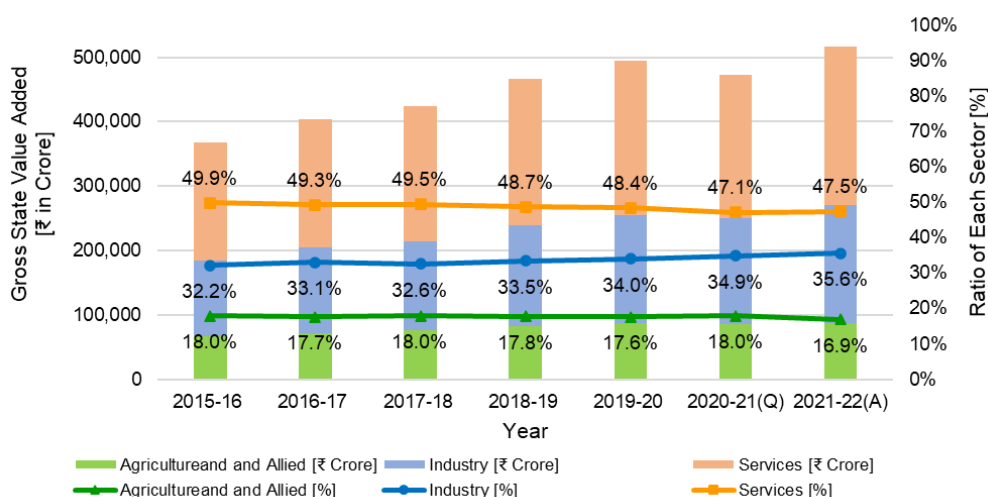
development. The policy aims to provide universal healthcare coverage, world-class infrastructure, and skilled manpower. In addition, the vision facilitates to attract investments in high-growth sectors such as aerospace, defence, electronics, and renewable energy. The policy also promotes inclusive growth and development by creating job opportunities, improving social infrastructure, and empowering communities. Through these policies, Haryana aim as a preferred destination for industries and to develop a skilled workforce in high-growth sectors.

Under the “Government of Haryana Vision 2030”, some policies aim to enhance the income and livelihoods of farmers engaged in horticulture, promote sustainable agriculture practices as below.

- Encouraging farmers to shift towards high-value horticulture crops and providing them with necessary training and support.
- Increasing the productivity and quality of horticulture crops by promoting the use of modern technologies, such as drip irrigation.
- Developing horticulture clusters across the state and establishing modern infrastructure facilities, such as cold storage, grading, and packaging units, to facilitate the marketing and export of horticulture produce.
- Encouraging private sector investment in the horticulture sector by offering attractive incentives and concessions and promoting Public-Private Partnerships (PPP) in the development of horticulture infrastructure and value chains.

## 2.4.2 Major Industry

The state economy of Haryana indicates steady growth between 2015-2022, except the covid-19 pandemic period in 2020-21. In these periods, ratio of gross state value added (GSVA) are composed of 16.9-18.0% from “agriculture and allied sector”, 32.2-35.6% from “industry sector” and 47.1-49.9% from “service sector”. While “industry sector” shows the significant growth (7.5% in 2019-20 and projected as 11.5% in 2021-22), the “agriculture and allied sector” has slowed down (4.8% in 2019-20 and projected as 2.6% in 2021-22). Among the agriculture sub-sectors, the crops and livestock sector has declined the growth (e.g., 10.1% in 2016-17, 5.1% in 2019-20 and projected as 2.3% in 2021-22).



(Q): Quick Estimates, (A): Advance Estimates

Source: "Economic Survey of Haryana 2021-22", Department of Economic and Statistical Analysis, Haryana

**Figure 2.4.1 GSVA at 2011-12 constant prices and ratio of each sector**

**Table 2.4.1 Comparison of GSVA between Pan India at 2011-12 constant prices (₹ in Crore)**

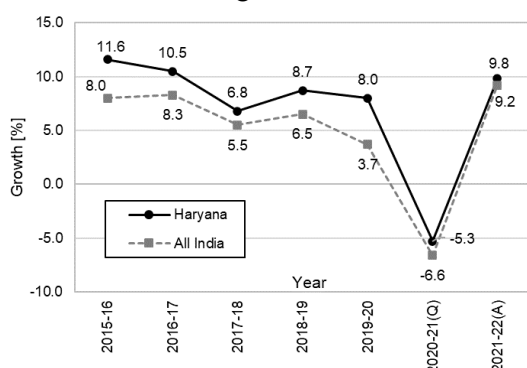
Sector	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21 (Q)	2021-22 (A)
Crops & Livestock	61,034.7	67,216.4	71,349.8	77,912.8	81,901.4	79,524.8	81,378.7
Forestry & Logging	3,984.4	2,871.8	3,372.3	3,735.9	3,739.5	3,764.8	3,946.6
Fishing	1,003.2	1,178.4	1,567.9	1,537.3	1,558.2	1,706.0	1,842.4
<b>Agriculture and Allied</b>	<b>66,022.2</b>	<b>71,266.6</b>	<b>76,290.0</b>	<b>83,186.0</b>	<b>87,199.1</b>	<b>84,995.6</b>	<b>87,167.7</b>

Sector	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21 (Q)	2021-22 (A)
Mining & Quarrying	695.2	1,191.2	1,089.0	772.6	1,367.0	1,620.9	1,777.6
Manufacturing	84,936.4	97,157.5	99,031.4	114,549.0	125,312.1	124,560.2	139,258.3
Electricity, Gas, Water Supply & Other Utility Services	2,960.6	3,561.6	4,439.8	4,247.4	4,651.2	4,660.4	5,170.5
Construction	29,581.8	31,522.1	33,630.6	36,608.6	36,597.5	34,174.2	37,830.9
<b>Industry</b>	<b>118,174.0</b>	<b>133,432.4</b>	<b>138,190.9</b>	<b>156,177.6</b>	<b>167,927.8</b>	<b>165,015.7</b>	<b>184,037.3</b>
Trade, Repair, Hotels & Restaurants	50,324.7	55,986.7	62,645.4	69,242.6	74,340.4	59,289.0	66,256.2
Transport, Storage, Communication & Services related to Broadcasting	24,381.9	24,631.9	24,707.9	25,739.6	26,413.6	21,883.1	24,768.6
Financial, Real Estate & Professional Services	81,917.6	89,570.6	90,199.1	98,340.0	102,259.7	106,367.2	114,818.2
Public Administration, Defense and Other Services	26,587.6	28,722.7	32,425.2	33,565.7	36,158.7	35,276.0	39,381.1
<b>Services</b>	<b>183,211.8</b>	<b>198,912.0</b>	<b>209,977.5</b>	<b>226,887.9</b>	<b>239,172.4</b>	<b>222,815.3</b>	<b>245,224.0</b>
<b>Total</b>	<b>367,408.0</b>	<b>403,610.9</b>	<b>424,458.3</b>	<b>466,251.5</b>	<b>494,299.2</b>	<b>472,826.5</b>	<b>516,429.0</b>

(Q): Quick Estimates, (A): Advance Estimates

Source: "Economic Survey of Haryana 2021-22", Department of Economic and Statistical Analysis, Haryana

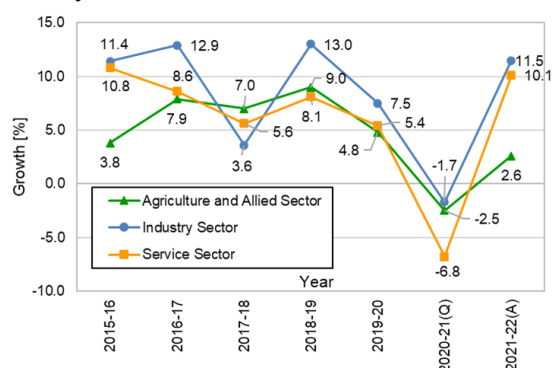
The growth rate of gross state domestic product (GSPD) and all India gross state domestic product (GDP) shown in Figure 2.4.2, which indicates Haryana grows faster than all India. On Figure 2.4.3, growth of GSVA of "agriculture and allied sector", "industry sector" and "service sector" are shown.



(Q): Quick Estimates, (A): Advance Estimates

Source: "Economic Survey of Haryana 2021-22", Department of Economic and Statistical Analysis, Haryana

**Figure 2.4.2 GSPD/GDP Growth Rate of Haryana and All India (at 2011-12 constant prices)**



**Figure 2.4.3 Growth in GSVA in Haryana (at 2011-12 constant prices)**

Haryana's GSVA contributed roughly 3.8% of India's total GSVA. This indicates that Haryana's economy was relatively smaller compared to the overall Indian economy. The sectoral distribution of GSVA across agriculture, industry, and services was different in Haryana and Pan India. Haryana had a higher percentage of its GSVA coming from the agriculture and manufacturing sectors (Table 2.4.2).

**Table 2.4.2 Comparison of GSVA between All India and Haryana State (₹ in Crore)**

Sector	All India GSVA		Haryana GSVA		
	2020-21	Ratio	2020-21	Ratio	(Haryana/Pan India) Ratio
Agriculture and Allied	2,040,079	16.4%	84,996	18.0%	4.2%
Industry	3,654,362	29.3%	165,016	34.9%	4.5%
Services	6,758,989	54.3%	222,815	47.1%	3.3%
<b>Total</b>	<b>12,453,430</b>	<b>100.0%</b>	<b>472,827</b>	<b>100.0%</b>	<b>3.8%</b>

Source: "Economic Survey of Haryana 2021-22", Department of Economic and Statistical Analysis, Haryana and Ministry of Statistics and Programme Implementation

### 2.4.3 Establishments<sup>5</sup>

Table 2.4.3 shows the number of establishments of each sector in Haryana from the 6th Economic Census conducted in 2013-14<sup>6</sup>. 494,707 (36.6%) of total number of establishments are engaged for “Agriculture, forestry and ” and this is the largest ratio compared to other sectors. While the agriculture sector consists of around 18.0% of GSVA, many people are engaged. Hence, encouragement of increase of farmers’ income will have a big impact on Haryana state’s economy.

**Table 2.4.3 Number of Establishments of Each Sector in Haryana**

Sector	Number of Establishments	Ratio
Agriculture, forestry and fishing	494,707	36.6%
Trade, repair, hotels and restaurants	400,255	29.6%
Construction	108,981	8.1%
Real estate, renting and business	73,783	5.5%
Manufacturing	71,111	5.3%
Transport and storage	66,390	4.9%
Other services activities	60,526	4.5%
Health and social work	27,478	2.0%
Education	24,937	1.8%
Financial services	11,171	0.8%
Public administration and defense	7,045	0.5%
Electricity, gas, water supply and waste	6,768	0.5%
Mining and quarrying	5,935	0.4%
Communication and broadcasting	2,248	0.2%
Total	1,350,167	100.0%

Source: 6th Economic Census

The district wise distribution of employment in rural and urban area is shown on Table 2.4.4. Nuh has the highest percentage of rural employment at 89.1%, while Gurugram has the lowest at 17.6%. Similarly, Nuh the lowest percentage of urban employment at 10.9%, while Gurugram highest at 82.4%. This data suggests that rural employment is still a significant source of livelihood in most of the districts of Haryana. However, there is a clear trend towards urbanization and industrialization in some districts, especially in the NCR region of Haryana’s parts (Figure 2.4.4).

NCR stands for the National Capital Region, which is a metropolitan region that is surrounding areas of Delhi. The NCR region comprises of states of Haryana, Uttar Pradesh, and Rajasthan. The districts of Haryana that are part of the NCR region are Gurugram, Faridabad, Sonipat, Rohtak, Rewari, Jhajjar, Panipat, Palwal, and Nuh. The districts of Uttar Pradesh that are part of the NCR region are Ghaziabad, Meerut, Gautam Buddha Nagar (Noida), Bulandshahr, Baghpat, Hapur, and Muzaffarnagar. The districts of Rajasthan that are part of the NCR region are Alwar and Bharatpur (Figure 2.4.5 NCR Region). It is a metropolitan area with a population of approximately 58.1 million (Regional plan 2041).

**Table 2.4.4 District Wise Number of Employment in Rural and Urban Area**

District	Rural Employment <sup>7</sup> (%)	Urban Employment <sup>8</sup> (%)	Total Employment
Nuh	89.1	10.9	242,885
Mahendragarh	83.5	16.5	514,606

<sup>5</sup> Establishments: The units engaged in productive activities to earn profit.

<sup>6</sup> Next Census was scheduled for 2021 and postponed to 2024.

<sup>7</sup> Rural Employment refers to the work or employment opportunities available in the rural areas of the country, typically in villages or small towns. Rural employment is characterized by agricultural activities and allied sectors, such as forestry, animal husbandry, and fisheries. It also includes non-agricultural activities such as rural handicrafts, handlooms, and other small-scale industries.

<sup>8</sup> Urban Employment refers to the work or employment opportunities available in urban areas, such as cities and towns. Urban employment is characterized by a wide range of activities, including manufacturing, construction, trade, services, and other formal and informal sectors. Urban employment also includes jobs in the public sector, such as government offices, schools, hospitals, and other institutions.

District	Rural Employment <sup>7</sup> (%)	Urban Employment <sup>8</sup> (%)	Total Employment
Jind	77.2	22.8	547,148
Sirsa	74.9	25.1	589,064
Fatehabad	73.6	26.4	332,668
Palwal	72.9	27.1	315,310
Bhiwani	70.7	29.3	651,662
Kaithal	66.8	33.2	382,996
Hisar	65.9	34.1	739,493
Rewari	57.7	42.3	373,085
Kurukshetra	54.8	45.2	375,640
Ambala	51.0	49.0	375,523
Karnal	48.5	51.5	596,100
Yamuna Nagar	46.5	53.5	463,128
Rohtak	44.3	55.7	622,328
Panipat	43.6	56.4	451,816
Jhajjar	43.3	56.7	236,027
Sonipat	33.3	66.7	661,032
Panchkula	26.6	73.4	176,054
Faridabad	18.7	81.3	758,165
Gurugram	17.6	82.4	1,297,382

Source: 6th Economic Census



Source: Department of Industries and Commerce, Government of Haryana.

Note: District name of Mewat was changed to Nuh in April 2016. This figure was made before April 2016  
Source: Department of Industries and Commerce, Government of Haryana

**Figure 2.4.4 District-wise Snapshot of Industrial Clusters**



Note: Union territory of Delhi (red) and states and the boundaries of their districts. The states shown are Haryana (green), Rajasthan (blue), and Uttar Pradesh (purple)

Source: JICA survey team based on the map from “Journals of India”

**Figure 2.4.5 NCR Region**

#### 2.4.4 Income

The per capita income in Haryana has grown since 2011 excluding covid pandemic (Table 2.4.5). As the district wise, in 2019, Gurugram is the highest income per capita (Rs. 7.41 lakh) and Nuh is the lowest income per capita (Rs. 1.15 lakh) (Figure 2.4.6). NCR region tends to be higher than other districts.

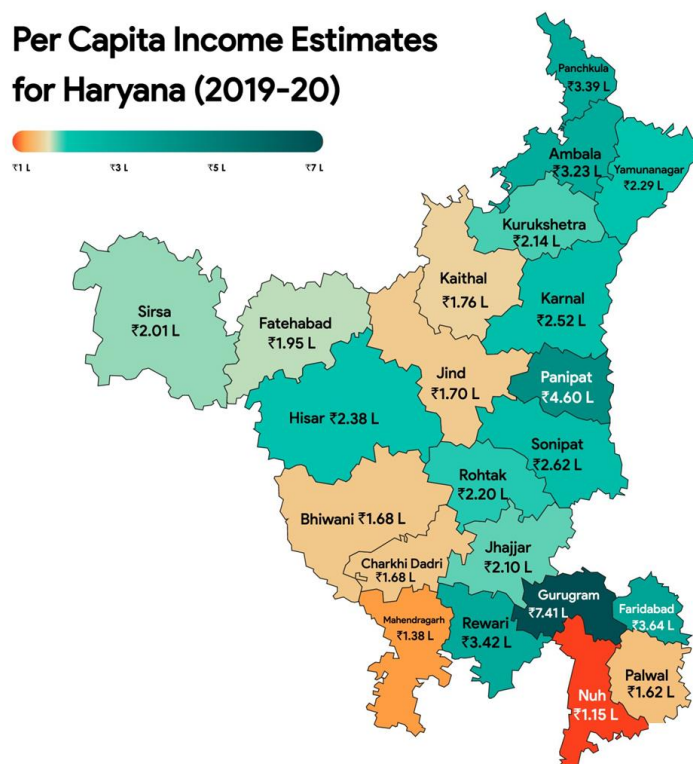
**Table 2.4.5 Growth of Per Capita Income Price (Base Year 2011-12)**

Year	At Current Prices (₹ in Crore)				At Constant (2011-12) Prices (₹ in Crore)			
	Haryana		All India		Haryana		All India	
	Per capita income	Compound Annual Growth Rate	Per capita income	Compound Annual Growth Rate	Per capita income	Compound Annual Growth Rate	Per capita income	Compound Annual Growth Rate
2011-12	106,085	-	63,462	-	106,085	-	63,462	-
2012-13	121,269	14.30%	70,983	11.85%	111,780	5.40%	65,538	3.27%
2013-14	137,770	13.60%	79,118	11.46%	119,791	7.20%	68,572	4.63%
2014-15	147,382	7.00%	86,647	9.52%	125,032	4.40%	72,805	6.17%
2015-16	164,963	11.90%	94,797	9.41%	137,833	10.20%	77,659	6.67%
2016-17	184,982	12.10%	104,880	10.64%	150,259	9.00%	83,003	6.88%
2017-18	208,437	12.70%	115,224	9.86%	156,200	4.00%	87,586	5.52%
2018-19	223,015	7.00%	125,946	9.31%	166,747	6.80%	92,133	5.19%
2019-20	240,507	7.80%	132,115	4.90%	177,507	6.50%	94,270	2.32%

Year	At Current Prices (₹ in Crore)				At Constant (2011-12) Prices (₹ in Crore)			
	Haryana		All India		Haryana		All India	
	Per capita income	Compound Annual Growth Rate	Per capita income	Compound Annual Growth Rate	Per capita income	Compound Annual Growth Rate	Per capita income	Compound Annual Growth Rate
2020-21	235,707	-2.00%	126,855	-3.98%	165,617	-6.70%	85,110	-9.72%
2021-22	274,635	16.50%	150,007	18.25%	179,367	8.30%	91,481	7.49%

Note: Current price series are influenced by the effects of inflation. Constant price series are used to measure the true volume growth, i.e. adjusting for the effects of price inflation (What is the difference between current and constant price series? – World Bank Data Help Desk). In this table, the base year is 2011-2012.

Source: JICA survey team based on the data in Estimates of State Domestic Product of Haryana 2011-12 to 2021-22



Source: Hindustan Times

Figure 2.4.6 District-wise Per Capita Income (2019-2020)

## 2.4.5 Wage employment

The Periodic Labour Force Survey revealed various dimensions of wage gap. A significant gap is observed between regular and casual workers. As per the National Sample Survey Office (NSSO) statistics, the regular workers are defined as those receive wage or salary on a regular basis for a prolonged period in return of their labour, while the casual worker receives wages on a daily basis or for periodic work contract. Table 2.4.6 highlights significant gender and location (urban vs. rural) wage disparities across India and particularly in Haryana. Women earn less than men in both regular/salaried and casual work. For example, female regular/salaried workers earn INR 748.68 in India and INR 794.14 in Haryana, compared to male workers who earn INR 984.10 and INR 977.89 respectively. Urban-rural wage gap: Urban workers earn more than their rural counterparts. Urban regular/salaried workers earn INR 1073.06 in India and INR 1059.27 in Haryana as compared to rural workers who earn INR 751.23 and INR 818.70 respectively.

**Table 2.4.6 Average Daily Earnings/ Wages**

Particulars		All India		Haryana	
		Regular / Salaried Workers (INR)	Casual Workers <sup>9</sup> (INR)	Regular / Salaried Workers (INR)	Casual Workers (INR)
Gender	Male	984.10	433.00	977.89	488.35
	Female	748.68	279.50	794.14	355.40
Sector	Urban	1073.06	482.00	1059.27	479.25
	Rural	751.23	389.50	818.70	464.99

*Source: Periodic Labour Force Survey (PLFS) conducted by the National Sample Survey Office (NSSO) 2022-2023*

## 2.4.6 Poverty

### (1) Poverty line

The table shows the percentage of rural households living below the poverty line<sup>10</sup> in various districts of Haryana, based on a survey conducted between 2002-07. The number of households below the poverty line and the total number of rural households at the time of the survey are also given. The percentage of households below the poverty line varies from 18.64% in Rohtak to 35.51% in Fatehabad. Some districts, such as Charkhi Dadri and Palwal, have no data available. The table provides valuable information about poverty levels in rural areas and can be used to inform policies aimed at reducing poverty.

**Table 2.4.7 Rural Families Living Below Poverty Line (2007) as per 2002-2007 Survey**

District	Total Number of Rural Households at the Time of Survey	Number of Households below Poverty Line	% Age of Households below Poverty Line to the Total Rural Households
Panchkula	41,340	13,514	32.69
Ambala	145,934	44,185	30.28
Yamuna Nagar	160,315	45,330	28.28
Kurukshetra	140,532	46,491	33.08
Kaithal	173,186	52,732	30.45
Karnal	195,597	52,355	26.77
Panipat	135,938	33,402	24.57
Sonipat	183,373	48,405	26.40
Jind	183,976	61,540	33.45
Fatehabad	137,193	48,720	35.51
Sirsa	184,637	47,640	25.80
Hisar	237,925	58,737	24.69
Bhiwani	260,951	70,009	26.83
Rohtak	120,308	22,426	18.64
Jhajjar	130,747	29,221	22.35
Mahendragarh	145,430	38,665	26.59
Rewari	136,008	34,729	25.53
Gurugram	93,130	22,211	23.85
Nuh	192,388	53,270	27.69
Faridabad	160,314	34,807	21.71

*Remarks: Palwal, Charkhi Dadri were officially notified as districts of Haryana by the Government of Haryana state in 2008 and 2016 respectively. Hence the data is not available. Nuh was recognized as a district in 2005, so this data is from the region's predecessor municipality.*

*Source: RURAL DEVELOPMENT DEPARTMENT, HARYANA No. of Rural BPL Households in the State along with Definition of Rural Poverty*

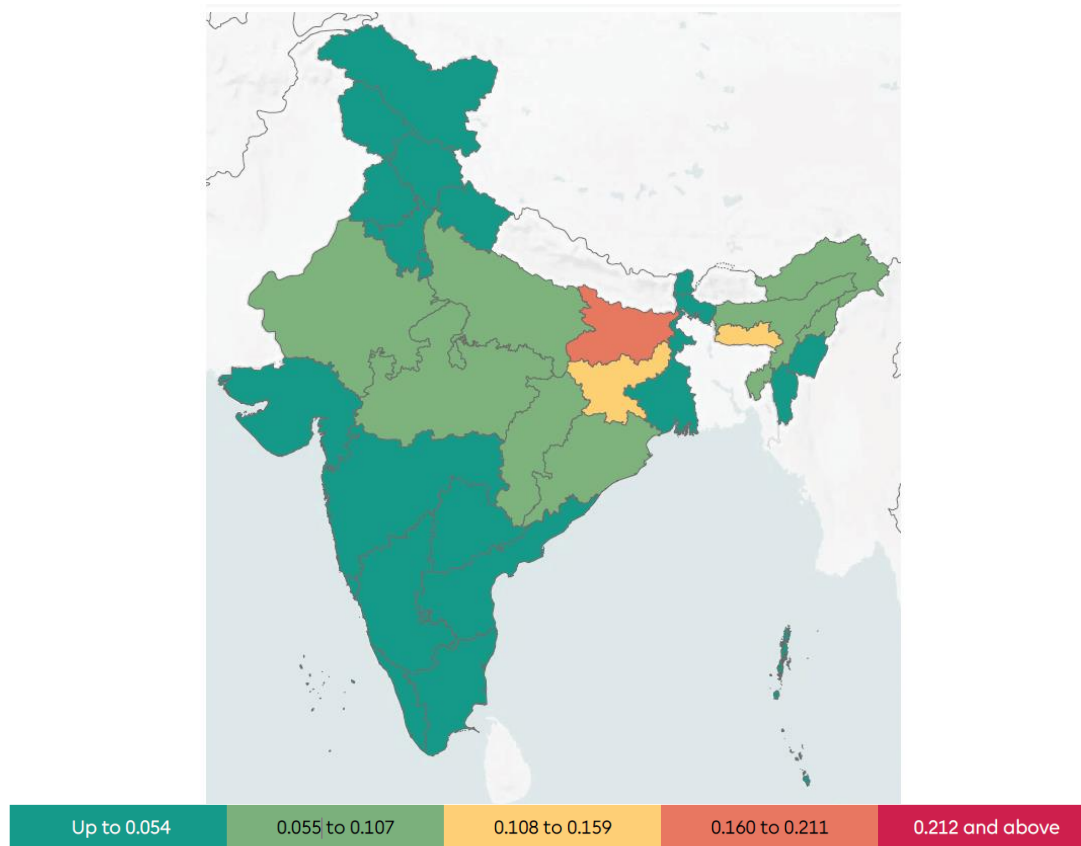
<sup>9</sup> Casual Workers are Seasonal Workers and other temporary employees.

<sup>10</sup> Living Below the Poverty Line in India refers to the situation where people are earning less than the minimum amount of income needed to cover basic needs like food, shelter, and clothing. As of in September 2021, the World Bank's international poverty line is set at \$1.90 per person per day. However, the exact amount varies as it is updated over time, reflecting changes in costs of living, inflation, and other economic factors.



## (2) Multidimensional poverty index (MPI)

Compared to other state, the poverty of Haryana is relatively low (Figure 2.4.7). Poverty can be calculated as Multidimensional poverty index (MPI). MPI is a comprehensive measure of poverty that takes into account income-based measures of poverty by considering the various dimensions of well-being, such as i) health, ii) education, and iii) living standards. The resulting index ranges from 0 to 1, with 0 indicating no poverty and 1 representing the highest level of multi-dimensional poverty. The MPI at the national level is 0.066 MPI in 2019-2021 while that of Haryana is 0.031 during same period.



Source: "National Multidimensional Poverty Index" NITI Aayog, 2023

**Figure 2.4.7 State-wise MPI**

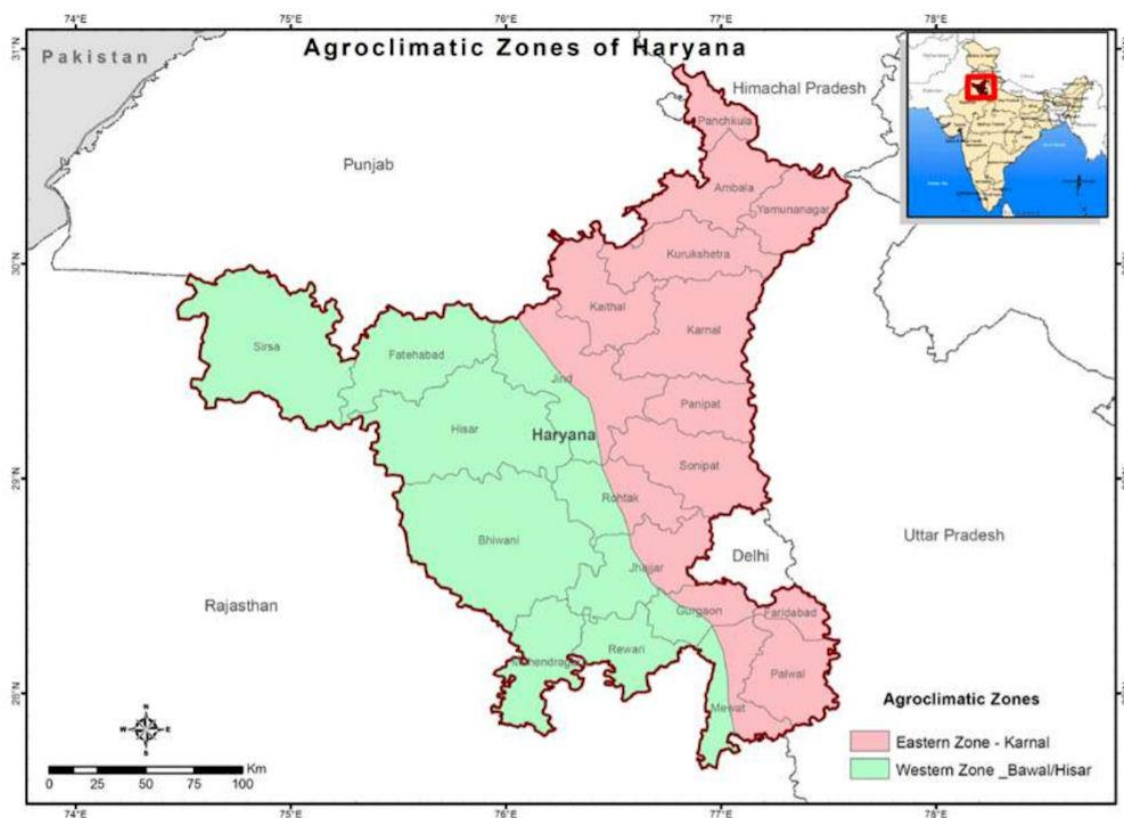
## 2.5 Agro-Ecology

Haryana is almost wholly plain area with altitudes ranging from 200 to 1100 m above mean sea level. The climate varies between hot and dry in the southwestern areas to moderate and humid in the foot of Himalayan mountains range.

### (1) Agro-climatic Zones

Haryana state can be divided into two main Agro-climatic zones: namely, the southwestern (SW) zone and the northeastern (NE) zone as shown in Figure 2.5.1. The northeastern zone covers the semi-arid and sub-humid areas of Ambala, Yamuna Nagar, Panchkula, Kaithal, Kurukshetra, Karnal, Panipat, Sonipat, Gurugram, Faridabad, Palwal, Nuh (Mewat), Jhajjar, Rohtak, and Jind districts. The southwestern zone mainly consists of arid tracts. This zone covers the Sirsa, Fatehabad, Hisar, Bhiwani, Charkhi Dadri, Rewari, and Mahendragarh districts.





Source: <https://www.globalsecurity.org/military/world/India/haryana-geography.htm>

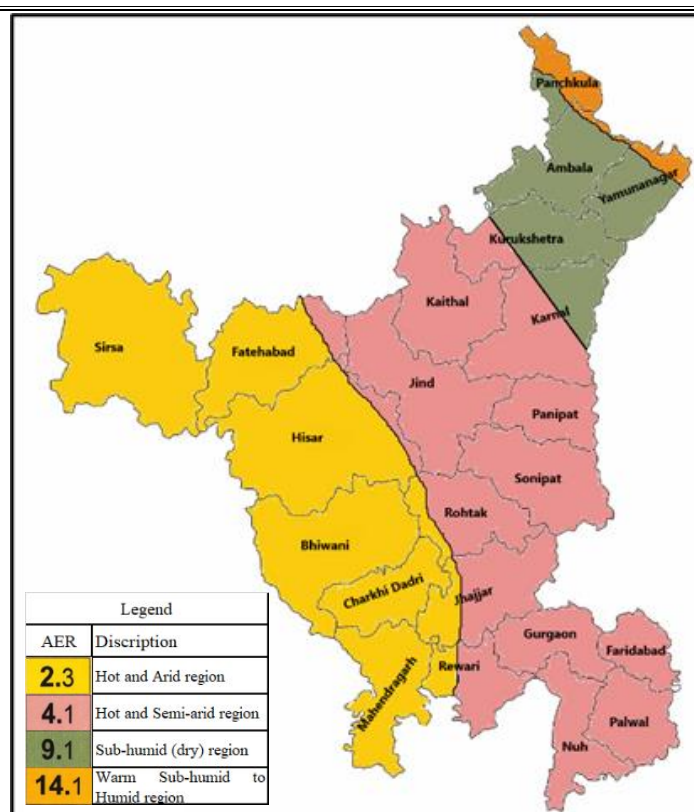
**Figure 2.5.1 Agro-climatic Zones of Haryana**

**(2) Agro-ecological Zones (Regions)**

An Agro-ecological region or zone is an area of land have homogeneous characteristics related to land suitability, potential production and environmental impact. According to Food and Agricultural Organization (FAO), an Agroecological Zone (AEZ) is a land resource mapping unit, defined in terms of climate, landforms and soils, and/or land cover, and having a specific range of potentials and constraints for land use.

Basically, AEZ is a fundamental geographic area which have similar crop combination, crop rotation, temperature, availability of rainfall, irrigation, type of soil, yield, topography, and environmental outcomes.

The National Bureau of Soil Survey & Land Use Planning (NBSS&LUP) divided India into 20 AEZs along with their agricultural and environmental characteristics. The respective location in Haryana has been provided in Figure 2.5.2.



Source: <https://esdac.jrc.ec.europa.eu/content/India-agro-ecological-subregions> (2011)

**Figure 2.5.2 Agro-Ecological Subregions (Soil Type)**

The major features of the respective AEZ are shown in Table 2.5.1.

**Table 2.5.1 Characteristic of Agro-Ecological Zones**

Sr. No.	Agro-ecological Zone	Sub Agro-Ecological region	Region	Precipitation	Soils	LGP (days)	Cultivated crops
				(mm)			
1	Arid (Hot) (AEZ-2)	2.3	Rajasthan Bagar, North Gujarat Plain and Southwestern Punjab Plain	< 300	Deep, loamy Desert soils (inclusion of saline phase)	<90	Guava, Pearl Millet, Chari (fodder), Pulses, Cotton, Sugarcane, Mustard, Gram, Wheat, Citrus, Guava, Ber, Temperate fruits and vegetables Bajra, Cotton
2	Semi-Arid (AEZ-4)	4.1	Northern Plain, Ganga-Yamuna Doab and Central Highland	500-800	Deep, loamy Alluvium-derived soils	90-120	Sugarcane, Groundnut, Maize, Paddy, Chili, Bajra, Jowar, Pulses, Vegetables, Wheat, Barley, Gram, Mustard, pulses, Guava
3	Sub-Humid (dry) (AEZ-9)	9.1	Northern Plain, Hot subhumid dry ecoregion	1000-1200	Deep loamy to clayey Alluvium-derived soils (inclusion of saline and sodic phase)	120-180	Rice, Maize, Barley, Pigeon pea, Jute, Wheat, Mustard, Lentil, Sugarcane, cotton. Guava, citrus, Ber

Sr. No.	Agro-ecological Zone	Sub Agro-Ecological region	Region	Precipitation	Soils	LGP (days)	Cultivated crops
				(mm)			
4	Warm Sub-humid to Humid with inclusion of Perhumid (AEZ-14)	<b>14.2</b>	South Kashmir and Kumaun Himalayas	1600-2000	Medium to deep loamy to clayey Brown Forest and Podzolic soils	150-210	Wheat, Millet, Maize, Rice, Oilseeds, Mango

Source: <https://esdac.jrc.ec.europa.eu/content/India-agro-ecological-subregions> (2011)

## Chapter 3 Present Condition of Horticulture Sector in The Survey Area

### 3.1 National and State Policy and Plan for Horticultural Sector

#### 3.1.1 Major National Policies and Schemes in Horticultural Sector

Agriculture and its related sectors are the foundation of India's economic growth. NITI (National Institution for Transforming India) Aayog, the premier policy think tank of the Indian government responsible for catalyzing the country's developmental agenda, projects that this sector will grow by 3% in FY2020-21.

The policy by NITI Aayog has been actively working on doubling farmers' incomes since 2016. The strategy aims to double the income of farmers by 2022 compared to the fiscal year 2015. It emphasizes transitioning from grains to higher-value crops like vegetables and fruits, improving irrigation infrastructure, enhancing seeds and fertilizers, and bettering the trading prices of agricultural products. The approach shifts the focus from increasing production output to elevating farmers' income, thus aiming to foster economic and social advancement in rural areas. In this regard, the Government constituted an Inter-Ministerial Committee in April 2016 to examine issues relating to the “Doubling of Farmers Income (DFI)” and recommended strategies to achieve the same. To achieve the objective, the Committee identified the following seven sources of income growth:

- i) Increase in crop productivity.
- ii) Increase in livestock productivity
- iii) Resource use efficiency - reduction in cost of production
- iv) Increase in cropping intensity
- v) Diversification to high value horticulture
- vi) Remunerative prices on farmers' produce
- vii) Shift of surplus manpower from farm to non-farm occupations

The premise of the strategy for doubling farmers income is based on the following primary principles:

- Increasing total output across the agricultural sub-sectors through realizing higher productivity
- Rationalizing/reducing the cost of production
- Ensuring remunerative prices in the agricultural produce
- Effective risk management
- Adoption of sustainable technologies

Apart from the strategy of “Doubling of Farmers Income (DFI)”, other significant initiatives include.

**MIDH (Mission for Integrated Development of Horticulture):** MIDH is an umbrella mission launched by the Indian government, aimed at the holistic growth of the horticulture sector in India. It integrates multiple schemes and missions under its umbrella for the comprehensive development of horticulture, including food and non-food crops. The National Horticulture Mission (NHM) is a sub-scheme of MIDH.

**National Horticulture Mission (NHM):** NHM was initiated as a focused approach to address the holistic development of the horticulture sector. Over time, NHM was subsumed under MIDH. NHM has various components, including the Cluster Development Programme (CDP), to ensure growth and development in the horticulture sector. It focuses on the production and post-harvest management of horticulture crops, R&D, and promotion of horticulture activities.

**Cluster Development Programme (CDP):** The CDP is an initiative under NHM/MIDH to develop clusters for specific horticulture crops in potential regions. It aims to establish specific crop-centric zones where resources, research, and production activities can be concentrated for the benefit of farmers.

Through CDP, the government promotes collective farming, adoption of high-tech horticulture, post-harvest management, and market linkages, among other activities. The idea is to centralize resources, expertise, and infrastructure for specific crops, resulting in better yield, quality, and market reach for farmers.

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**Pradhan Mantri Krishi Sinchai Yojana (PMKSY):** This is primarily aimed at improving irrigation facilities but also has a direct impact on improving productivity in the horticulture sector.

**Krishi Vigyan Kendras (KVKs):** These are community-based resource centers that provide farmers with new technologies and practical knowledge. This is expected to increase productivity and income in the horticulture sector.

India also has several policies and initiatives related to groundwater conservation and management. Groundwater is one of India's major water resources, critical for sustainable agriculture, drinking water supply, and industrial uses. The following are some of the key policies and programs related to groundwater conservation and management.

**Atal Bhujal Yojana (ABY):** This is a scheme to promote groundwater management and sustainable use, developing area-specific plans to prevent excessive extraction of groundwater and promote rehabilitation and sustainable use of the groundwater table.

**Central Ground Water Authority (CGWA):** CGWA is the primary agency responsible for groundwater management and regulation. It sets guidelines to regulate groundwater extraction in certain areas and issues licenses and permits to prevent excessive extraction.

**National Water Policy:** This policy provides a national policy to promote the sustainable management and use of water resources. It includes several recommendations for the sustainable use and management of groundwater.

**Participatory Groundwater Management (PGWM):** This is a community participation-based approach to groundwater management that aims to strengthen the capacity of local communities to manage and use their own water resources.

**Watershed Development Programs:** These programs aim to protect and rehabilitate local watershed areas, with the goal of enhancing groundwater recharge and protection of water resources.

As per the strategy, the Government has adopted and implemented several policies, reforms, developmental programmes and schemes for achieving higher incomes for the farmers directly or indirectly. These include:

### **(1) Unprecedented enhancement in budget allocation**

In the year 2015-16, the Budget allocation for the Ministry of Agriculture & FW (Farmers Welfare, including DARE, DAH&D) was only Rs. 25,460.51 crore. This has increased by more than 5.44 times to Rs. 1,38,550.93 crore in 2022-23.

### **(2) Income support to farmers through Pradhan Mantri Kisan Samman Nidhi (PM KISAN)**

Launch of PM KISAN in 2019 -an income support scheme providing Rs. 6,000 per year in 3 equal instalments. PM KISAN is an income support scheme introduced by the Indian government in 2019 to assist small-scale farmers financially. The program provides a direct annual cash transfer of Rs. 6,000 to registered farmers, disbursed in three equal instalments of Rs. 2,000 each. The initiative aims to stabilize the incomes of farmers and enhance their living standards. Beneficiaries include almost all small-scale farmers, with specific exceptions based on income or professional criteria, like certain government officials and income taxpayers. The implementation and registration of the scheme fall under the jurisdiction of individual states and union territories. With direct bank transfers, the scheme ensures transparency, reducing the risk of fraud or misappropriation of funds. More than Rs. 2 lakh crore has been released so far to approximately 11.3 crore eligible farmer families.

### **(3) Pradhan Mantri Fasal Bima Yojana (PMFBY)**

The Pradhan Mantri Fasal Bima Yojana (PMFBY) is a comprehensive agricultural insurance scheme launched by the Indian government to shield farmers from various risks. Introduced in 2016, it covers damages due to weather anomalies, natural disasters, pests, and diseases. Additionally, the scheme compensates for sowing failures due to inadequate rainfall. PMFBY offers affordable premium rates, with the government subsidizing a portion of the cost, and employs modern technologies like drones and remote sensing for swift damage assessment and claim processing. In the past 6 Years of implementation, 38 crore farmer applications have been enrolled and over 11.73 crore (Provisional) farmer applicants have received claims. During this period, nearly Rs. 25,185 crore were paid by farmers

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as their share of the premium, against which claims of over Rs. 124,223 crore (Provisional) have been paid to them. Thus, for every 100 rupees of premium paid by farmers, they have received about Rs. 493 as claims.

#### **(4) Institutional credit for the agriculture sector**

The Kisan Credit Card (KCC) is a financial initiative introduced in India in 1998 to provide farmers with flexible and timely short-to-medium-term credit for agricultural activities. Designed to finance crop production costs, its scope has expanded to cover activities like livestock farming and aquaculture. Beneficiaries enjoy simplified procedures, potential interest subventions for prompt repayments, and can renew the card periodically, possibly receiving higher credit limits. The KCC initiative stands as a pivotal tool in India's institutional credit system, catering swiftly to the financial needs of farmers. The Kisan Credit Card (KCC) is primarily designed for farmers in India. Eligible beneficiaries include individual farmers, regardless of whether they are owner-cultivators, tenant farmers, sharecroppers, or lessees. Additionally, joint farming groups or self-organized groups involved in agriculture activities, as well as those engaged in aquaculture, apiculture, and livestock rearing, can also apply for KCC.

- i) It was increased from Rs. 8.5 lakh crore in 2015-16, with a target to reach Rs. 18.5 lakh crore in 2022-23.
- ii) The benefit of concessional institutional credit through Kisan Credit Cards (KCC) at 4% interest per annum has also now been extended to animal husbandry and fisheries farmers to meet their short-term working capital needs.
- iii) A special drive has been undertaken since February 2020 to provide concessional institutional credit with a focus on covering all PM-KISAN beneficiaries through KCC. As of 11.11.2022, 376.97 lakh new KCC applications have been sanctioned with a sanctioned credit limit of Rs. 433,426 crore as part of the drive.

#### **(5) Fixing the Minimum Support Price (MSP) at one-and-a-half times the cost of production**

MSP is the minimum support price for certain agricultural products as determined by the central government of India. It is intended to enable farmers to sell at a guaranteed minimum price and stabilize their incomes. The Commission for Agricultural Costs and Prices (CACP), an agency of the central government, recommends MSPs for these crops. The central government then officially determines the MSP based on its recommendations. MSP is for grain pulses and oilseed crops (six Rabi crops and 14 Kharif crops).

- i) The government has increased the MSP for all mandated Kharif, Rabi and other commercial crops with a return of at least 50 per cent overall India weighted average cost of production from 2018-19.
- ii) MSP for Paddy (standard) has increased to Rs. 2,040 per quintal in 2022-23 from Rs. 1,310 per quintal in 2013-14.
- iii) MSP for Wheat increased from Rs. 1,400 per quintal in 2013-14 to Rs. 2,125 per quintal in 2022-23.

In conjunction with the central government's MSP, the Bhavantar Bharpai Yojana (BBY) policy is being implemented in the state of Haryana. Bhavantar Bharpai Yojana (BBY) in Haryana covers only Fruits and Vegetables. The scheme started in 2018 to incentivize farmers to offset losses during low prices of horticultural produce in the market. Twenty-one horticulture crops are covered under the scheme. Farmers can register on the Meri Fasal Mera Byora (MFMB) Portal. Farmers are compensated when the wholesale price falls below the fixed price/protected price, and the difference is paid to them. Since launching, a total benefit of INR 23 Crore and 27 lakh has been given to 9,485 farmers. A seed capital of Rs. 10 crore will be kept aside by the State Government for the scheme for the year 2023

The BBY Registration Process for Farmers is as follows:

All the farmers need to follow these steps to become eligible for this scheme:

- i) During the seeding duration, all the farmers need to register at the BBY e-portal of the horticulture department and on the website of the Haryana State Marketing Board (HSAMB).

- ii) Area Certification by the officers of the forest department.
- iii) In case a farmer is unsatisfied with the certified area, then there is a provision to file an appeal.
- iv) Free Registration for Producers /Manufacturers.
- v) All these registrations will remain applicable within the above-mentioned time limits.
- vi) Common Service Centres, E-Disha Centres, Marketing Board, Horticulture Department, Agricultural Department, and Internet kiosks will provide the registration facility.
- vii) Registration, Verification, Issue of Appeal, and Sale period are valid within the above-mentioned dates.

#### **BBY Crops, MSP and Production**

Several vegetables and fruits have been included under this scheme; the latest list is available here. The MSP and scheduled production is given in the table below.

**Table 3.1.1 Crops covered under the scheme under the BBY**

Sn.	Crop	Protected Price (Rs. per qtl.)	Sn.	Crop	Protected Price (Rs. per qtl.)
<b>Vegetables</b>					
1	Tomato	500	8	Brinjal	500
2	Onion	650	9	Carrot	700
3	Potato	600	10	Cabbage	650
4	Cauliflower	750	11	Chilli	950
5	Bhindi	1050	12	Capsicum	900
6	Bottle gourd	450	13	Pea	1100
7	Bitter gourd	1350	14	Radish	450
<b>Spices</b>					
15	Turmeric	1400	16	Garlic	2300
<b>Fruits</b>					
17	Mango	1950	20	Ber	2400
18	Guava	1300	21	Litchi	1500
19	Kinnow	1100			

Source: <https://www.pradhanmantriyojana.co.in/bhavantar-bharpai-haryana-apply-msp/>

The implementation process of the scheme is as follows.

- i) To make sure that all farmers get the advantages of this new program, the state authority will implement it on as much as 25% of the total cultivable area present in the state.
- ii) Better agriculture must be supported with better vegetable and fruit mandis. As per the reports, new fruit and vegetable markets will be set up in the state and its periphery. For this, the state will acquire and develop 500 acres.
- iii) According to reports, the state will start the task of establishing markets in selected locations in Sonipat and Ganaur. Apart from these, work is in progress on special flower mandis in Gurugram.
- iv) Indo-Israel and milk markets are also a part of this scheme. Step-by-step implementation will develop the overall status of agricultural workers.

It is another addition to the already existing list of welfare schemes that has been targeted towards the development of the farmers of Haryana. With its implementation, the investment of all agricultural workers will be safeguarded from losses due to the lower price of produce in the markets.

#### **(6) Promotion of organic farming in the country**

- i) Paramparagat Krishi Vikas Yojana (PKVY) was initiated in 2015-16 to promote organic farming in the country. The goal is to enhance sustainable production, offer healthy food, and conserve the environment. The scheme emphasizes a collective approach, forming clusters of 20 or more farmers covering 50-acre land to adopt organic farming. It provides training to farmers on organic techniques, financial support for transitioning to organic methods, certification after three years of conversion, and support for marketing and selling organic

produce. 32,384 clusters have been formed and an area of 6.53 lakh hectare has been covered benefitting 16.19 lakh farmers. In addition, Under Namami Gange Programme 123,620 hectare area covered and under natural farming 4.09 lakh hectare area covered. Farmers in Uttar Pradesh, Uttarakhand, Bihar and Jharkhand have taken-up organic farming on either side of the river Ganga to control river water pollution as well as to fetch additional income to farmers.

- ii) Government also proposes to promote sustainable natural farming systems through the scheme Bhartiya Prakratik Krishi Padhati (BPKP). The proposed scheme aims at cutting down cost of cultivation, enhancing farmer's income and ensuring resource conservation and safe and healthy soils, environment and food.
- iii) Mission Organic Value Chain Development in North East Region (MOVCDNER) has been launched. 379 Farmer Producer Companies have been formed comprising of 189,039 farmers and covering 172,966 hectare area.

### **(7) Per Drop More Crop**

Per Drop More Crop (PDMC) scheme was launched in the year 2015-16, which aims to increase water use efficiency, reducing cost of inputs and increasing productivity at the farm level through Micro Irrigation technologies i.e. drip and sprinkler irrigation systems. So far, an area of 69.55 lakh hectares has been covered under micro irrigation through the PDMC scheme from the year 2015-16.

### **(8) Micro Irrigation Fund**

A Micro Irrigation Fund of initial corpus Rs 5,000 crore has been created with NABARD. In the budget announcement for 2021-22, the corpus of the fund is to be increased to Rs.10,000 crore. Projects worth Rs 4,710.96 crore covering 17.09 lakh hectares have been approved.

### **(9) Promotion of Producer Group (PG<sup>1</sup>)**

- i) To bring scales of economy to agricultural operations, a new Central Sector Scheme for formation & promotion of new 10,000 FPOs (PGs) was launched by Hon'ble Prime Minister on 29th February 2020 with budget outlay of Rs 6865 crore till 2027-28.
- ii) As of 31<sup>st</sup> October 2022, 3,855 PGs have been registered under new FPO (Farmer Producer Organization) scheme.

### **(10) A National Beekeeping and Honey Mission (NBHM)**

NBHM has been launched in 2020 as part of the Atma Nirbhar Bharat Abhiyan to increase productivity of crops through pollination and increase in honey production as an additional source of income. Rs. 500 crore for the period 2020-2021 to 2022-2023 has been allocated for beekeeping sector. 114 projects for assistance of about Rs. 139.23 crore, approved/ sanctioned for funding under NBHM during 2020-21 & 2021-22 till date.

### **(11) Agricultural Mechanization**

Mechanization is an extremely vital to modernize agriculture and reduce drudgery of farming operations. During the period from 2014-15 to March, 2022 an amount of Rs.5490.82 crore have been allocated for agricultural mechanization. 13,88,314 numbers of machines and equipment have been provided to farmers on subsidy basis. 18,824 custom hiring centres, 403 high-tech hubs and 16,791 farm machinery banks have been established to make available agricultural machines and equipment to the farmers on rental basis. During the current year i.e. 2022-23, so far an amount of Rs. 504.43 crore have been released for distribution of around 65302 machines on subsidy, establishment of 2804 CHCs, 12 Hi-tech hubs and 1260 Village Level Farm Machinery Banks.

### **(12) Providing Soil Health Cards to farmers**

Soil Health Card Scheme was introduced in the year 2014-15 to optimize usage of nutrients. The following numbers of cards have been issued to farmers;

- i) Cycle-I (2015 to 2017) – 10.74 crore

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<sup>11</sup> Farmer producer organisations FPOs are referred to as Producer Groups (PG) in this project.



- ii) Cycle-II (2017 to 2019)- 11.97 crore
- iii) Model Village Programme (2019-20)- 19.64 lakh

### **(13) Setting up of National Agriculture Market (e-NAM) extension Platform**

The National Agriculture Market (e-NAM) is an online trading platform introduced by the Indian government in 2016 to integrate various regional agricultural markets. Its primary goals are to provide farmers with price transparency and competitive returns for their produce. The platform facilitates real-time price discovery, competitive online bidding, and quality inspection. It offers digital payment mechanisms, real-time market trend insights, and allows farmers to trade without being physically present, expanding their market reach beyond local regions. Details are in 3.4.6.

- i) 1260 mandis of 22 States and 03 UTs have been integrated to e-NAM platform.
- ii) As on 31.10.2022, more than 1.74 crore farmers & 2.36 lakh traders have been registered on e-NAM portal.
- iii) Total volume of 6.5 crore MT & 19.24 crore numbers (bamboo, betel leaves, coconut, lemon & sweet corn) collectively worth approximately Rs. 2.22 lakh crore of trade has been recorded on e-NAM platform as of 31.10.2022.

In contrast, E-kharid is being developed in Haryana. E-kharid is an online platform initiated by the government of Haryana, India, aimed at providing a transparent and efficient trading mechanism for agricultural products. It facilitates direct interactions between farmers and traders, ensuring fair pricing and transparency in transactions. The platform offers functionalities such as online auctions, transaction tracking, and transparency in payments. E-kharid registers cultivation history and other information, enabling traceability of cultivation, while E-nam is transaction-focused and has no such functionality. They are utilized in accordance with the needs of the sales destination and procurement destination. More details are provided in 3.5.2.

### **(14) Launch of the National Mission for Edible Oils – Oil Palm –**

NMEO has been approved with a total outlay of Rs 11,040 crore. This will bring an additional area of 6.5 lakh hectares under Oil Palm plantation with 3.28 lakh hectares in the north-eastern states and 3.22 lakh hectare in the rest of India in the next 5 years. The major focus of the mission is to provide viability prices of fresh fruit bunches (FFBs) to the farmers linked with assured procurement by industry with a simpler price fixing formula. The Central Government will compensate farmers through a viability gap payment if price paid by industry is below the viability price up to October, 2037.

### **(15) Agri Infrastructure Fund (AIF)**

Since the inception of AIF in the year 2020, the scheme has sanctioned an amount of Rs.13681 crore worth agriculture infrastructure in the country for more than 18133 projects. With the support of the scheme, various agriculture infrastructures were created and some of the infrastructures are at the final stage of completion. These infrastructures include 8076 warehouses, 2788 primary processing units, 1860 custom hiring centres, 937 sorting & grading units, 696 cold store projects, 163 assaying units and around 3613 other kinds of post-harvest management projects and community farming assets.

### **(16) Improvement in farm produce logistics, Introduction of Kisan Rail.**

Kisan Rail has been launched by the Ministry of Railways to exclusively cater to movement of perishable horticulture commodities. The first Kisan Rail was started in July 2020. Till 31st October 2022, 2,359 services on 167 routes have been operated.

### **(17) Creation of a Start-up Ecosystem in agriculture and allied sector**

India is launching initiatives to bolster the startup ecosystem in agriculture and its allied sectors. This encompasses technological innovations, funding support, the establishment of incubation centers, promoting research and technology transfers, and expanding market access. So far, 1055 startups during FY 2019-20 to 2022-23 have been finally selected by different knowledge partners and agribusiness incubators of DA&FW. A total of Rs. 6317.91 lakh grants-in-aid has been released for funding to these startups to the respective knowledge Partners (KPs) & RKVY RAFTAAR Agri Business Incubator (R-ABIs) as grants-in-aid support by DA&FW.

### (18) Achievement in Export of Agri and Allied Agri- Commodities

The country has witnessed emphatic growth in export of agri and allied commodities. As compared to the year 2015-16, the agri and allied export has increased from 32.81 billion USD in 2015-16 to 50.24 billion USD in 2021-22 i.e. an increase of 53.1%.

Other key national policies are summarized below.

### (19) Pradhan Mantri Fasal Bima Yojana (PMFBY)

Weather-based crop insurance (Pradhan Mantri Fasal Bima Yojana/PMFBY) is a central scheme administered by the Ministry of Agriculture and Farmer Welfare. It provides a safety net. The policy covers cereals (grains, pulses, and oilseeds), annual horticultural crops, and commercial crops. Farmers who receive loans to grow such crops must purchase the insurance, but it is optional for all other farmers.

Farmers get their insurance claims through a straightforward process. Insurance companies receive support from the government to help cover losses that farmers face due to disasters or issues after harvesting. They upload important data like the usual crop yield and past records to the National Crop Insurance Portal (NCIP) and make sure everything is correct. After collecting information on the losses through surveys, and getting approval from the authorities, they put this data into the NCIP quickly.

The insurance company figures out which claims are valid, starts the payment process, and keeps the NCIP updated. At the end of the season, they use government data and the Public Financial Management System (PFMS) to process final claims. If any data is late, it gets automatically approved, and they might use technology to help sort things out. Farmers that work with financial institutions get their claims money electronically through PFMS, while others receive their money directly in their bank accounts, and get a text message about it. They handle different types of crop losses using set procedures, send out text messages when claims are settled, and have committees to deal with any disputed claims. Finally, all payments go through either PFMS or the Aadhaar Enabled Payment System (AEPS) if there are any issues with bank transactions.

In Haryana, PMFBY was implemented from Kharif 2016. At that time, under this system, paddy, bajra, maize, cotton, and mung were covered in the Kharif period, and wheat, mustard, gram, barley, and sunflower in the Rabi period. However, now, in addition to commodity crops, oilseeds, horticultural crops, commercial crops, are also covered. The Central Government has made amendment under PMFBY from Kharif-2020. The scheme is voluntary for the farmers, keeping in view State Government has decided to implement the scheme from Kharif-2020 to Rabi-2022-23. Under the scheme farmer's premium will be 1.50% for Rabi, 2% for Kharif crops and 5% for Cotton crop. Following risk will be covered in standing crop under the scheme i.e., inundation (except paddy), hailstorm, flood, drought, cloud burst. In addition to this the assessment of yield loss will be on individual plot basis in case of occurrence of cyclone, cyclonic rains and unseasonal rains resulting in damage to harvested crop lying in the field in 'cut and spread' condition, up to a maximum period of 14 days from harvesting. The progress under PMFBY is given in the table below.

**Table 3.1.2 The Cropping Season-wise Progress under PMFBY**

Season		Total Farmers covered	Number of Farmers benefited	Collected Premium			Total Premium	Claim
				Farmers Share	State Share	Central Share		
Kharif	2016	738,795	150,881	12,736	8,332	4,616	25,684	23,423
Rabi-	2016-17	597,298	62,606	6,995	1,893	1,893	10,780	5,703
Kharif-	2017	632,421	242,699	12,487	11,436	6,182	30,104	80,500
Rabi	2017-18	691,246	77,433	8,126	3,379	3,379	14,883	8,625
Kharif-	2018	722,953	322,574	13,908	26,085	18,100	58,093	79,729
Rabi	2018-19	774,947	80,721	10,237	8,526	8,526	27,289	12,705
Kharif-	2019	820,585	247,995	16,743	39,951	28,970	85,664	59,256

Season		Total Farmers covered	Number of Farmers benefited	Collected Premium			Total Premium	Claim
				Farmers Share	State Share	Central Share		
Rabi-	2019-20	890,453	321,220	10,163	13,156	13,156	36,475	34,339
Kharif-	2020	887,258	342,672	26,471	34,953	34,943	96,368	99,530
Rabi-	2020-21	757,035	106,810	7,985	13,213	13,202	34,401	15,615
Kharif-	2021	746,606	419,933	24,249	31,925	31,925	88,099	138,881
Rabi-	2021-22	733,674	72,412	7,607	13,640	13,632	34,878	8,396
Total	-	8,993,271	2,447,956	157,705	206,489	178,525	542,719	566,703

Source: Department of Agriculture and Farmers Welfare, Haryana.

## (20) Mera Paani, Meri Virasat Scheme (MPMV)

The Crop Diversification Programme, Mera Pani Meri Virasat, is a joint central and state Government initiative aimed at promoting crop diversification in India. Crop diversification involves changing the regional dominance of a crop to meet the increasing demand for various agricultural products such as cereals, vegetables, fruits, and animal feed. The programme promotes sustainable agriculture and the latest technologies to enable farmers to choose alternative crops, increase productivity, and income. The programme was launched in 2013-14 with 100% central Government assistance, which changed to a 60:40 financial system (Centre-State) from 2015-16. Ten districts have been identified under the programme in the state of Haryana. The long-term targets of the programme include reducing the area under high water-intensive crops, establishing alternative crops for sustainable agriculture, increasing farm income, resource conservation, restoring the water table, and reducing soil fatigue and pollution. The programme includes cluster demonstration of alternative crops, site-specific activities, and awareness, training, implementation, and monitoring. Under the Crop Diversification Scheme (State Plan), farmers in all districts of the state are given grants to promote crop diversification, including maize, cotton, Kharif oilseed, Kharif pulses, Kharif onion, fodder crops, and Horticulture/vegetable crops, even in case of fallow land.

In Haryana State the scheme was launched during Kharif (Sowing in June – July, Harvested In September – October) 2020 for conservation of water and crop diversification to replace the Paddy crop with maize/ cotton/ Bajra/ Pulses in 1 lac hectare in targeted block having ground water level > 40 meters. It was decided that Gram Panchayats agriculture land having ground water level 35 meter and above will be restricted for the cultivation of Paddy and applicable financial assistance also provided to the respective gram panchayats. Below is a list of district wise/block wise area where water table is >35 and 40 meters under Panchayat Land where cultivation of paddy is restricted.

**Table 3.1.3 District wise/ block wise area (the water level >40m) in 2020**

Sr No.	District	Block	Water Table June (2019) (in meters)	Area under Paddy (in hectares)
1.	Fatehabad	Ratia	41.60	41136
2.	Kaithal	Siwan	49.88	10678
		Guhla	41.38	41259
3.	Kurukshetra	Pipli	42.82	12854
		Shahbad	45.38	18950
		Babain	42.04	8327
		Ismailabad	45.16	16246
4.	Sirsa	Sirsa	47.43	30501
Total				179951

Source: DOA&FW Haryana

**Table 3.1.4 District wise/Block wise area (water table >35m) in 2020**

Sr. No.	District	Block	Water Table June (2019) (in meters)	Area under Paddy (in hectares)
1.	Kurukshetra	Thanesar	35.83	928
		Pehowa	39.51	1843

Sr. No.	District	Block	Water Table June (2019) (in meters)	Area under Paddy (in hectares)
2.	Fatehabad	Fatehabad	36.28	121
		Jakhal	38.58	244
Total				3136

Source: DOA & FW Haryana

The implementation guidelines are as follows.<sup>2</sup>

- The farmers have to diversify 50% of their cultivated paddy area by growing alternate crops.
- An assistance of Rs. 7000/- per acre is provided to the farmers under this scheme.
- All those farmers which are operating their tube well with 50hp electric motor will not be allowed to grow paddy.
- All diversified crops will be procured by the Government.
- The Government will install maize dryers in related grain market for reducing moisture content of maize grain procured by the farmers.

Year wise alternate crop covered under this scheme for the kharif season are as follow.

**Table 3.1.5 Year wise alternate crop covered under this scheme for the kharif season**

Kharif season	Alternate Crop
2020	Maize, Cotton, Pearl millet, Pulses, Vegetables, and Fruits.
2021	Maize Cotton, Oilseeds (Sesame, castor, groundnut), Pulses (Moth, Black gram), Cluster bean, Soyabean), Onion, Fodder crops, Vegetables, and Fruits
2022	Maize Cotton, Oilseeds (sesame, castor, groundnut), Pulses (Moth, Black gram), Cluster bean, Soyabean), Onion, Fodder crops, Poplar, eucalyptus, Vegetables, and Fruits

Source: DOA & FW Haryana

Year wise and district wise targets under MPMV scheme are as follow.

**Table 3.1.6 The districts wise/ crop wise target area under MPMV for the Kharif 2021**

(in acres)

Sr. No.	District	Maize	Cotton	Pulses	Oilseeds	Fodder/ Fallow	Horticulture/ vegetables	Total
1	Ambala	6300	0	185	100	1000	2500	10085
2	Bhiwani	30	6200	175	100	1000	1250	8755
3	Charkhi Dadri	10	5300	70	50	1000	250	6680
4	Faridabad	275	1200	100	0	1000	625	3200
5	Fatehabad	515	18000	100	100	1000	1875	21590
6	Gurugram	70	120	170	0	1000	250	1610
7	Hisar	300	10000	300	200	1500	1875	14175
8	Jhajjar	160	5200	150	250	1000	1250	8160
9	Jind	310	20000	250	0	1500	1250	23310
10	Kaithal	2800	8200	300	0	1500	1875	14675
11	Karnal	6000	50	150	0	2500	2500	11200
12	Kurukshetra	2000	30	150	0	1500	2500	6180
13	Mahendragarh	0	0	0	0	0	0	0
14	Mewat	20	150	200	150	1000	250	1770
15	Palwal	0	0	50	100	1000	250	1400
16	Panchkula	3700	0	200	0	1000	250	5150
17	Panipat	1450	100	100	0	1000	2500	5150
18	Rewari	25	250	100	100	1000	0	1475
19	Rohtak	185	2000	200	180	2000	1250	5815
20	Sirsa	450	22000	400	200	2000	2500	27550
21	Sonipat	1200	4200	300	0	2000	2500	10200
22	Yamuna Nagar	4200	0	1200	470	3500	2500	11870
Total		30000	103000	5000	2000	30000	30000	200000

Source: DOA & FW Haryana

<sup>2</sup><https://timesofindia.indiatimes.com/city/chandigarh/haryana-sets-2-lakh-acre-target-for-crop-diversification/articleshow/83268375.cms>, <https://haryana.nic.gov.in/15-july-2021-1>, <https://www.hindustantimes.com/cities/chandigarh-news/7-haryana-districts-fail-to-achieve-dsr-sowing-target-101657834140279.html> <https://www.youtube.com/watch?v=YY5UCrFmsE> <https://www.tribuneindia.com/news/haryana/palwal-leads-in-water-conservation-287389> (2021)

**Table 3.1.7 The districts wise/ crop wise target area under MPMV for the Kharif 2022**  
(in acres)

Sr. No.	District	Maize	Cotton	Pulses	Oilseeds	Fodder/ Fallow	Horticulture/ vegetables	Total
1	Ambala	3149	0	92	50	500	1250	5041
2	Bhiwani	15	3100	88	50	500	625	4378
3	Charkhi Dadri	5	2650	35	25	500	125	3340
4	Faridabad	138	600	50	0	500	310	1598
5	Fatehabad	258	9000	50	50	500	938	10796
6	Gurugram	35	60	85	0	500	125	805
7	Hisar	150	5000	150	100	750	938	7088
8	Jhajjar	80	2600	150	125	500	625	4080
9	Jind	155	10000	125	0	750	625	11655
10	Kaithal	1400	4100	150	0	750	938	7338
11	Karnal	3000	25	75	0	1250	1250	5600
12	Kurukshetra	1000	15	75	0	750	1250	3090
13	Mahendragarh	0	0	0	0	0	0	0
14	Mewat	10	75	100	75	500	125	885
15	Palwal	0	0	25	50	500	125	700
16	Panchkula	1850	0	100	0	500	125	2575
17	Panipat	725	50	50	0	500	1250	2575
18	Rewari	13	125	50	50	500	0	738
19	Rohtak	93	1000	100	90	1000	625	2908
20	Sirsa	225	11000	200	100	1000	1250	13775
21	Sonapat	600	2100	150	0	1000	1250	5100
22	Yamuna Nagar	2100	0	600	235	1750	1250	5935
	<b>Total</b>	<b>15001</b>	<b>51500</b>	<b>2500</b>	<b>1000</b>	<b>15000</b>	<b>14999</b>	<b>100000</b>

Source: DOA& FW Haryana

Year wise Achieved Target area are as follows.

**Table 3.1.8 Crop wise area diversified from 2020 to 2022 under MPMV scheme**  
(in acres)

Year	Maize	Cotton	Bajra	Pulses	Oilseeds	Horticulture/ Vegetables	Fodder/ Fallow	Agroforestry (Popular& Eucalyptus)	Total
2020	4580	41159	10237	348	0	5399	0	0	61723
2021	1916	28826	0	1126	384	6955	12689	0	51896
2022	1406	24214	0	594	276	9228	17912	5195	58825
<b>Total</b>	<b>7902</b>	<b>94199</b>	<b>10237</b>	<b>2068</b>	<b>660</b>	<b>21582</b>	<b>30601</b>	<b>5195</b>	<b>172444</b>

Source: DOA&FW Haryana

Year wise details of area diversified and number of farmers who benefitted from the scheme are as follows.

**Table 3.1.9 Year wise details of area diversified and no of Farmers benefitted from the scheme**

Year	Area Diversified (acre)	No. of Farmers benefitted	Expenditure (Rupees in crore)
2020	61723	41947	45.00
2021	51896	32186	31.00
2022	58825	34239	41.22
<b>Total</b>	<b>172444</b>	<b>108372</b>	<b>117.22</b>

Source: DOA&FW Haryana

The inspection of the diversified area is done by the coordination of the various departments including agriculture, local land revenue officers (Local land revenue officers provide the details of the crops being grown by the farmers last year) etc. After the registration by the farmers on the online portal. The agriculture department will verify the crop being grown by the registered famers (whether it's diversified

or not) by getting this information from the local land revenue officer of that block/area. Once it's being verified, the benefits of the schemes are being given to the registered farmer.

The whole execution of the scheme is done on an online portal. These departments are linked through this portal. As far as the real figures are concerned, they get these figures from the online portal, and there is no such relevant information in regard to if this is available to them.

### **3.1.2 State Policy and Plan for Horticulture Sector**

Haryana has Haryana Vision 2030 as an outline of specific strategies and measures that the government plans to implement in various areas such as agriculture, forestry, and fisheries. This vision outlines specific strategies and measures that the government plans to implement in various areas, including agriculture, industry, infrastructure, education, health, and governance.

The Haryana government's Vision 2030 is written in line with the United Nations SDGs and identifies the following challenges for agriculture.

1. High consumption of water, fertilizers, and pesticides in the fields, which is not sustainable in the long run.
2. Deterioration of water quality due to pollution from domestic, industrial, and agricultural activities, as well as over-exploitation of groundwater.
3. Low investment in groundwater and drought management, which exacerbates the effects of climate change on agriculture.
4. Heat stress due to high temperatures or rising temperature-humidity index (THI), which impairs reproductive functions in livestock and alters breeding and birthing seasons.
5. Lack of awareness about climate change mitigation and adaptation among cultivators and households, which hinders efforts to promote environmental sustainability and mitigate environmental degradation.

The Vision mentions several specific measures that the Government of Haryana has taken or plans to take to address the challenges in the agricultural sector. These measures include:

1. Providing training to small farmers in post-harvest management, developing suitable infrastructure, and subsidizing their use by small farmers .
2. Developing market linkages between food producers, manufacturers, exporters, and other participants in the agricultural market, through the use of modern technologies such as e-platforms like e-Kharid .
3. Increasing the efficiency and effectiveness of existing schemes, such as Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA)<sup>3</sup> and Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY)<sup>4</sup> to ensure more accurate identification of sector and skill gaps amongst the poor and vulnerable to improve their employability .
4. Developing proper institutional grievance redressal systems to ensure transparency and accountability throughout local governance, with IT integration to optimize efficiency and ensure regular data collection, processing, and monitoring at even the local level .
5. Poverty alleviation programs such as new policies to ensure an adequate land bank for future development, an e-auctioning policy for residential, commercial, industrial, and institutional plots (for private organizations), and better solid waste management systems .
6. Setting up a State Nutrition Mission as an independent body committed to bringing about a reduction in maternal and child undernutrition rates, which is expected to play a catalytic role in accelerating efforts towards reducing undernutrition amongst children and women by converging and collaborating with nodal departments and ensuring effective and quality implementation of nutrition interventions.

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<sup>3</sup> The Mahatma Gandhi National Rural Employment Guarantee Act aims to provide a minimum guarantee of employment to all households in India. MNREGA aims to provide a stable income to poor households in rural areas, especially during the off-farm season, thereby reducing migration, increase rural purchasing power, and improve the management of natural resources.

<sup>4</sup> Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY) is a government-sponsored program in India aimed at providing vocational training and employment opportunities for youth. It specifically targets vulnerable segments of the rural population. The initiative, implemented by India's Ministry of Rural Development, is designed to economically empower vulnerable segments of the rural population and promote sustainable economic growth and social progress by providing skills training and employment opportunities to a large number of youth

These measures are part of the Government of Haryana's broader policy to promote sustainable and inclusive growth in the agricultural sector.

The project's components, such as promotion of post-harvest management through value chain infrastructure development, DX development, and nutritional improvement are completely in line with this Vision.

In accordance with the above policy, the DOH policy is defined, and according to interviews with DOH, the three-pronged strategy are cluster identification, formation of PGs, and infrastructure built-up in clusters. Other major nine scheme, budgets and details are shown in the table below.

**Table 3.1.10 State Scheme, budget and contents for Horticulture Sector**

Sr No.	Name of the scheme	2023-2024 (in lakh)		
		BE <sup>5</sup>	Approved	Description
1.	2401-Crop-Husbandry-119-Horticulture and vegetable crops (SB No. 58): Plan scheme for promotion of Advanced National and International Technologies in horticulture sector.	5600.00	5000.00	The department is now collaborating with the international agencies in the field of horticulture for transfer of international technologies in the Haryana state. The budget will be utilized for the establishment of 2 more Centre of excellences. Apart from these centres, departments have govt. Garden and nurseries where other demonstration activities are organized. The plan scheme has been devised to cater the demand of farmers and to demonstrate technologies.
2.	2401-Crop husbandary-119-horticulture & vegetable crops (SB No. 54): Plan Scheme for “On-Farm & Marketing Support to Horticulture Farmers (SB. 54)”.	9000.00	9000.00	The whole expenditure of the scheme is being borne by the state govt. in the form of assistance to PG's/Farmers group for establishment of pack houses in the clusters and on contingencies and establishments. The approved budget is for the establishment of 50 pack-houses in the state.
3.	P-01-27-2401-51-119-63-51: Plan scheme for Mukhyamantri Bagwani Bima Yojana (MBBY) in Haryana. (2022-2023)	1000.00	1000.00	(MBBY) is a horticultural insurance scheme launched by Haryana's Government in 2021. It provides financial protection to farmers for crop losses, covering a wide range of crops. Farmers pay a nominal premium, subsidized by the Government. “The total expenditure under this scheme will be 1000.00 lakh for the year 2023.
4.	2401-crop husbandary-789-Special component plan scheme for scheduled castes (SB No. 98); Integrated Horticulture Development Plan Scheme for Scheduled caste Families. (non-recurring bases)	1000.00	1000.00	Scheme is approved in the budget estimates of the department. The expenditure of the year will be phased out in four quarters viz. quarter 25%, 2 <sup>nd</sup> quarter 20%, 3 <sup>rd</sup> quarter 25% and 4 <sup>th</sup> quarter 30%
5.	2401-crop-husbandry-190-Assistance to public sector and other undertakings (99): plan scheme for Bhavantar Bharpayee Yojana in Haryana.	0	1000.00	The fund under the schemes has been kept into corpus fund managed by DOH. This fund can only be used for incentivizing the producers under the scheme. An independent cell has been created in DOH for the management of corpus fund and implementation of the program.
6.	2401-crop Husbandry -119-Horticulture & vegetable crops (SB No. 65): plan scheme for Integrated Horticulture Development in Haryana.	9200.00		The expenditure of the year will be phased out in four quarters viz. quarter 25%, 2 <sup>nd</sup> quarter 20%, 3 <sup>rd</sup> quarter 25% and 4 <sup>th</sup> quarter 30%
7.	[P-01-10-2401-51-119-53-51]-N-V: Establishment of Horticulture University.	0	2000.00	Administrative approval-cum-financial sanction to release fund for the establishment of university for the year 2022-2023 as non-recoverable financial assistance in the form of interest free perpetual loan.
8.	2401- Crop husbandry-119-National Farming and Sustainable initiative in Horticulture	500	500.00	DOA&FW is the nodal agency of the scheme. The norms and guidelines approved by the DOA & FW is being followed in the scheme. The entire budget

<sup>5</sup> BE is for Budget Estimate

Sr No.	Name of the scheme	2023-2024 (in lakh)		
		BE <sup>5</sup>	Approved	Description
				of the scheme is being transferred by the DOA& FW to DOH.
9.	Centrally sponsored scheme on Mission for Integrated Development of Horticulture (MIDH)	9200	7000.00 (Revised estimates)	Administrative approval-cum-financial sanction to release under captioned mater subject to the condition that the fund will be utilised in accordance with the guidelines of the govt. of India.

Source: DOH

### 3.1.3 Financial Status of the Horticultural Sector in the State

Table 3.1.11 shows the consolidated fund of the Haryana state government. This budget trend shows an overall increase from 2018 to 2023. Relatively large increases are seen in FY 2018-2019 and FY 2020-2021, with increases of 14.75% and 9.35%, respectively. The 2019-2020 and 2021-2022 fiscal years also show increases, but at somewhat different rates, 7.69% for the former and 13.93% for the latter.

**Table 3.1.11 Budget of Haryana state government**

Year	Budget (In crore)	Expenditure	Growth rate
2023-2024	109122.42	A. Revenue Account	
	5200	B. Capital Account	
	1132.8	C. Repayment of Debt	
	64840	D. Loans (Advances)	
	3654.75		
	183949.97	Total (A+B+C+D)	3.77 %
2022-2023	177255.99	Total (A+B+C+D)	13.93 %
2021-2022	155645.45	Total (A+B+C+D)	9.35 %
2020-2021	142343.78	Total (A+B+C+D)	7.69 %
2019-2020	132165.99	Total (A+B+C+D)	14.75 %
2018-2019	115198.29	Total (A+B+C+D)	

Source: Budget at glance (2023-24)(2022-23)(2021-22)(2020-21)(2019-20)(2018-19) finance department, Haryana

Table 3.1.12 shows the budgeted outlay and expenditures of the Haryana State Horticulture Department for the past 10 years. Outlay represents the total amount of funds allocated to the department, while expenditures represent the amount actually spent. The percentage of expenditures is calculated by dividing expenditures by outlay and multiplying by 100.

Over the years, the outlay has increased significantly from 5,486.22 lakh in 2011-12 to 49,201.34 lakh in 2021-22. However, the expenditure has not always been as high as the outlay, with some years showing expenditure below 80% of the outlay. The highest expenditure was recorded in 2018-19 at 96.20%, while the lowest was in 2015-16 at 60.54%.

**Table 3.1.12 Budget Outlay & Expenditure (Last Ten Years): (Rs. in lakh)**

Sr. No.	Year	Outlay	Revised	Expenditure	% expenditure
State & Central Plan (Sharing+100%)					
1.	2011-12	5486.22	5465.93	4498.76	82
2.	2012-13	5400.00	7200.00	7069.52	98
3.	2013-14	9500.00	9500.00	8716.34	92
4.	2014-15	29448.50	18910.00	13205.34	70
5.	2015-16	23945.00	24073.45	14575.41	60.54
6.	2016-17	37844.45	26884.89	20446.47	76.05
7.	2017-18	39692.55	29251.41	25617.41	87.75
8.	2018-19	83491.48	34498.07	33186.93	96.20
9.	2019-20	52388.12	28638.39	20404.15	71.25
10	2020-21	49281.85	46459.81	45522.89	98.07
11	2021-22 up to 31-03-2022	48901.34	96955.72 (yet not approved)	26096.19	30.99

Source: Department of Horticulture



## 3.2 Administrative Set-up and Other Related Organization for Horticulture Development

### 3.2.1 Department of Horticulture (DOH)

Department of Horticulture (DOH) deals with the production and maintenance of fruits, vegetables, and flowers, spices mushrooms, medicinal and aromatic plants. The cultivation of horticulture crops is highly specialized, technical, and remunerative venture as compared to traditional crops being grown by the farmers. Farmers in Haryana have also started taking up horticulture crops as a separate viable economic activity. With a view to give a boost to the growth of horticulture in the state, Haryana Government created a separate Department of Horticulture in 1990-91, which was previously a part of Agriculture Department, Haryana.<sup>6</sup>

#### (1) Vision and Objectives<sup>7</sup>

The vision and objectives of DOH are as follows.

Vision: To make Haryana a leading modern fruit and vegetable growing state in domestic and export markets.

Objective.

- i) Diversification from agriculture to horticulture.
- ii) Doubling of horticultural production under the 11th Five Year Plan.
- iii) Optimal use of basic natural resources.
- iv) Establish coherence and synergy among stakeholders.
- v) Increase in productivity, yield, and quality of horticultural production.
- vi) Increase in per-unit economic status and associated increase in income.
- vii) Dissemination of the latest technologies at the farmers' field.
- viii) Ensuring nutrition for the people.
- ix) Creation of export potential and acquisition of foreign exchange.

These visions and objectives aim to provide nutritional security to the people of Haryana and at the same time promote the growth and development of the horticulture industry in the state.

In addition, Specifically, the Haryana government will work to promote protected cultivation, farmer-producer organizations, and the cultivation of fruits, vegetables, and crops that require less water. It is stated that the state will establish a strong framework for post-harvest management to enhance the value of Haryana's crops. The project's components - diversification from agriculture to horticulture, promotion of water-saving irrigation, establishment of synergies among stakeholders, improvement of quality of horticultural produce, value chain development to increase income and promote exports, dissemination of modern cultivation techniques, and improved nutrition are consistent with this objective.

#### (2) Administrative Set-up

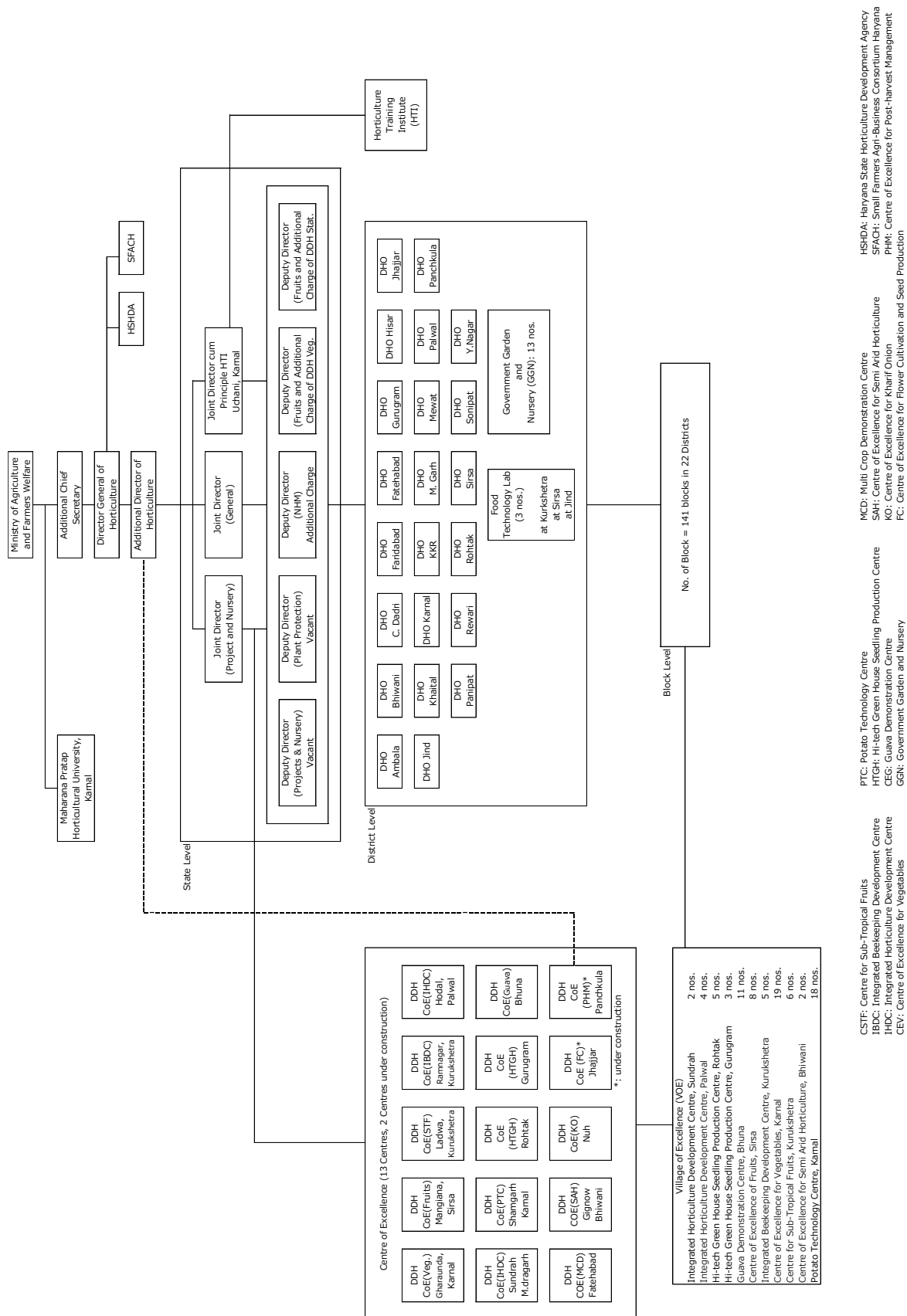
The organizational structure of DOH is shown in Figure 3.2.1. The Agriculture and Farmer Welfare Minister, Haryana and the Additional Chief Secretary, Government of Haryana are the policy making authorities in the state, the DOH is headed by the Director General of Horticulture with headquarters at Panchkula, Haryana. The Director of Horticulture is assisted by the Additional Director of Horticulture (vacant), three Joint Directors of Horticulture at the headquarters, and Deputy Director of Horticulture.

#### (3) Agriculture Extension

The Deputy Director of Horticulture is responsible for implementation of all horticulture development programmes in the districts. Under the Director General, the Joint Director of Horticulture General, Chief Vigilance Officer, the Joint Director Horticulture (NHM) will oversee planning matters, including the National Horticulture Mission, and will supervise matters related to accounting and budget. The Deputy Director of Horticulture is assisted by the District Horticultural Officers and other supporting technical staff. The Deputy Director for Horticulture will be assisted by the District Horticulture Officer and other supporting technical staff.

<sup>6</sup> Home | Horticulture Department, Government of Haryana ([hortharyana.gov.in](http://hortharyana.gov.in))

<sup>7</sup> Home | Horticulture Department, Government of Haryana ([hortharyana.gov.in](http://hortharyana.gov.in))



(Q): Quick Estimates, (A): Advance Estimates

Source: "Economic Survey of Haryana 2021-22", Department of Economic and Statistical Analysis, Haryana

**Figure 3.2.1 Organization Structure of the Department of Horticulture, State of Haryana**

The Horticulture Development Officer in the District Office prepares extension plans, and Horticulture Extension Services, also in the District Office, provides farmers with farm management guidance. Their role and responsibility of major staff of DOH are summarized in Attachment 3.2.1:

The number of head and field officers in the DOH (as of November 2022) is shown below.

**Table 3.2.1 Staff Position in Head Office of DOH (as of Nov. 2022)**

Position	Sanctioned Posts	Presently Filled-up Posts	Vacant Posts
Director General Horticulture (Class I)	1	1	0
Mission Director (Class I)	1	0	1
Additional Director (Class I)	1	0	1
Joint Director Horticulture (Class I)	3	3	0
Deputy Director Horticulture (stat.) (Class I)	1	0	1
Deputy Director Horticulture (Class I)	5	2	3
Technical Staff in Class II	29	24	5
Technical Staff in Class III	2	0	2
Administrative staff in Class II	7	3	4
Administrative staff in Class III/IV	77	48	29
Total	127	81	46

*Note: including Head office of DOH and Centres of Excellence  
Source: Department of Horticulture, Panchkula, March 2023*

**Table 3.2.2 Staff Position in Field Offices of DOH (as of Nov. 2022)**

Position	Sanctioned Posts	Presently Filled-up Posts	Vacant Posts
Class I	10	6	4
Technical Staff in Class II	240	144	96
Technical Staff in Class III/IV	19	13	6
Administrative staff in Class II	-	-	-
Administrative staff in Class III/IV	567	386	181
Total	836	549	287

*Note: including District Horticulture Offices and Horticulture Training Institute (HTI)  
Source: Department of Horticulture, Panchkula, March 2023*

Furthermore, updated Technical Staff Position in DDH Offices and DHO Offices of DOH are shown in Attachment 3.2.2 and 3.2.3. Central Government Initiatives.

#### (4) Initiatives Taken by the Department

The schemes conducted under the central Government initiatives are shown as follows:

**Table 3.2.3 Schemes Conducted under Central Government Initiatives (2021-22 and 2022-23)**

Sr No.	Name of Scheme	Contents
1	Integrated Development of Horticulture	Comprehensive approach to horticultural practices, emphasizing research, production, marketing, and value addition.
2	Agriculture Human Resource Development	Enhancing skills, knowledge, and capacity of agricultural workers through training and education.
3	Demonstration-cum-Food Processing Technology	Showcasing advanced food processing techniques and promoting their adoption.
4	Various Horticulture Activities in Haryana	Support for horticultural practices and initiatives tailored for the Haryana region.
5	Promotion of Advance National & International Technology in Horticulture	Introducing and adopting cutting-edge domestic and global horticultural technologies.
6	Integrated Horticulture Development for SC Families	Uplifting Scheduled Caste families with support in horticulture through training and resources.
7	On Farm & Marketing Support of Horticulture Farmers	Providing on-ground support and improving marketing avenues for horticultural produce.
8	Establishment of Horticulture University	Setting up a dedicated university in Haryana for horticultural research and education.

Sr No.	Name of Scheme	Contents
9	Bhavantar Bharpayee Yojana	A price deficit financing scheme compensating farmers for selling below a predetermined price.
10	Organic Farming and Zero Budget Natural Farming Practices	Promoting chemical-free farming methods with an emphasis on self-sustenance.
11	Plan Scheme Mukhyamantri Bagwani Bima Yojana (MBBY)	Insurance scheme for horticultural farmers ensuring financial protection.
12	Crop Cluster Development Programme (CCDP)	Developing specific crop clusters to promote collective farming and boost productivity.

Source: Department of Horticulture, Panchkula, March 2023

In the schemes mentioned above, it is intimated that Integrated Development of Horticulture is the most important scheme. This scheme is officially named as Mission for Integrated Development of Horticulture (MIDH), which 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.

The schemes conducted under state Government initiatives are shown as follows:

**Table 3.2.4 Schemes Conducted under State Government Initiatives (Sharing Basis)  
(2021-22 and 2022-23)**

No.	Name of Scheme
1	Mera Pani Meri Virasat Scheme
	Haryana Government has launched Mera Pani Meri Virasat Scheme 2023 or crop diversification scheme for farmers. The implementing agency for this scheme in Haryana is the Department of Agriculture, but the Department of Horticulture also implements the MPMV scheme, with implementation based on plans prepared by the Department of Agriculture. The state govt. is inviting Mera Pani Meri Virasat Scheme farmers registration/application form 2023 at the official portal of the scheme, apply online for Rs. 7000 / acre incentive to switch from paddy cultivation to other crops. Under the new Mera Pani Meri Virasat Scheme, the state govt. of Haryana will provide Rs. 7,000 per acre incentive to farmers to switch from paddy. This water conservation initiative will also protect depletion of natural resources such as water and soil. Details are described in 3-1.
2	National Horticulture Mission
	The National Horticulture Mission (NHM) in Haryana, India, is a part of a broader initiative by the Indian government to promote holistic growth of the horticulture sector through a range of strategic actions. Specifically for Haryana, the NHM emphasizes enhancing horticultural production by providing support in the form of financial assistance, technical guidance, and marketing strategies. The mission aims to encourage the adoption of sustainable farming practices, improve post-harvest management, enhance productivity, and create opportunities for farmers in the state to gain better returns from horticultural crops.
3	Scheme for Silk Samagra
	Scheme for Silk Samagra aims to promote holistic development of the silk industry from production to export, emphasizing sustainable practices, technological advancements, and skill enhancement. If this scheme has been specifically adapted or implemented for the state of Haryana, it would likely focus on enhancing the local sericulture industry, providing support to silk farmers, and promoting value-added silk products from the region.
4	Mukhya Mantri Kisan Khet Sadak Marg Yojana (MMKKSMTY)
	A state Government initiative aimed at improving connectivity between agricultural fields and main roads. The scheme focuses on constructing and upgrading rural roads to facilitate the transportation of agricultural produce, reduce post-harvest losses, and boost farmers' income.
5	Market Intervention Scheme (MIS)
	A central Government scheme designed to provide price support to farmers during periods of market glut or when market prices fall below a certain threshold. The scheme aims to prevent distress sales by farmers and stabilize market prices for agricultural commodities.
6	Rashtriya Krishi Vikas Yojana (RKVY)
	A centrally sponsored scheme aimed at promoting agricultural growth and development. The scheme provides financial support to state Governments for implementing various agricultural projects and initiatives, such as infrastructure development, technology adoption, and capacity building for farmers.
7	Integrated Horticulture Development Scheme (IHDS)
	A central Government scheme aimed at promoting the development of horticulture in India. The scheme provides financial assistance to farmers for the cultivation of fruits, vegetables, flowers, and other horticultural crops. It also supports the development of post-harvest infrastructure, such as cold storage facilities and processing units, to reduce post-harvest losses and enhance farmers' income.

Source: DOH, Panchkula, March 2023

## (5) Centre of Excellence

In Haryana state, there are currently six Centres of Excellence for boosting production of horticultural crops. A Center of Excellence (CoE) is an institution dedicated to providing expertise in a specific horticultural crop; a CoE serves as a center for advanced research, best practices, and training. Their objectives include strengthening discipline-specific knowledge, providing advanced training and education, fostering innovation and research, bridging academia and industry, and fostering global collaboration. Many states and central institutions in India have established and supported CoEs to enhance national development and competitiveness. The Israel-India cooperation in agriculture has deepened and widened since full diplomatic relations were established in 1992. During the initial period of the establishment of Centres of Excellence, the newest technologies in the field of agriculture were brought from Israel and implemented at these centres.

Over the years, the agricultural cooperation between the two countries has further expanded. Now Israeli technologies and know-how are being transferred and manufactured in India, further boosting the 'Make in India' initiative and benefiting the entire world, said the release.

Israel is a pioneer in developing sustainable technologies and solutions for all agricultural sectors. For many decades, Israel has successfully overcome harsh climatic conditions and knows how to maximize resources in an arid environment.

It is intimated that there are currently 30 fully active Centres of Excellence in different states across India. More such centres are in the pipeline. These centres are increasing farmers' yield and productivity while diversifying local crops and improving the quality of produce.

In the state of Haryana, there are presently 13 CoEs as shown in the following table.

**Table 3.2.5 Centres of Excellence in Haryana State**

Category	District	Commodities	Established Year
1. Vegetables	Karnal	Major vegetables	2011
2. Fruits	Sirsa	Major fruits	2013
3. Hi-tech Green House Seedling Production	Gurugram	Vegetables	2013
4. Hi-tech Green House Seedling Production	Rohtak	Vegetables	2014
5. Sub-tropical fruits	Kurukshetra	Major fruits	2016
6. Potato	Karnal	Potato	2016
7. Integrated Bee Development Center (IBDC)	Kurukshetra	Beekeeping	2017
8. Integrated Horticulture Development Centre	Palwal	Fruits & Vegetables	2018
9. Integrated Horticulture Development Centre	Mahendragarh	Fruits & Vegetables	2019
10. Guava	Fatehabad	Guava	2020
11. Horticulture	Bhiwani	Semi-arid horticultural crops	2023
12. Flower	Jhajjar	Major flowers	Under construction
13. Kharif Onion	Nuh	Onion	Inauguration Not yet

Source: JICA Preparatory Work Team, March 2023

It is intimated that they are being motivated by promoting horticulture and floriculture. It was said that the state Government had set a target to increase the area under cultivation of vegetables, fruits, and flowers from the existing 12 lakh acres to 22 lakh acres. As many as 340 villages are being developed as horticultural villages at a cost of Rs 517 crore and Centres of Excellence are being opened in every district to encourage farmers. The farmers can more than double their income by cultivating vegetables. The Center of Excellence has facilities for state-of-the-art technology, research, training, and demonstrations related to the applicable agricultural category or specialty.

Specifically, the following facilities are in place

**Model Water Saving Irrigation Facility:** Advanced irrigation systems including drip irrigation, sprinkler irrigation, and moisture sensors.

**Nursery Center:** A facility for growing and producing high-quality nursery plants and seeds.

**Demonstration Farms:** Best practices and methods of cultivation.

**Training Centers:** Training centers that impart knowledge to farmers and other stakeholders.

**Laboratories** to develop new varieties and technologies.

**Cold Storage & Processing Unit:** to store and process agricultural products and increase shelf life.

**Varietal Improvement Center:** Focuses on the development of new and improved varieties of agricultural products.

**Soil & Water Testing Labs:** Soil and water testing labs that analyze soil quality and provide advice to improve crop yields.

**Organic Cultivation Center:** Promotes organic farming methods.

**Agricultural Machinery Center:** Exhibits modern and efficient agricultural machinery.

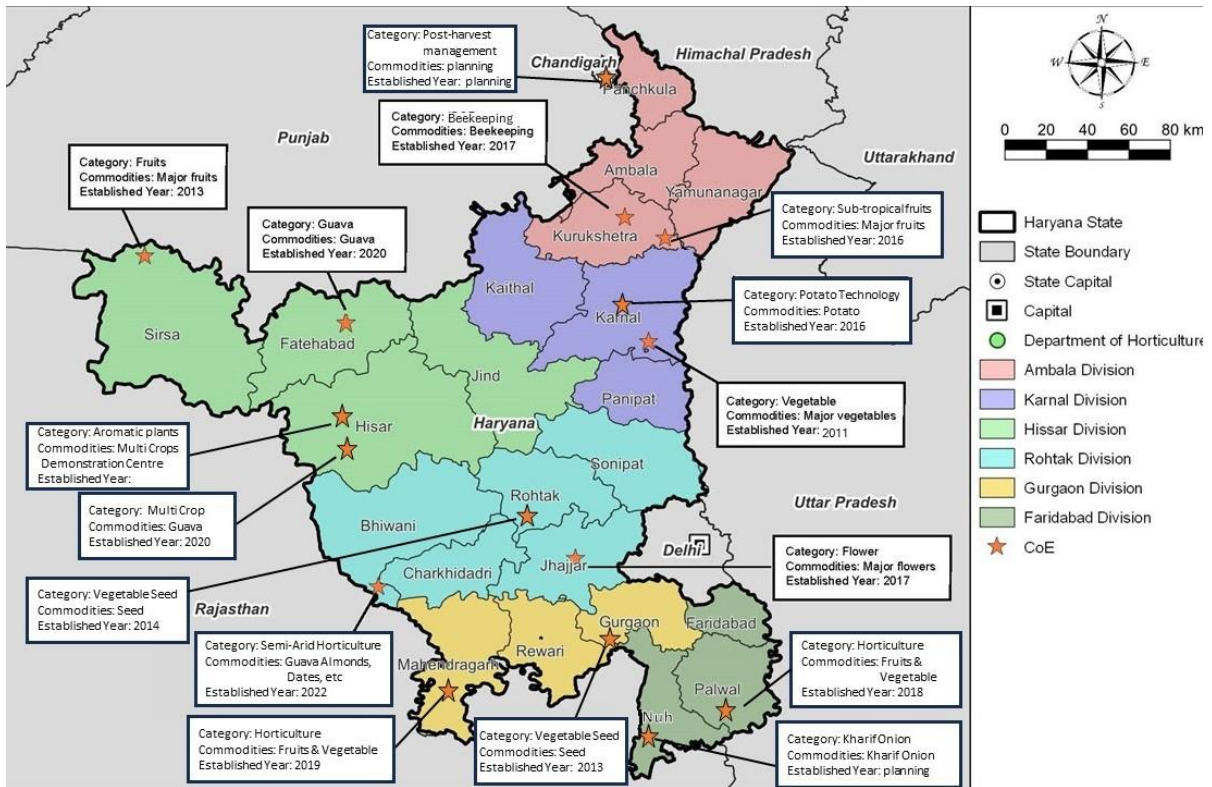
The Haryana government generally plays the lead role in providing funding for the establishment and operation of Centers of Excellence. However, they may also receive financial and technical assistance from the central government and international cooperating and funding agencies.

The ownership structure varies depending on the background and purpose for which the center was established. In general, ownership of Centers of Excellence in Haryana is held by the Haryana government. However, there may be centers that operate under joint projects with the central government or in cooperation with other collaborating institutions.

The following are some specific suggestions for linking the functions of Centres of Excellence (COEs) with the Project.

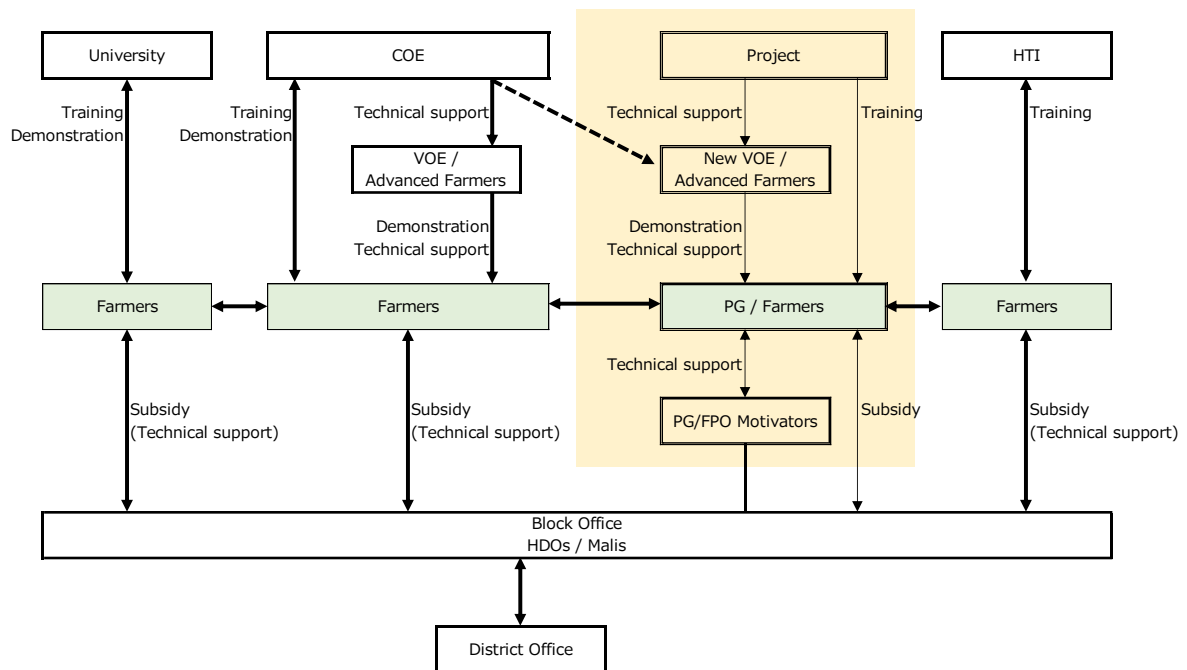
- i) **Technology transfer and education:** COEs can develop new agricultural technologies and best practices and educate members of the agro value chain development projects on these. Currently, the method of visiting and receiving training is one of the causes of low vegetable productivity. Therefore, by implementing initiatives that allow online training and video courses to be taken without having to visit training facilities, growers will be able to grow, harvest, and sell their crops more efficiently.
- ii) **R&D and Innovation:** COEs can develop new types of crops, genetically modified crops that improve disease resistance, drought tolerance, and yield, etc. A possible linkage would be to attach test plots to COEs to test technologies from companies such as J-method farming described in Chapter 6. These new technologies can improve the efficiency and productivity of the value chain and increase the competitiveness of agricultural products.
- iii) **Assistance in building supply chains:** COEs provide training on each step of the agricultural value chain, from seeding to post-harvest. Within the project, networking with the relevant stakeholders will enable producers to maximize their benefits.
- iv) **Quality control and safety assurance:** The project will not include a component to set up an inspection agency. So COEs can play an important role in crop quality control and food safety. They can monitor crop quality using the latest scientific methods and help maintain food safety and sanitation standards.

Current extension activities including COEs, HTI (Horticulture Training Institute) and Horticultural University are shown in the below figure.



Source: JICA Survey Team

**Figure 3.2.2 Locations of Centres of Excellence in Haryana State**



**Figure 3.2.3 Extension Activities under DOH in Haryana State**

### **3.2.2 Department of Agriculture (DOA)**

The Department of Agriculture & Farmers Welfare (DOAFW) is the main agency functioning as part of the central government of India and is responsible for formulating, implementing, and overseeing national agricultural policies. The department serves many purposes, including promoting sustainable agricultural production, proper management of resources in agriculture, stabilizing prices of agricultural products, and improving farmers' livelihoods. Specific activities include soil health, seed certification, research and dissemination of agricultural technologies, and improvement of irrigation facilities.

Haryana also has its own Department of Agriculture & Farmers Welfare to formulate and implement its own agricultural policies based on the guidelines and policies of the central DOAFW. Under this department in Haryana are several bureaus and units to manage specific crops and activities.

With respect to agriculture, the Department of Agriculture and the Department of Horticulture

The responsibilities of DOA and DOH departments are differentiated primarily based on the types of crops and activities they oversee. The target crops for DOA are Cereals (rice, wheat, and maize), Pulses (gram, pigeon pea, and lentil), Oilseeds (Mustard, sunflower, and sesame), Commercial Crops (sugarcane and cotton.) This department also undertakes soil testing, seed certification, farmer training, and the promotion of sustainable and modern agricultural practices.

The target crops for DOH are Fruit, Vegetable, Floriculture, Spices, Medicinal and Aromatic Plants. This department is also responsible for promoting modern horticultural practices, post-harvest management, and facilitating the marketing of horticultural produce.

#### **(1) Vision and Objectives**

The DOA of the state Government is fully responsible for carrying out the following mandates:

To diversify the traditional farming system based on subsistence agriculture to commercial market-oriented farming system;

- i) To harness the ecological niches for the promotion of environment-friendly farming system suited to the different agro-climatic conditions of the state;
- ii) To create conditions, infrastructure, services and facilities for improving the levels of farm income and employment by increasing production, productivity and quality of produce thereby improving the quality of life of the rural population;
- iii) To use science and technology to a greater extent for the optimum utilisation of the state's agricultural potential and for that to develop, introduce, adapt and extend appropriate technology for adoption at the farm level; and
- iv) To formulate and implement sound and scientific plans for the development of agriculture in Haryana with equal participation from the farmers, farmers' organisations and the industry.

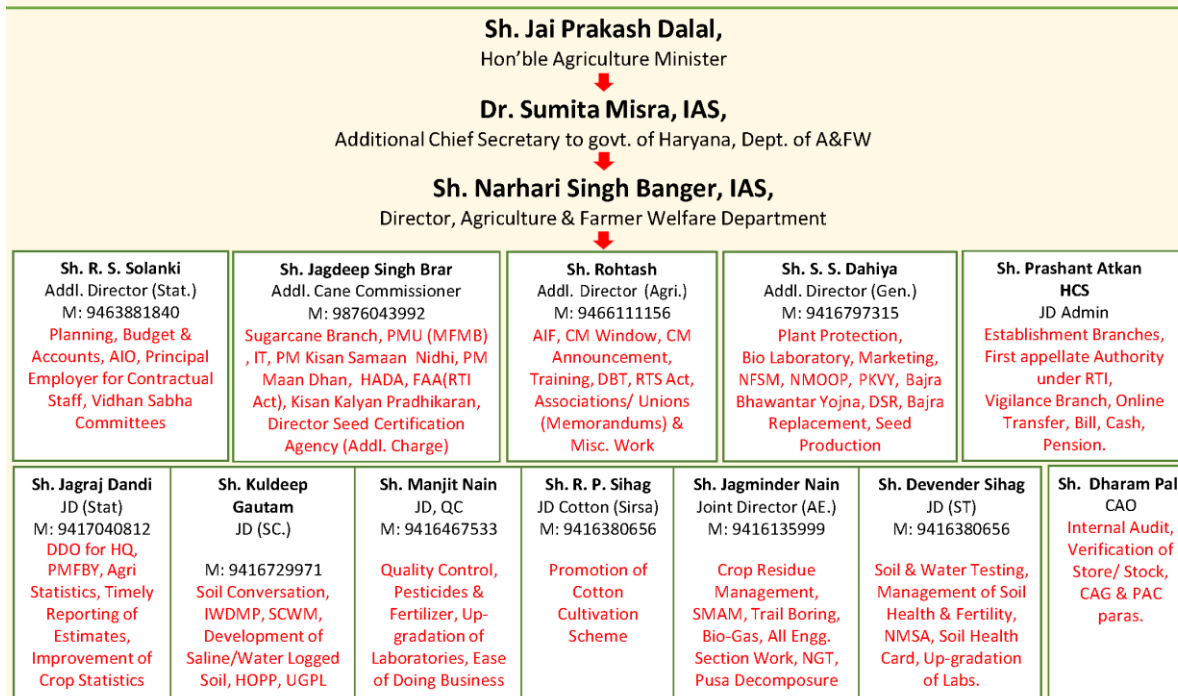
#### **(2) Administrative Set-up**

The organizational structure of DOAFW is shown in Figure 3.2.4.



## Department of Agriculture & Farmers Welfare

### [ ORGANIZATIONAL CHART ]



Source: DOA&FW, 2023

**Figure 3.2.4 Organization Structure of Department of Agriculture & Farmers Welfare, State of Haryana**

Number of technical officers in District Agricultural Offices is shown below.

**Table 3.2.6 Staff Position in each District Agricultural Office (as of June 2023)**

Sr. No.	District	SMS	APO	QCI	SDAO	ACDO	Under ATMA		Total
							BTM	ATM	
1	Ambala	0	1	0	0	0	6	17	24
2	Bhiwani	7	0	1	3	0	5	19	35
3	Charkhi Dadri	3	0	0	1	0	3	6	13
4	Faridabad	1	1	1	0	0	2	5	10
5	Fatehabad	5	1	1	2	1	2	11	23
6	Gurugram	2	1	1	1	0	1	11	17
7	Hisar	5	1	1	2	0	1	5	15
8	Jhajjar	6	1	1	2	0	4	15	29
9	Jind	6	1	1	3	1	7	20	39
10	Kaithal	3	1	1	2	1	6	18	32
11	Karnal	2	1	1	1	3	6	18	32
12	Kurukshetra	5	1	1	2	1	6	18	34
13	Mahendragarh	4	1	1	2	0	5	15	28
14	Mewat	1	0	1	2	0	4	8	16
15	Palwal	0	0	0	0	0	4	12	16
16	Panchkula	4	0	1	1	0	4	12	22
17	Panipat	2	1	0	1	1	5	15	25
18	Rewari	0	1	0	1	0	4	15	21
19	Rohtak	3	1	1	0	1	5	11	22
20	Sirsa	0	1	0	2	0	7	21	31
21	Sonapat	2	1	1	2	1	3	18	28
22	Yamuna Nagar	2	0	0	0	1	6	17	26
Total		63	16	15	30	11	96	307	538

Note: SMS: Subject Matter Specialist, APO: Assistant Protection officer, QCI: Quality Control Inspector, SDAO: Sub-divisional Agriculture Officer, BTM: Block Technical Manager, ATM: Assistant Technical Manager  
Source: DOAFW Haryana

The DOA functions under the administrative control of the Additional Chief Secretary of the Government of Haryana and is headed by the Director of Agriculture with headquarters at Chandigarh. In the headquarters, the Director of Agriculture is assisted by four Additional Directors, six Joint Directors as follows:

i) Director

The Director is the Head of the department who is controlling of all the schemes and activities emphasized by the Govt. to the Agriculture Department.

ii) Additional Directors

There are four additional Directors in the Agriculture Department who are next to the Director of Agriculture and looking after the different sections according to the specific and emphasized schemes and miscellaneous work given to them. The respective roles of the Additional Directors are as under:

- Planning, budget & Accounts, AIO, Principal Employer for Contractual Staff, and Vidhan Sabha Committee
- Sugarcane branch, PMU (MFMB), IT, PM Kisan Saman Nidhi, PM Maan Dhan, Hada FAA (ZRTI Act), Kisan Kalyan Pradhikaran, Director Seed Certification Agency
- AIF, CM Window, CM Announcement, Training, DBT, RTS Act, Associations/ Unions & Misc. Work
- Plant Protection, Bio Laboratory, Marketing, NFSM, NMOOP, PKVY, Bajra Bhawantar Yojna, DSR, Bajra Replacement, Seed Production

iii) Joint Directors

There are six Joint Directors in the Agriculture Department. The respective roles of the Joint Directors are as listed below:

- DDO for HQ, PMFBY, Agri. Statistics, Timely Reporting of Estimates, Improvement of Crop Statistics
- Soil Conservation, IWMP, SCWM, Development of Saline / Waterlogged Soil, HOPP, UGPL
- Quality Control, Pesticides & Fertilizer, Up-gradation of Laboratories, Ease of Doing Business
- Promotion of Cotton Cultivation Scheme
- Crop Residue Management, SMAM, Trail Borinbg, Biogas, All Engg. Section Work, NGT, Pusa Decomposer
- Soil & Water Testing, Management of Soil Health & Fertility, NMSA, Soil Health Card, Up-gradation of Labs

iv) Deputy Directors of Agriculture and Supporting Staff in District

One Deputy Director of Agriculture (DDA) is posted in each district to implement and coordinate all the agricultural activities in their respective districts. They are assisted by Sub Divisional Agriculture Officers, SMSs (Subject Matter Specialist) and Superintendents.

### **(3) Agriculture Extension**

The extension of the latest technology is very necessary to reach to the real users i.e., farmers. Presently, the department of Agriculture is extending the latest technology within the reach of the farmers through various means and methods. The extension workers (Primary) i.e., ADOs are deployed in the field after imparting them a three-month training in the HAMETI, Jind. All the field functionaries are helping the farmers in advocating and launching to the farmers various new technologies and all the specific things as per the package of practices issued by the SAU. The farmers are getting benefits from the field functionaries.

The department is extending and distributing 35 thousand copies of Krishi Sanwad, magazine which is free of cost. The farmers are taking the benefits through this magazine by reading the different articles which are there in Hindi language.

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The Department is making advertisements in different newspapers for the publicity of various useful things for the farmers.

The department is also extending Jingles in different radio stations. The telephone call stations in the state are there at Bawal, Kurukshetra, Hisar and Panchkula which are free of cost. The farmers can ask on telephone to solve their problems.

The department will have to plan for the latest technologies of extension being covered in the developing countries.

#### **(4) Initiatives Taken by the Department**

The Department of Agriculture has taken many initiatives and the strategies already chalked out have also been accelerated in a holistic manner during recent past for the overall growth of farmers and farming. The emphasis was sincerely given by the department to cope with the challenges like Degradation of Soil Health, Depletion of Groundwater Resources and its Management, Quality Seeds, Farm Mechanization, Extension, Weather Climate Change, etc.

Major initiatives and strategies followed by the department are:

i) **Soil Health Improvement**

The plant nutrients are called essential elements. In the absence of any one of these essential, a plant fails to complete its life-cycle, though the disorder can, however be corrected by the addition of that element. It is well known that 16 plant-food elements are necessary for the growth of green plants. The crops in the state are taking many quantities of these elements from the soil day by day and year by year. To enrich the soil, it is very essential to feed it back through different sources. Department of Agriculture has taken many initiatives in this regard.

ii) **Depletion of Groundwater Resources and its Management through Various Sources**

Water management is a thrust area not only of the department, State but also a very critical need of the nation. To economize the use of water, various water saving techniques are being promoted in a more holistic manner by the department. Underground Pipe Line (UGPL), Drip and Sprinkler systems are being extended to the farmers on subsidies rates so that others can learn the benefits of the systems and may use the same at their own level also.

It is intimated that depletion of groundwater is a serious concern, therefore, "The Haryana Preservation of Sub Soil Water Act, 2009" was strictly implemented. "The Haryana Preservation of Sub Soil Water Act, 2009" is legislation passed by the state government of Haryana, India, with the primary intent of conserving sub-soil water. Recognizing the alarming depletion of groundwater resources in the state, this Act stipulates various measures to prevent wastage and over-extraction of sub-soil water. One of its significant provisions is the restriction on the transplantation of paddy before a specified date, as paddy cultivation consumes a substantial amount of water. This helps in ensuring that water is not drawn from the ground before the onset of the monsoon season. The Act gives authority to concerned officials to monitor and implement these provisions and penalize those who violate the stipulated guidelines. This will go a long way in preservation of sub soil water in state. The farmers are prohibited to grow the nursery of Paddy before 15th May and transplanting of paddy before 15th June. This act has been quite successful in checking the exploitation of ground water specially in paddy growing areas.

Also, this program not only helps to encounter the problem of depletion of ground water but also improves soil health and maintains dynamic equilibrium of agro-eco system. Under this program, the crops like maize, pulses, basmati and agro-forestry crops are being promoted.

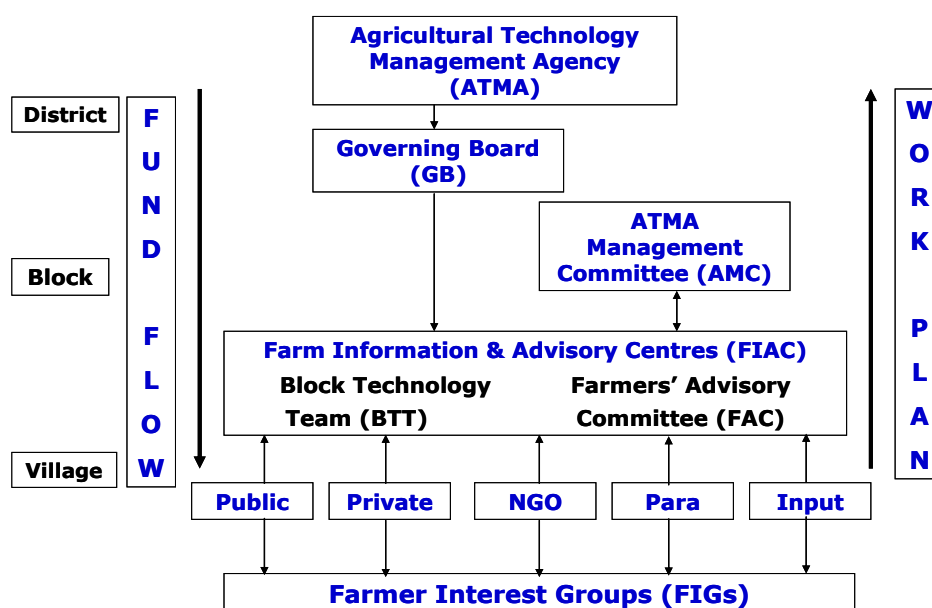
#### **(5) Agricultural Technology Management Agency (ATMA)**

ATMA is an autonomous institution with participation of all the key stakeholders involved in agricultural activities for sustainable agricultural development in the district. It has the flexibility to receive funds directly (Government of India / States, membership fees, beneficiaries' contribution, etc).

ATMA has the main responsibility of all the technology dissemination activities at the district level. It has linkages with all the line departments, research organizations, non-Governmental organizations and

agencies associated with agricultural development in the district with a substantial representation of farmer organizations. Research and extension units within the district, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Marketing etc. are constituent members.

The organizational structure of ATMA is shown as follows:



Source: JICA Survey Team

**Figure 3.2.5 Organizational Structure of ATMA**

Each district ATMA is under jurisdiction of Governing Board chaired by District Magistrate and having some officers in charge, ATMA Management Committee (AMC) consisting of official members, and Farmers Advisory Committee (FAC) with respective members. The programmes and procedures concerning district-wise activities are determined by ATMA, Governing Board and implemented by its management committee. In order to manage programme implementation at block level and below, ATMA has established a Farm Information and Advisory Centre (FIAC) at each block in the district. In effect the FIACs act as extension planning and operational arm of ATMA. These are supported by two groups; one, a group of technical officers at block derived from different functional areas termed as Block Technology Team (BTT) whereas, the others are a Farmers Advisory Committee (FAC) which is a body exclusively of farmers. While BTT develops the Block Action Plans (BAPs) in light of the SREP and is responsible for its implementation, the FAC plays a more proactive role by scrutinizing, improving and approving BAPs, before these are referred to the ATMA GB for its final approval.

Commodity oriented Farmer Interest Groups (FIGs) are promoted at the block/ village level to make the technology generation / dissemination farmer driven and farmer accountable. These village level FIGs are ultimately federated at block / district level and represented in FACs and GB. In order to address the extension needs of these groups, ATMA has established close linkages with various players operating at cutting edge level viz., public, private, NGOs, para extension workers and input dealers etc. 2 to 3 Assistant Technology Managers (ATM) and one Block Technology Manager (BTM) is envisaged each block under this scheme.

Activities carried out under ATMA are mentioned below:

- i) Farmer oriented activities:
  - Training of Farmers
  - Demonstration
  - Exposure visit
  - Mobilization of farmer groups
  - Reward & incentive for best group
  - Best farmer awards
- ii) Farm information and dissemination:

- District level kisan mela/ exhibitions
  - Information dissemination through printed leaflets/ local advertisement
- iii) Agriculture technology refinement, validation, and adoption:
- Farmers-scientist interactions
  - Field days with strengthen research-extension-farmers linkages
  - Assessment, refinement and validation of technologies

### **Linking with the project**

The project can collaborate with ATMA to boost horticultural development through following activities. Joint Training and Demonstrations: Focus on advanced horticultural techniques to increase productivity and sustainability.

Exposure Visits: Organize visits to innovative horticulture projects to facilitate knowledge exchange.

Events and Materials: Utilize ATMA's platforms like Kisan Melas and produce targeted leaflets to highlight horticultural advances and opportunities.

Validation of Practices: Conduct on-farm trials to demonstrate the practical benefits of new technologies in horticulture.

Use ATMA's Infrastructure: Leverage FIACs and BTTs for effective delivery of horticultural programs.

Engagement with FACs: Ensure that horticultural initiatives are aligned with farmer needs and priorities. This concise approach leverages ATMA's network and structures for targeted support and dissemination in horticulture, ensuring effective technology transfer and sustainable agricultural development.

### **3.2.3 Haryana Agricultural Management & Extension Training Institute (HAMETI)**

The Haryana Agricultural Management & Extension Training Institute (HAMETI) is registered as an autonomous institute with the mandate of capacity building of extension functionaries for promoting agricultural development. It conducts courses on participatory extension management, project management, watershed management, human resources management and information technology. It also provides consultancy in agricultural extension management. It provides facilities for conducting training, having well-equipped training halls with a conference system and multimedia projection facility.

#### **(1) Mandate of HAMETI**

The main mandates of HAMETI are as follows<sup>8</sup>:

- i) To function as state level institute to provide extension management input for extension functionaries.
- ii) To organize need based training programmes for middle level and grass root level agriculture and allied subject extension functionaries.
- iii) To develop and promote the application of management tools for improving the effectiveness of agricultural extension services through better management of human and material resources.
- iv) To publish literature and conduct studies on agriculture management, communication, participatory methodologies, etc. as sequel to the feedback from training programmes.
- v) To provide consultancy in areas like project planning, appraisal, implementation etc.

#### **(2) Areas of Training**

The mandate of HAMETI is to promote the extension and management tools for improving efficiency in extension services.

The training emphasis is laid on the following aspects:

- i) Integrated Nutrient Management
- ii) Agro-ecological Situation
- iii) Role / Function of Micro-Nutrients in Plants
- iv) Available forms of different plant nutrients and related fertilizers

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<sup>8</sup> Mandate – SAMETI Haryana

- v) Inorganic Fertilizer
- vi) Soil fertility and Soil Health
- vii) Different sources of Organic Manure
- viii) Soil / Water Testing, Soil / Water Sampling techniques
- ix) Role of crop rotation
- x) Recommended dose of fertilizer
- xi) Fertilizer Control Act-1985
- xii) Communication skills and Innovative extension tools including ICTs to reach out to farmers
- xiii) Human Resource Management
- xiv) Farming System Approach
- xv) Public Private Partnership and Farmer-led Extension
- xvi) Market-led Extension and Marketing Management

### (3) Training in HAMETI

Training programmes that were conducted at HAMETI in the fiscal year of 2019-20 are shown in the following table.

**Table 3.2.7 Training Progress at HAMETI in 2019-2020 I. HAMETI Sponsored Training**

Sr. No.	Title of Course	Category of Participants	No. of Participants	Scheme
1	Training of field Staff on Bio-fortification	ATMs/BTMs/SAs/ADOs/ BAOs/SDAOs Distt. Jind	60	RKVY (Raftaar)
2	Contact classes for PGDAEM, (1st semester)	ADOs/BAOs/ATMs/ BTMs /SAs /VS of Haryana	27	ATMA
3	Within State Farmers Training	Farmers of Distt. Kurukshetra	26	ATMA
4	21 Days Refresher Training Course on cotton cultivation	ATMs/BTMs/SAs/ADOs/BAOs/SDAOs of Agri. & FW Dept. Haryana.	30	New State Plan Scheme on Cotton
5	21 Days Refresher Training Course on cotton cultivation	ATMs/BTMs/ SAs /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana	20	New State Plan Scheme on Cotton
6	Significance of Saral Portal and its mode of operation	ADO/BAO, SMS, Haryana sta	35	-
7	Plant protection measures in the Kharif crops	ADO(PP) of Haryana stat	35	-
8	PGDAEM Examination, (1st Semester)	ADOs/BAOs/ATMs/ BTMs/VS of Haryana	27	ATMA
9	21 Days Refresher Training Course.	ATMs/BTMs/ SAs /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana.	30	New State Plan Scheme on Cotton
10	Two days of Training on Oilseed/Pulses	ATMs/BTMs/ SAs /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana	20	NFSM
11	Two days of Training on Oilseed/Pulses.	ATMs/BTMs/ SAs 20 04.09.2019 Two days Training on NFSM 2 /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana	20	NFSM
12	Two days of Training on Oilseed/Pulses	ATMs/BTMs/ SAs /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana	20	NFSM
13	Two days of Training on Oilseed/Pulses.	ATMs/BTMs/ SAs /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana	20	NFSM
14	Two days of Training on Oilseed/Pulses.	ATMs/BTMs/ SAs /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana	20	NFSM
15	Two days of Training on Oilseed/Pulses.	ATMs/BTMs/ SAs /ADOs/ BAOs/ SDAOs of Agri. & FW Dept. Haryana.	20	NFSM
16	Two days of Training on Oilseed/Pulses.	ATMs/BTMs/ SAs /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana	20	NFSM

Sr. No.	Title of Course	Category of Participants	No. of Participants	Scheme
17	Contact Classes for PGDAEM Diploma 2nd Semester.	ATMs/BTMs/ SAs /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana	27	CRM
18	21 Days Refresher Training course on Cotton Cultivation.	ATMs/BTMs/ SAs /ADOs/ BAOs/SDAOs of Agri. & FW Dept. Haryana	30	New State Plan Scheme on Cotton
19	Training of farmers for crop residue management and prevention of stubble burning	Farmers of Distt. Jind, Kaithal and Panipat	150	CRM / ATMA

Source: HAMETI, March 2023

#### (4) Infrastructure Facilities of HAMETI

- i) A fully air-conditioned auditorium with 170 seating capacity equipped with latest audio-visual aids.
- ii) A newly constructed conference hall with 50 seating capacity equipped with digital podium and audio-visual aids.
- iii) An air-conditioned classroom with 30 seating capacity having latest audio-visual aids.
- iv) An information technology lab having computers each with modern configuration.
- v) A library with 1200 Plus Books.
- vi) Trainees hostel & boarding with well-furnished 32 rooms.

#### (5) Linking with the project

The project can work with HAMETI in the following areas.

**Capacity building:** HAMETI will strengthen horticultural practices by training technical support groups and horticultural extension services in the latest agricultural technologies and directly support the dissemination and adoption of innovative horticultural practices.

**Needs-based training:** HAMETI can provide key training programmes such as soil health, nutrient management and micronutrient use that are critical to the success of horticultural crops.

**Improved efficiency:** HAMETI can facilitate the use of management tools and innovative extension tools, including ICT.

**Infrastructure support:** HAMETI's advanced training facilities, including well-equipped classrooms and IT labs, provide an ideal environment for quality horticultural training and facilitate better learning and adoption of sustainable practices.

### 3.2.4 Haryana State Agriculture Marketing Board (HSAMB)

#### (1) Vision and Mission

The vision of the Haryana State Agriculture Marketing Board (HSAMB) is to provide opportunities for increasing net incomes in the agriculture sector and creating a prosperous, progressive and proud farmer by setting up efficient and knowledge-based marketing systems and services.

Further, a mission for setting up efficient marketing services, the following points are indicated.

- i) Integrate and professionalise delivery of agricultural services and get better value for the farmer's produce
- ii) Facilitate diversification of crops and promote judicious and profitable use of land resources
- iii) Introduce knowledge and technology-based interventions
- iv) The enforcement of Acts, Rules, and By-laws
- v) Improve skill sets and awareness of the farmers
- vi) Develop quality control and standards in agriculture sector

#### (2) Organization Structure and Existing Facilities

The board has been continuously endeavouring to improve upon the marketing system in the state. New markets are being developed to replace the old existing markets and better facilities are continued to be provided in the existing markets so that sale and purchase of agricultural produce may take

place in smoothly in the markets. In all reality, the Punjab Agricultural Produce Markets Act, 1961, laid the foundation for a state-wide agricultural marketing infrastructure with the roles, responsibilities and scopes of various entities pre-defined and well regulated. HSAMB implements these administrative and infrastructural arrangements through the various Market Committees (MCs).

There are in total 107 Market Committees all over Haryana, with 107 principal market yards (Mandis) and 174 of sub-yards and 195 purchase centres, 33 Fruit & vegetable mandis, 25 Fodder mandis and 107 Grain Markets. The MCs have been provided with all required infrastructural facilities such as:

- i) Agri business information centre
- ii) Common auction platforms
- iii) Shops & booths
- iv) Weigh bridge
- v) Food storage godowns
- vi) Kisan rest house
- vii) Parking place
- viii) Firefighting station
- ix) Drinking water facilities
- x) Sulabh sauchalya
- xi) Provision of site for post office & banks.
- xii) Canteen
- xiii) Provision for water supply and sewerage system.
- xiv) Provision for petrol/diesel pump

### (3) Marketing in Major Wholesale Markets surrounding Haryana

The following four wholesale markets were referred to confirm the current situation in the handling of major vegetables.

- i) Azadpur wholesale market in Delhi
- ii) Chandigarh wholesale market in Chandigarh
- iii) Ambala city wholesale market in Haryana
- iv) Ludhiana wholesale market in Punjab

#### (a) Arrival Quantity of Major Vegetables

The total arrival quantity of major vegetables in 2014 is summarized as follows:

**Table 3.2.8 Total Arrival Quantity of Major Vegetables by Major APMCs in 2014**

(Unit: ton)

Major Vegetables	Wholesale Market			
	Azadpur*1	Chandigarh	Ambala City	Ludhiana
Tomato	181,014	12,499	1,748	31,894
Onion	355,742	31,634	7,034	85,869
Cauliflower	66,452	4,702	1,166	10,261
Peas	41,024	6,186	944	9,742
Cabbage	54,680	5,519	428	5,886
Beans	16,798	1,311		726
Potato	428,721	28,629	6,762	80,621
Chili	122,487	2,239	444	6,150
Garlic	45,773	848	97	2,510
Capsicum	37,857	1,918	220	2,129
Radish	21,447	1,863	436	9,126
Brinjal	28,399	2,575	335	5,135
Cucumber	86,305	2,190		5,634
Okra	62,488	792	200	1,147
Ginger	105,126	1,332	-	3,313

Note: \*1 Azadpur: April 2104 to March 2015

Source : JICA TCP Phase II Project for Crop Diversification in Himachal Pradesh, 2015



**(b) Competing Marketing Sources for Major Vegetables**

Regarding competing marketing sources for major vegetables, APMC Azadpur has arrival records by state available, while other APMCs have no records by state. Through interviews with 3 APMCs, competing marketing source for major vegetables were confirmed as shown below.

**Table 3.2.9 Prioritized Competing Marketing Sources for Major Vegetables by Wholesale Markets**

Major Vegetables	Wholesale Market		
	Azadpur	Chandigarh	Ludhiana
Tomato	Madhya Pradesh 26% Gujarat 15% <b>Harvana 14%</b>	Himachal Pradesh 35% Gujarat 25% Maharashtra 20%	Punjab 40% Maharashtra 18% Himachal Pradesh 18%
Onion	Rajasthan 46% Maharashtra 24% Madhya Pradesh 11%	Maharashtra 35% Punjab 30% Rajasthan 15%	Maharashtra 48% Gujarat 30% Rajasthan 20%
Cauliflower	<b>Harvana 40%</b> Himachal Pradesh 23% Rajasthan 12%	Punjab 70% Himachal Pradesh 30%	Punjab 85% Himachal Pradesh 15%
Peas	Punjab 26% Himachal Pradesh 23% Rajasthan 22%	Punjab 50% Himachal Pradesh 25% Uttar Pradesh 25%	Punjab 30% Himachal Pradesh 28% Uttarakhand 14%
Cabbage	Uttar Pradesh 65% Himachal Pradesh 12% Karnataka 11%	Punjab 50% Himachal Pradesh 30% Uttar Pradesh 20%	Punjab 90% Himachal Pradesh 7% Karnataka 3%
Beans	Himachal Pradesh 32% West Bengal 29% Uttar Pradesh 24%	Uttar Pradesh 40% Himachal Pradesh 30% Delhi 30%	Himachal Pradesh 63% West Bengal 27% Punjab 10%
Potato	Uttar Pradesh 65% Punjab 28% Himachal Pradesh 2%	Punjab 80% Himachal Pradesh 15% Uttar Pradesh 5%	Punjab 80% Himachal Pradesh 20%
Chili	Uttar Pradesh 37% Maharashtra 34% West Bengal 11%	Punjab 40% Himachal Pradesh 30%	Punjab 50% West Bengal 20% Uttar Pradesh 20%
Garlic	Rajasthan 40% Madhya Pradesh 34% Uttar Pradesh 17%	<b>Harvana 50%</b> Himachal Pradesh 25% Uttar Pradesh 10%	Punjab 60% Madhya Pradesh 28% Rajasthan 12%
Capsicum	Maharashtra 25% Chhattisgarh 25% Uttar Pradesh 19%	Himachal Pradesh 40% Uttar Pradesh 30%	Punjab 50% Himachal Pradesh 15% Maharashtra 10% Madhya Pradesh 10% Uttar Pradesh 10%
Radish	Delhi 53% <b>Harvana 38%</b> Uttar Pradesh 10%	Punjab 90% Himachal Pradesh 5% Uttar Pradesh 5%	Punjab 90% Himachal Pradesh 10%
Brinjal	Uttar Pradesh 37% Gujarat 23% Rajasthan 20%	Punjab 30% Uttar Pradesh 30%	Punjab 90% Uttar Pradesh 10%
Cucumber	Uttar Pradesh 32% West Bengal 22% <b>Harvana 18%</b>	Punjab 60% Himachal Pradesh 25% Uttar Pradesh 15%	Punjab 90% Himachal Pradesh 10%
Okra	Gujarat 45% <b>Harvana 42%</b> Uttar Pradesh 5%	Punjab 60% Uttar Pradesh 20%	Punjab 80% Gujarat 16% West Bengal 4%
Ginger	Karnataka 92% West Bengal 5% Assam 2%	Assam 60% Himachal Pradesh 20%	Assam 35% West Bengal 25% Uttar Khand 20%

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*Note: %: Proportion of dealing amount in each wholesale market*

*Source: JICA TCP Phase II Project for Crop Diversification in Himachal Pradesh, 2015*

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#### **(4) Linking with the project**

The project can be managed effectively by working with the Haryana State Agricultural Marketing Board (HSAMB). The ways in which this can be done are as follows.

**Knowledge and technology transfer:** Leverage HSAMB's objective of introducing knowledge and technology based interventions by disseminating advanced horticultural production practices and innovations through the HSAMB network.

**1. Branding:** to contribute to the development and promotion of quality control and standards specific to horticultural crops in order to increase market competitiveness and consumer confidence.

**Leverage infrastructure:** utilise HSAMB's extensive network of market committees, main market yards, sub-yards and buying centres to promote and market horticultural crops.

**Information and marketing services:** form a platform linked to HSAMB's Agribusiness Information Centres to provide farmers with critical market information and better marketing tools to effectively market horticultural crops.

**Capacity building:** organise training, workshops and demonstrations on horticultural practices, post-harvest management and marketing strategies using HSAMB facilities (e.g. Kisan Rest House).

**Market analysis and strategy formulation:** analysing data from key wholesale markets (Azadpur, Chandigarh, Ambala City, Ludhiana, etc.) to understand the demand and supply dynamics of key vegetables and formulate targeted marketing strategies for horticultural crops.

#### **3.2.5 Agricultural, Horticultural Education, Research, and Training**

The agriculture universities and agricultural and horticultural research and training institutes, which are involved in agricultural and horticultural research, education, and extension in Haryana state, are mentioned below.

- Agricultural Universities:
- Chaudhary Charan Singh Haryana Agricultural University, Hisar
- Maharana Pratap Horticultural University, Karnal

A brief description on the mandate and their involvement in the agricultural, horticultural research, education and extension activities are given below

##### **1) Haryana Agricultural University (HAU Hisar)**

The university was established in February 1970 as a result of bifurcation of the erstwhile Punjab Agricultural University. From 31<sup>st</sup> October 1991, it has been renamed as Chaudhary Charan Singh Haryana Agricultural University after the fifth Prime Minister of India.

The university is spread over an area of 2921.43 ha (7219 Acres) at Hisar and 577.08 ha (1426 Acres) at outstations. The area at Hisar under farms is 2623.58 ha (6483 Acres) and under buildings and roads is 297.85 ha (736 Acres). It has one of the best developed campuses in India to meet academic and extra-curricular needs of the students. (detail explanation is shown in attachment 3.2.4) 1

In the realm of teaching at HAU Hisar, there are several esteemed colleges encompassing areas like Agricultural Engineering, Agriculture, Fisheries Sciences, Basic Sciences & Humanities, and Home Science, offering a diverse array of courses from B.Sc. to Ph.D throughout the year. Additionally, the university maintains seven research stations spread out in different locations. Their longstanding collaboration since 2001 with the Haryana Seed Development Corporation has bolstered their capabilities, evident in their seed processing plant and the release of 265 crop varieties/hybrids spanning 56 crops as of March 2021. The technology transfer will be carried out jointly with Krishi Vigyan Kendras.

Krishi Vigyan Kendras (KVKs) are a community-based agricultural training center that works closely with agricultural universities and research institutions. KVK.a pioneering initiative in India designed to bridge the gap between agricultural research and its application at the grassroots level. With a vision to enhance agricultural productivity and livelihoods, KVKs' mission centers around on-site testing and

adapting agricultural techniques, imparting training to farmers, and promoting innovative practices. Their activities span a wide range, from soil testing and farm advisory to organizing demonstrations and conducting vocational training for rural youth.

## 2) Maharana Pratap Horticulture University, Karnal

On 28 November 2016, the university came into existence via a legislative act of Haryana Vidhan Sabha. On 18 April 2017, Chief Minister Manohar Lal Khattar's administration renamed it after the Maharana Pratap, a king of Mewar from the Sisodia dynasty.

The Mandate of the University is to be a centre of excellence in the teaching, research and extension education in the field of horticulture and allied sectors for food and ecological security, improved livelihood opportunities and economic prosperity of farming communities. The university aims to develop diversified sustainable farming systems for improving productivity and profitability in horticulture and to train the farmers and extension functionaries for the effective dissemination of advanced horticultural technologies in Haryana and its neighboring states.

Main campus is in Anjanthali village in Nilokheri tehsil of Karnal after 97 acres land of HAU's Regional Research Station was transferred to the Horticulture University. The university has "Regional Research Centres" at Ambala, Jind, Jhajjar, Sonipat, Bhiwani and Karnal. (detail explanation is shown in attachment 3.2.5)

### 3.2.6 Agricultural, Horticultural Research and Training Institute

In terms of research and training, there are many institutes in Haryana. The following are the items picked-up from them.

Agricultural and Horticultural Research and Training Institutes:

i) ICAR-Central Soil Salinity Research Institute, Karnal

Central Soil Salinity Research Institute (CSSRI) is a premier research institute dedicated to pursuing interdisciplinary research on salinity/ alkalinity management and use of poor-quality irrigation waters in different agro-ecological zones of the country. The Institute started functioning at Hisar (Haryana) on 1<sup>st</sup> March 1969. Later, it was decided to shift this Institute to Karnal in October 1969. It is also doing breeding efforts in rice got impetus with the identification, selection, and introgression of salt tolerance from land races.<sup>9</sup>

ii) ICAR-Indian Institute of Wheat and Barley Research, Karnal

The wheat research started in an organized manner more than hundred years ago during the British period after joining of Sir Howards as the Imperial Botanist at Pusa (Bihar) in 1905. The Directorate of Wheat Research in 1978 and in 1990 it moved from IARI, New Delhi, to its present location at Karnal. In 2014, it became an institute, ICAR-Indian Institute of Wheat and Barley Research. By doing so, the ICAR formalized the establishment of a distinct institutional identity for the second most important cereal crop of the country. In their research, major focus is on crop improvement, crop protection, quality improvement, resource management, social sciences, and barley network.<sup>10</sup>

iii) Central Fertilizer Quality Control & Training Institute, Faridabad

In pursuance of the recommendations of the Fertilizer Distribution Committee (Patel Committee, 1960), Sivaraman Committee (1965) and Estimates Committee of Lok Sabha (1967-68) to provide a lead to the State Quality Control Laboratories and to deal with the matters related to fertilizer quality control, the erstwhile Central Fertilizer Control Laboratory was set up as a sub ordinate office of Ministry of Agriculture & Farmers Welfare, Department of Agriculture and Farmers Welfare in the end of 4<sup>th</sup> Five Year Plan (1971-72) to undertake inspection and analysis of indigenous and imported fertilizers, standardization of methods of analysis and providing technical guidance to the State Govts. Objectives are drawal, inspection and analysis of both indigenous and imported fertilizers; Training of State fertilizer inspectors

<sup>9</sup> Source: <http://www.icar-iirr.org/AICRIP/Centres/Karnal.pdf>

<sup>10</sup> Source: <https://iiwbr.icar.gov.in/>

and fertilizer analysts; Standardization/Development of methods of analysis of fertilizers; Acting as a referee laboratory and advisory body on matters related to FCO; Preparation of technical literature in the field of fertilizer quality control; Other task assigned by the Ministry from time to time.<sup>11</sup>

iv) National Horticulture Board, Gurugram

The National Horticulture Board (NHB) was set up by the Government of India in 1984 as an autonomous organization under the administrative control of the Ministry of Agriculture and Farmers Welfare and registered as a society under Societies Registration Act with its headquarters at Gurugram. Presently, NHB has 29 field offices located all over the country. The broad aims and objectives of the Board are to develop production clusters/hubs for integrated Hi-tech commercial horticulture, development of post-harvest and cold chain infrastructure, ensure the availability of quality planting material, and to promote the adoption of new technologies/tools/ techniques for hi-tech commercial horticulture etc.<sup>12</sup>

v) Central Insecticide Board & Registration, Faridabad

Directorate of Plant Protection Quarantine & Storage was established in the year 1946 on the recommendation of woodhead commission as an apex organization for advising the Government of India and state Governments on all the matter related to Plant Protection. The Directorate is headed by a Plant Protection adviser. Plant Protection strategy and activities have significant importance in the overall crop production programmes for sustainable agriculture. Plant protection activities encompass activities aimed to minimize crop losses due to pests through integrated pest management, plant quarantine, regulation of pesticides, locust warning & control and training in desert areas besides training and capacity building in plant protection.<sup>13</sup>

vi) HAMETI (SAMETI Haryana) (State Agricultural Management and Extension Training Institute)

HAMETI is under the Department of Agriculture and Farmers' Welfare, Panchkula, Haryana. HAMETI is working to improve the effectiveness of agricultural extension services through better management of human and material resources. HAMETI was established in the year 2006. HAMETI conducts various activities like lectures, exposure visits, field visits, group discussions, hands on activities, project planning, appraisal, implementation, etc. Institute provides capacity building support in extension management related areas to the extension functionaries from public, private, and non-Governmental sectors.

Director HAMETI works under the overall guidance of the state nodal officer identified under Agricultural Technology Management Agency (ATMA)

vii) ATMA

ATMA scheme was launched during 2005-06. It aims at making extension system farmer driven and farmer accountable by way of new institutional arrangements for technology dissemination in the form of an Agricultural Technology Management Agency (ATMA) at district level to operationalize the extension reforms. ATMA has active participation of farmers/farmer-groups, NGOs, Krishi Vigyan Kendra (KVKs), Panchayati Raj Institutions and other stakeholders operating at district level and below. The release of funds under ATMA scheme is based on State Extension Work Plans (SEWPs) prepared by the State Governments. Allocation of resources for activities related to extension is linked to the number of farm households and blocks.

The scheme Is implemented through the institutional mechanisms set up at the state, district, block, and village levels.

viii) ICAR-Indian Agricultural Research Institute Regional Station, Karnal

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11 Source: <https://cfqcti.dacnet.nic.in/aboutus07.html>

12 Source: <https://nhb.gov.in/>

13 Source: <https://ppqs.gov.in/divisions/central-insecticides-board-registration-committee>

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The journey of Indian Agricultural Research Institute (IARI), popularly known as Pusa Institute, began in 1905 at Pusa (Bihar) with the generous grant of 30,000 pounds from an American philanthropist, Mr. Henry Phipps. The institute was then known as the Agricultural Research Institute (ARI) which functioned with five departments, namely Agriculture, Cattle Breeding, Chemistry, Economic Botany and Mycology. Bacteriology unit was added in 1907. The name of ARI was changed to the Imperial Institute of Agricultural Research in 1911 and, in 1919 it was renamed as Imperial Agricultural Research Institute. Following a devastating earthquake on 15th January 1934, the institute was shifted to Delhi on 29th July 1936. Post-independence, the institute has been renamed as Indian Agricultural Research Institute (IARI). IARI provides leadership for “Science-led sustainable and globally competitive agriculture for food, nutrition and livelihood security”.

ix) Extension Education Institute, Nilokheri

The Department of Agriculture and Cooperation, Ministry of Agriculture and Farmer’s Welfare, Govt. of India has established four EEIs for four regions of the country: EEI (Northern Region) at Nilokheri, Haryana (1959). The Extension Education Institute, Nilokheri was established in 1959 as the first training institute of its kind in the country during the second five-year plan period. The institute’s main mandate is to provide in-service training to middle-level extension functionaries. It is one of the pioneer and premier extension training institutes of the country which carries the responsibility of organizing training courses for the various departments including Agriculture, Horticulture, Animal Husbandry & Dairy, Forestry, Fisheries, Sericulture, Watershed management, Rural development, and master trainers of SAMETIs of the northern states of India viz. Haryana, Punjab, Delhi, Himachal Pradesh, Uttarakhand, Bihar, Jharkhand, Uttar Pradesh, and Union Territories of J&K and Ladakh. In the year 1991, its administrative control was handed over to CCS Haryana Agricultural University, Hisar and since then it functions under the administrative control of CCS HAU, Hisar on the basis of a memorandum of understanding between DAC, MoA, GOI, New Delhi, and EEI, Nilokheri.<sup>14</sup>

x) Northern Region Farm Machinery Training and Testing Institute, Hissar

Northern region farm machinery training & testing institute is a public funded agricultural and farm training and testing institute located at Sirsa road, Hisar in the state of Haryana. It is one of the four such institutes established by the Government of India’s Ministry of Agriculture & Farmers Welfare. The institute is catering scheduled training programs as per ‘SMAM’ guidelines for the benefit of farmers & working woman farmers, academic level, NGO’s: Need based, encouraging entrepreneurs, their skill development. These guidelines are re-affirmed from time to time. This institute is making a significant contribution to meet the requirement of the trained personnel in selection, use and management aspects of farm machinery.<sup>15</sup>

xi) Horticulture Training Institute, Karnal

Horticulture Department deals with the production and maintenance of fruits, vegetables, and flowers, spices mushrooms, medicinal and aromatic plants. The cultivation of horticulture crops is highly specialized, technical and remunerative venture as compared to traditional crops being grown by the farmers. Apart from this, majority of Horticulture crops, being perishable in nature, requires systematic planning for their development. Horticulture development has assumed greater importance in recent years since this sector has been identified as remunerative for diversification of land use which provides increased employment opportunities, and better return per unit area besides filling the nutritional gaps. Farmers in Haryana have also started taking up horticulture crops as a separate viable economic activity. With a view to give a boost to the growth of horticulture in the state, Haryana Government created a separate Department of Horticulture in 1990-91, which was previously a part of Agriculture Department, Haryana.

14 Source: <https://www.eeinilokheri.ac.in/>

15 Source: <http://nrfmmtti.gov.in/>

Vision and Objectives: Keeping in view the emerging challenges in the field of horticulture and to provide nutritional security to the masses the department with a vision “to make Haryana modern fruit and vegetable cultivation State with a vision to lead in domestic and export market” has earmarked the following objectives: Diversification from agriculture to horticulture. Doubling of horticulture production in 11<sup>th</sup>.<sup>16</sup>

xii) Centre of Excellence for Vegetables in Karnal

Centre of Excellence for Vegetables in Gharaunda in Karnal district is the first Indo-Israel agricultural project in the country. With this facility, scientists from Israel brought the technology of protected cultivation to Haryana. Currently, there are 26 such Indo-Israel centres in the country. The objectives of the CEV in Gharaunda are to demonstrate the protected cultivation technology of high-value vegetables for farmers to see the result for themselves and be motivated to try the latest technologies available. Among these said latest technologies is micro-irrigation with different systems installed to produce high-quality, disease-free, healthy seedlings in the soil. The project’s vision also includes demonstrating the technical know-how and training the farmers to boost crop productivity and, ultimately, the farmer’s income. Protected cultivation enables high-quality vegetables like cherry tomatoes, Cucumber, brinjal, chili, colored capsicum, green capsicums and so on to be grown round the year. They are cultivated in high-tech polyhouses, naturally ventilated polyhouses, walk-in tunnels with controlled climate and provisions for micro irrigation along with drip Irrigation for unseasonal crop cultivation and high yield. The centre has selected 100 farmers from 20 villages under the village of excellence scheme from three districts of Haryana viz. Karnal, Panipat, and Sonipat.

xiii) Excellence for Flower Cultivation and Seed Production Technology, Munimpur

A Centre of Excellence for Flowers is being set up with the assistance of the Netherlands in district Jhajjar of Haryana to encourage the farmers to take up floriculture. Haryana agriculture minister OP Dhankar said the state Government was taking effective steps to double the income of farmers. The minister was speaking at the concluding session of the Haryana International Trade Expo organized jointly by PHD Chamber of Commerce and Industry and the Haryana State Industrial and Infrastructure Development Corporation (HSIIDC) in Faridabad on March 28, 2017.

They are being motivated by promoting horticulture and floriculture. He said that the state Government had set a target to increase the area under cultivation of vegetables, fruits and flowers from the existing 12 lakh acres to 22 lakh acres. As many as 340 villages are being developed as horticultural villages at a cost of Rs 517 crore and Centres of Excellence are being opened in every district to encourage the farmers. The farmers can more than double their income by cultivating vegetables, fruits and flowers to meet the requirements of four crore people living in the National Capital Region, which has a turnover of Rs 100 crore per day. Apart from this, agriculture offers abundant possibilities associated with the industrial sector, which could be utilized by the farmers to sell their products abroad.

Urging the farmers and entrepreneurs to cooperate and help each other for better opportunities, the minister also shared his contact information with them so that they might avail the benefits of various schemes being implemented by the state Government for their welfare.<sup>17</sup>

xiv) Centre of Excellence for Semi-Arid Horticulture, Gignow

According to a statement, the Israeli ambassador said both India and Israel will work together in the field of advanced agricultural resources, agricultural research, and training. Ambassador of Israel to India, Dr Ron Malka, on Wednesday, laid the foundation stone of the fifth Indo-Israel Centre of Excellence in Horticulture at Gignow village in Bhiwani, which will be set up at a cost of around ₹8.25 crore. According to a statement, the Israeli ambassador said both

<sup>16</sup> Source: <https://hortharyana.gov.in/en/about-us>

<sup>17</sup> Source: <https://economictimes.indiatimes.com/news/economy/agriculture/haryana-Government-to-set-up-centre-for-flowers-in-jhajjar-to-promote-floriculture/articleshow/57875544.cms?from=mdr>

India and Israel will work together in the field of advanced agricultural resources, agricultural research, and training.

Haryana agriculture minister J.P. Dalal said this Centre of Excellence for Horticulture will be built on 50 acres in the next six months. “Keeping in view the increasing holdings and expenditure on agriculture, the Government has decided to establish this Centre in this semi-arid region to double the income of farmers,” he said.

Dalal said with the establishment of this Centre, farmers of the Loharu assembly constituency will be encouraged to adopt cultivation of fruits, flowers, and vegetables. He said agricultural scientists from Israel and Haryana Agricultural University will regularly give their services at the Centre.

Haryana already has four Centres of Excellence under Indo Israel collaboration. They are Centre of Excellence for Vegetables, Gharaunda (Karnal), Centre of Excellence for Fruits, Mangiana (Sirsa), Centre for Sub Tropical Fruits, Ladwa (Kurukshetra) and Integrated Beekeeping Development Centre, Ramnagar (Kurukshetra).

The 30th Indo-Israel Centre of Excellence was inaugurated in Haryana on 22nd January 2023. This coincides beautifully with the completion of 30 years of full diplomatic relations between the two countries. This centre, established as part of the Indo-Israel Agricultural Project, is dedicated to semi-arid horticultural crops. Israel, which is famous for “making the desert bloom,” is a pioneer in developing sustainable technologies and solutions for all agricultural sectors. For many decades, Israel has successfully overcome harsh climatic conditions and knows how to maximize resources in an arid environment.

30 COEs established with coordination between the Government of India, state Governments, and MASHAV – (Israel’s Agency for International Development Cooperation at Israel’s Ministry of Foreign Affairs), these centres provide a suitable platform for a rapid transfer of technology to Indian farmers. New agricultural technologies such as protected cultivation, drip irrigation and fertigation are demonstrated here. The methods and technologies are adapted to the local conditions and requirements of the Indian farmers, with the intent of significantly increasing their income.

Every year, the centres produce more than 40 million premium-quality vegetable seedlings, over 500 thousand high-quality fruit plants, and train more than 120 thousand Indian farmers. MASHAV also brings many Israeli experts to India and trains the trainers of these centres throughout the year. Similarly, Indian agricultural officers heading these centres receive training in Israel. For example, over 60 Indian Government officials visited Israel to receive training last year.

xv) Integrated Bee Keeping Development Centre (Indo-Israel Agriculture Project)

The Integrated Beekeeping Development Centre (IBDC), Ram Nagar, Kurukshetra is a joint exercise of Haryana Govt., MASHAV, and Centre for International Agricultural Development Cooperation of Israel’s Ministry of Agriculture and Rural Development (CINADCO) with the assistance of professional and technical experts from India and Israel.

This Centre for honeybees has been well furnished with infrastructure facilities for beekeepers and farmers training programme as well as with technological managements of beehives, pest and disease, multiplication of queens and role of honeybees in the pollination of Agricultural and Horticultural crops. The Centre is also promoting automatic processing of honey, quality control, value addition of honey, manufacturing of quality beehives and comb foundation sheet for the benefit of beekeepers in the state. The Centre was established in 2017-18 by the Department of Horticulture, Govt. of Haryana with funding from the Govt. of India. The Centre organizes the 01-, 03-, 04- & 45-days training programme on “Scientific Beekeeping”.

xvi) International Centre of Excellence in Food Safety and Quality, Sonipat

The COE in Food Safety and Quality, Sonipat aims to undertake projects that offer solutions to the food industry and conduct analytical studies to develop new processes and products while improving existing ones. The centre also studies to extend product shelf life, fortify food, and ensure the stability of such fortified foods. It focuses on the development of nutraceuticals,

functional foods, and new analytical methods, including their validation. The centre is dedicated to developing and characterizing new packaging materials while studying food-packaging interactions and compatibility. Additionally, it conducts training programs for skill enhancement, serves as the Centre for CODEX<sup>18</sup> and provides support to FSSAI. The Centre ensures food quality and safety by offering an accredited state-of-the-art food testing laboratory to the industry.

National Institute of Food Technology Entrepreneurship and Management (NIFTEM) is in the process of setting up an International Centre of Excellence in Food Safety and Quality. In the present era of globalization and global food trade, it is essential to address the present issues of food safety & quality and to enable and facilitate our agri-produce and the processed food products. In this regard, NIFTEM is in the process of setting up an International Centre of Excellence in Food Safety and Quality.

The collaboration between the agencies and the proposed project is described in 6.6 Convergence.

### 3.2.7 Farmers' Organizations

In Haryana, various organizations have been formed among farmers such as cooperative societies, farmer producer organizations (FPOs)<sup>19</sup>, self-help groups (SHGs), joint liability groups (JLGs), etc. Different Government departments/agencies and NGOs have promoted forming and capacity development of these farmers' organizations under certain Government schemes and programmes.

#### i) Primary Agriculture Cooperative Societies (PACS)

Different primary and state level cooperative societies are registered in Haryana as per the provision of the Haryana Co-operative Societies Act, 1984. Haryana Cooperative Department is in charge of their registration and performing various statutory, quasi-judicial and administrative functions. Primary Agriculture Cooperative Society (PACS) usually consists of 10 mini cooperative banks covering total of 10 to 15 villages. Its District-wise numbers in 2020-21 are shown in the below table. PACS provides agricultural inputs (seeds, fertilizers, pesticides, etc.) with subsidized rates and short-term credits to member farmers, and long-term loans to progressive farmers (cash and in kind). PACS recently have new functions of collecting bills for public utilities (e.g., electricity, etc.) and distributing old-age pensions.

**Table 3.2.10 Primary Agricultural Cooperative Societies in Haryana**

Sr. No	District	Number of PACS	Number of Membership
1	Ambala	56	160,000
2	Bhiwani	54	263,082
3	Charkhi Dadri	*	*
4	Faridabad	30	156,158
5	Fatehabad	31	133,000
6	Gurugram	33	167,400
7	Hisar	47	245,487
8	Jhajjar	23	155,000
9	Jind	31	202,000
10	Kaithal	37	185,000
11	Karnal	87	218,000
12	Kurukshetra	71	139,000
13	Mahendragarh	23	131,284
14	Nuh	*	*
15	Palwal	*	*
16	Panchkula	11	50,000
17	Panipat	35	106,000
18	Rewari	26	126,998
19	Rohtak	22	127,000
20	Sirsa	36	131,696

<sup>18</sup> CODEX Standards (Joint FAO/WHO Codex Alimentarius Commission, CAC)

<sup>19</sup> FPO is a generic name, which means and includes farmer producers' organization incorporated/registered either under Part IXA of Companies Act or under State Co-operative Societies Act. FPO registered under Companies Act is called FPC (Farmer Producer Company).



Sr. No	District	Number of PACS	Number of Membership
21	Sonipat	34	173,870
22	Yamuna Nagar	43	142,000
Total		730	3,012,975

Note: Figures of Charkhi Dadri, Palwal and Nuh are included in Bhiwani, Faridabad and Gurugram, respectively. Gender-wise numbers of membership are not available.

Source: Statistical Abstract of Haryana 2020-21, Department of Economic and Statistical Analysis, Haryana.

ii) National Policy and Schemes to Promote Farmer Producer Organizations (FPOs)

Department of Agriculture, Cooperation & Farmers' Welfare (DAC&FW), Ministry of Agriculture & Farmers' Welfare (MoA&FW) launched a pilot programme for promoting PG(FPO)s in 2011-12 under two-schemes of the Rashtriya Krishi Vikas Yojana (RKVY), namely the national vegetable initiative for urban clusters and the programme for pulses development for 60,000 rain-fed villages. The purpose of promoting PGs is to collectivize farmers, especially small producers, to facilitate technology dissemination, improve productivity, enable improved access to inputs, services (e.g., financial ones, etc.) and facilities (e.g., storages, etc.), thus, to increase farmer incomes and strengthen their sustainable agriculture-based livelihoods. These attempts resulted in mobilizing 300,000 farmers into village-level Farmer Interest Groups (FIGs), which were being federated into registered PGs. In February 2020, MoA&FW announced the central sector scheme for "Formation and Promotion of 10,000 FPOs (2019/20 - 2023/24)" for providing support for up to five years. Its operational guidelines were published in July 2020. The salient features of this initiative are summarized in the below table.

**Table 3.2.11 Features of Formation and Promotion of 10,000 FPOs Scheme**

Main issues	Overview
Objectives	<ul style="list-style-type: none"> <li>To support forming new 10,000 FPOs to facilitate the development of vibrant and sustainable income-oriented farming.</li> <li>To enhance productivity through efficient, cost-effective, and sustainable resource use and realize higher returns through better liquidity and market linkages.</li> <li>To provide effective capacity building to FPOs to develop agriculture-entrepreneurship skills to become economically viable and self-sustaining.</li> </ul>
Main Implementing Agency	<ul style="list-style-type: none"> <li>Small Farmers Agribusiness Consortium (SFAC)</li> <li>National Bank for Agricultural and Rural Development (NABARD)</li> <li>National Cooperative Development Corporation (NCDC)</li> </ul>
No. of FPO	<ul style="list-style-type: none"> <li>10,000 FPOs in total</li> <li>15% of the total number of FPOs shall be in the Aspiration Districts<sup>20</sup>.</li> <li>In the Aspiration Districts, at least one FPO in each block to be organized.</li> <li>Aspiration Districts in Haryana: Nuh</li> </ul>
Unit of FPO formation	<ul style="list-style-type: none"> <li>FPOs will be formed on the basis of cluster of agriculture and allied sectors.</li> </ul>
Registration	<ul style="list-style-type: none"> <li>FPOs must be registered under Part IX A of the Companies Act or State Cooperative Societies Act.</li> </ul>
No. of members	<ul style="list-style-type: none"> <li>Plain areas: 300 members in minimum, 500 for efforts.</li> <li>North-Eastern and hilly areas: 100 members in minimum, 200 for efforts.</li> </ul>
Facilitation	<ul style="list-style-type: none"> <li>Cluster-based Business Organizations (CBBO) will be engaged by implementing agencies in each cluster or state.</li> <li>Major duties of CBBOs are: i) assist implementing agencies in cluster identification and community mobilization, ii) registration of FPOs (training of Board of Directors(BODs)), iii) capacity building of FPOs (training), iv) preparation/execution of business plans, v) assist FPOs in availing equity grants credit guarantee facilities, vi) facilitate establishment of necessary infrastructure facility by FPOs, vii) facilitate traceability, compliance and global market connectivity, viii) assist FPOs in proper financial management, utilization of funds, and accounting, etc.</li> </ul>
Financial and capacity building support	<ul style="list-style-type: none"> <li>FPO management cost: Financial support to FPO up to Rs. 1.8 million per FPO for 3 years.</li> <li>Equity grant: Equity grant shall be in the form of matching grant up to Rs. 2,000 per farmer member of FPO subject to maximum limit of Rs. 1.5 million fixed per FPO.</li> </ul>

<sup>20</sup> Aspiration District programme was launched in January 2018. The programme is anchored by NITI Aayog in partnership with state governments and district level administrations. It aims to quickly and transport 112 most under-developed districts across the country. It focuses on 5 main themes of health & nutrition, education, agriculture & water resources, financial inclusion & skill development, and infrastructure.

Main issues	Overview
	<ul style="list-style-type: none"> <li>• Credit guarantee facility: Credit guarantee cover per FPO will be limited to Rs. 20 million.</li> <li>• Specialized training and skill development:               <ul style="list-style-type: none"> <li>➤ Bankers Institute of Rural Development (BIRD)* is nodal training institution for FPOs promoted by NABARD, SFAC, and other designated implementing agencies under Part IX A of Companies Act or State Cooperative Societies Act.</li> <li>➤ Laxmanrao Imandar National Academy for Cooperative Research &amp; Development (LINAC)* is nodal training institution for FPOs promoted by NCDC under State Cooperative Societies Act.</li> </ul> </li> </ul>

Note: BIRD announced FPO related trainings ([BIRD\\_Lucknow\\_Training\\_Programmes.pdf \(nabard.org\)](#)).

LINAC implements such training programmes as on organizational development, agri-produce marketing cooperatives, warehousing and storage management, general management, and human resources, etc.

Source: Department of Agriculture, Cooperation & Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare, "Formation and Promotion of 10,000 FPOs: Operational Guidelines".

### iii) Implementing Agencies for PG(FPO) Formulation and Promotion in Haryana

Under the "Formation and Promotion of 10,000 FPOs" scheme, the following organizations have been functioned as implementing agencies for FPO formation and promotion<sup>21</sup>. By the end of November 2022, 127 FPOs have been formed and registered in Haryana.

**Table 3.2.12 Implementing Agencies in Haryana for "10,000 FPOs Scheme"**

Implementing Agencies No. of FPOs	Mandates
National Bank for Agricultural and Rural Development (NABARD)  No. of FPOs: 15	NABARD has made efforts to form different types of farmer/rural collectives such as SHGs, SHG Federations, JLGs, and FPOs. NABARD is extending support to FPOs through the various funds such as i) Producers Organizations Development Upliftment Corpus (PRODUCE) Fund, ii) Producers Organization Development Fund (PODF), iii) PODF-Credit Liked Grant Assistance, and iv) PODF-Interest Differential (PODF-ID).
Small Farmers Agribusiness Consortium (SFAC)  No. of FPOs: 50	SFAC was established in January 1994 as an autonomous society by the Ministry of Agriculture, Cooperation and Farmers' Welfare. SFAC implements Central Schemes such as VCA, and EGCGS for economic inclusion of small and marginal farmers agribusiness activities. It is pioneer in organizing those farmers for endowing them with bargaining power and economies of scale. It provides them a platform for increased accessibility and cheaper availability of agricultural inputs and for establishing forward and backward linkages in supply chain management. Recently it has been entrusted with the task of implementing the Delhi Kisan Mandi and National Agriculture Market Scheme on an e-platform to progressively free agricultural trade and offer price discovery to farmers.
Small Farmers Agribusiness Consortium Haryana (SFACH)  No. of FPOs: 48	SFACH was registered as an autonomous society in July 2008 (revised in November 2016) with focus on increasing incomes of small and marginal farmers through aggregation and development of agribusiness. SFACH supports forming farmers groups and properly looking after their management with providing various inputs of training and capacity building and linking to inputs suppliers, technology providers and market players. SFACH has also implemented State Scheme of the "Crop Cluster Development Programme (CCDP)".
National Cooperative Development Corporation (NCDC)  No. of FPOs: 7	NCDC was established by an Act of Parliament in 1963 as a statutory Corporation under the Ministry of Cooperation. NCDC has financing programmes for production, processing, marketing, export and import of agricultural produces and other items. Loans and grants are advanced to the State Governments for financing primary and secondary level cooperative societies and direct to the national level and other societies having objects extending beyond one State. NCDC is endowed with in-house technical managerial capabilities in such areas of cooperation, organization & methods, financial management, management information systems, certain crops including fruits & vegetables, civil engineering, refrigeration, preservation, etc., to help cooperatives identify/formulate projects and successfully implement them.
National Agricultural Cooperative Marketing	NAFED was established in October 1958 and was registered under the Multi State Co-operative Societies Act. It aims to promote co-operative marketing of agricultural produce

<sup>21</sup> Under "10,000 FPOs Scheme", 3 agencies, namely, SFAC, NCDC and NABARD are designated as initial implementing agencies. SAFC will be responsible for FPOs to be incorporated under Part IXA of Companies Act. NCDC will be responsible for FPOs to be registered under State Co-operative Societies Act. NABARD will be responsible for FPOs which are registered either Part IXA of Companies Act or State Co-operative Societies Act. Since State/UT could propose its own implementing agency to DAC&FW, SFACH was designated as an additional implementing agency in Haryana.

Implementing Agencies No. of FPOs	Mandates
Federation of India Ltd. (NAFED)  No. of FPOs: 7	to benefit the farmers. Agricultural farmers are the main members of NAFED who have the authority to say in the form of members of the General Body of NAFED.

Source: Prepared by JICA Survey Team based on State wise and Implementing Agencies wise details of Registered FPOs as on 30-11-2022.pdf (sfacindia.com) and websites of respective organizations.

#### iv) Existing PG(FPO)s in Haryana

Through the above-mentioned government initiatives, 747 PGs have been so far formed and registered in Haryana as of August 2023, out of which 574 PGs are in horticulture clusters (HCs). The below table shows District and category-wise numbers of PGs listed in SFACH website ((a) in the table)<sup>22</sup> and PGs in HCs provided by DOH ((b) in the table). There are 543 Horticulture PGs (all in HCs), 132 Agriculture PGs (4 in HCs), 18 Animal Husbandry & Dairy PGs (9 in HCs), 6 Fisheries PGs (3 in HCs), 11 Honey PGs (1 in HCs), 30 Mixed/Multi-purpose PGs (7 in HCs), and 15 PGs without information on their categories (all in HCs<sup>23</sup>). It could be thought that outstanding number of Horticulture PGs is because the objective of forming PGs is collectivizing small farmers who are mainly engaged in horticultural crop cultivation.

<sup>22</sup> One FPO (Armagnac Agrotech Producer Company Limited) in HCs in Karnal which is not included the list of SFACH website, but its category is already identified (horticulture), thus, this FPO is added to this list for compilation.

<sup>23</sup> 15 FPOs without information on their categories are included in those in HCs provided by DOH, but they are not included in the list of SFACH website.

**Table 3.2.13 Numbers of Existing PG(FPO)s by District and by Category**

	District	Total Blocks	Category												Total PGs (a)	Total PGs in Haryana	Total PGs (b)
			Horti-culture	Agriculture		Animal Husbandry & Dairy		Fisheries		Honey		Mixed/Multipurpose		Unkno wn			
			(a) (b)	(a)	(a)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(b)			
1	Ambala	6	18	1	25	1	0	1	0	1	0	3	0	1	25	26	19
2	Bhiwani	7	16	13	32	1	0	0	0	2	0	0	0	0	32	32	16
3	Charkhi Dadri	4	16	0	17	1	0	0	0	0	0	0	0	1	17	18	17
4	Faridabad	3	10	2	13	0	0	0	0	0	0	1	1	0	13	13	11
5	Fatehabad	7	20	9	36	1	0	1	1	1	0	4	0	0	36	36	21
6	Gurugram	4	16	0	18	1	1	0	0	0	0	1	0	0	18	18	17
7	Hisar	9	41	13	75	4	1	1	0	2	0	14	6	4	75	79	52
8	Jhajjar	7	32	13	47	0	0	1	1	1	0	0	0	0	47	47	34
9	Jind	8	24	5	30	0	0	0	0	1	0	0	0	1	30	31	25
10	Kaithal	7	29	8	37	0	0	0	0	0	0	0	0	3	37	10	32
11	Karnal	9	37	2	40	0	0	0	0	1	1	0	0	0	40	40	38
12	Kurukshetra	7	36	0	36	0	0	0	0	0	0	0	0	0	36	36	36
13	Mahendragarh	8	25	12	37	0	0	0	0	0	0	0	0	2	37	39	27
14	Nuh	7	37	6	44	0	0	1	1	0	0	0	0	3	44	47	41
15	Palwal	6	13	8	23	2	2	0	0	0	0	0	0	0	23	23	16
16	Panchkula	4	21	2	26	0	0	0	0	0	0	3	0	0	26	26	21
17	Panipat	6	30	2	33	0	0	0	0	0	0	1	0	0	33	33	31
18	Rewari	7	14	12	29	0	0	0	0	0	0	3	0	0	29	29	15
19	Rohtak	5	15	4	19	0	0	0	0	0	0	0	0	0	19	19	15
20	Sirsa	7	36	8	46	2	1	0	0	0	0	0	0	0	46	46	37
21	Sonipat	8	27	10	42	5	4	0	0	0	0	0	0	0	42	42	31
22	Yamuna Nagar	7	22	2	27	0	0	1	0	2	0	0	0	0	27	27	22
	<b>Total</b>	143	<b>535</b>	132	<b>732</b>	18	9	6	3	11	1	30	7	15	<b>732</b>	<b>747</b>	<b>574</b>

Source: Prepared by JICA Survey Team based on <http://sfcharyana.in/districtwiseppo> (above (a)) and list of FPOs in horticulture clusters provided by DOH (August 2023)(above (b)).

v) Self-help groups (SHGs) established under NABARD and NRLM

There are various initiatives promoting formulating and assisting SHGs. SHG in India is usually composed of around 15 women members. SHGs are formed and start with saving activities (saving money and lending among members), then they could receive assistance such as credits and training related to their income generation activities under various programs and schemes.

NABARD has initiated the formation of self-help groups (SHGs) as community-based groups for saving, lending, and delivering micro-credit since late 1980s. NABARD has implemented the SHG-Bank Linkage Programmes with wide acceptance by banks, NGOs, and various Government departments. With this Programme, 36 banks participated, 71,528 SHGs had saving linked, and 50,394 SHGs had credit linked as of the end of March 2021<sup>24</sup> <sup>25</sup>. NABARD has shifted its focus of supports from saving and credit to income generation activities (grants and training).

SHG movement has been accelerated under the NRLM (National Rural Livelihoods Mission) scheme which was launched by the Ministry of Rural Development (MoRD) in June 2011. In Haryana, NRLM has been implemented by Haryana State Rural Livelihoods Mission and Rural Development Department for enabling rural poor to increase household income through sustainable livelihoods enhancements and improved access to financial services. Until February 2023, 55,600 SHGs have been formed in all blocks of Haryana under NRLM. The table below provides district-wise details of the SHGs.

**Table 3.2.14 SHGs Formed under NRLM in Haryana in Different Districts**

No.	District	Total Blocks	Number of Blocks where SHGs entry has started	Total number of SHGs
1	Ambala	6	6	3,021
2	Bhiwani	7	7	4,137
3	Charkhi Dadri	4	4	1,341
4	Faridabad	3	3	1,151
5	Fatehabad	7	7	3,642
6	Gurugram	4	4	1,213
7	Hisar	9	9	2,457
8	Jhajjar	7	7	2,594
9	Jind	8	8	2,603
10	Kaithal	7	7	3,087
11	Karnal	9	9	4,879
12	Kurukshetra	7	7	2,485
13	Mahendragarh	8	8	1,198
14	Nuh	7	7	4,210
15	Palwal	6	6	1,939
16	Panchkula	4	4	1,546
17	Panipat	6	6	1,760
18	Rewari	7	7	2,171
19	Rohtak	5	5	1,834
20	Sirsa	7	7	1,880
21	Sonapat	8	8	2,283
22	Yamuna Nagar	7	7	4,169

<sup>24</sup> State Focus Paper 2022-23 (State – Haryana), NABARD, Haryana Regional Office, Chandigarh.

<sup>25</sup> Under NRLM, each SHG is able to access a credit amount of Rs. 10-20 Lacs per year. Concessional interest rates (usually lower than market ones) are given to SHGs. NABARD provides SHG loans to banks and financial institutions at a concessional rate (currently 7 %), and they provide loans to the SHGs with slightly higher rates depending on those banks/institutions, loan amounts and repayment periods (around 5-6 years) (e.g. 9.5-11.5% for Bank of Baroda, 12 % for State Bank of India, etc.).

No.	District	Total Blocks	Number of Blocks where SHGs entry has started	Total number of SHGs
	Total	143	143	55,600

Source: SHGs Profile Entry Status, Ministry of Rural Development.

vi) Joint liability groups (JLGs)

JLGs are promoted by NABARD to enable small farmers to access institutional credit. The group is formed by 4 - 10 small farmers having a common interest. Cumulatively, 495,638 JLGs have been credit linked with an outstanding loan amount of Rs. 2,123.55 crore in Haryana as of the end of September 2021.<sup>26</sup>

NABARD has been supporting promotion of JLGs by sanctioning grants of up to Rs. 4,000 per JLG for promotion and bank linkage of JLGs, training and mentoring, etc. Apart from tie up with several cooperative banks, NABARD has entered into an agreement with SBI (State Bank of India) for promotion of 1,000 JLGs.

vii) NGOs

Like other states of India, there are huge number of NGOs working in different sectors in the Haryana. Number of NGOs/VOs in Haryana signed up on the NGO-DARPAN is 3,830.<sup>27</sup> 532 out of them are working in agriculture sector. Several NGOs are engaged in formulating SHGs and supporting their capacity strengthening (including income generation activities). The table below shows some examples of these NGOs.

**Table 3.2.15 Examples of NGOs involved with SHG-related activities**

NGOs	Major Activities
Shri Swami Rama Foundation Trust  Districts: Panchkula, Ambala	<ul style="list-style-type: none"> <li>• SHG formation and linkages with banks under the guidance of NABARD.</li> <li>• Provision of livelihood entrepreneurship training (making and online selling of woven belts, etc.) with credit, and skill trainings (stitching, weaving, fish raising, etc.) for income generation under HNRLM.</li> <li>• Provision of skill training (crocheting, mushroom cultivation, goat raising, etc.) under the Livelihood Entrepreneurship Development Programme (LEDP).</li> <li>• Work under JLG Project of NABARD.</li> </ul>
Abhivyaakti Foundation  Districts: Faridabad, Palwal, Nuh	<ul style="list-style-type: none"> <li>• SHG formation, linkages with banks, different skill development training and livelihood activities under the guidance of NABARD.</li> <li>• Provision of skill training (cutting and stitching) for members of 6 SHGs for their income generation under the Micro Entrepreneurship Development Programme (MEDP).</li> <li>• Provision of skill development programmes for 90 members of 10 SHGs under LEDP.</li> <li>• 2,000 JLGs have been formed by this NGO under JLG Project of NABARD.</li> </ul>
Lakshy Gramin Vikas Sanstha  District: Faridabad	<ul style="list-style-type: none"> <li>• Provision of skill training (wooden crafts, garment making, sanitary pad making, etc.) under MEDP.</li> <li>• Provision of skill development programmes for 90 members in 3 different clusters under LEDP.</li> </ul>
Jan Kalyan Samiti  District: Karnal	<ul style="list-style-type: none"> <li>• Provision of skill training (jute bag making, bakery products, pickles, etc.) for 30 members under MEDP.</li> <li>• Provision of skill upgradation training (dairy farming and milk production) for 90 members under LEDP.</li> <li>• Provision of training (carpet making, computer accounting) for wage employment opportunities of rural youth under Skill Development Programme (SDP).</li> </ul>
Lord Krishna Educational Foundation  Districts: Rewari, Bhiwani, Mahendragarh, Nuh, Rohtak, Jhajjar	<ul style="list-style-type: none"> <li>• SHG formation (sanctioned 350 SHGs) and linkages with banks (275 SHGs have linked) under guidance of NABARD.</li> <li>• 2,500 JLGs have been formed by this NGO in different 15 projects with partnership of NABARD and DCCB.</li> <li>• 1,000 JLGs have achieved saving and credit linkages by this NGO under SBI (State Bank of India)-JLG Project.</li> <li>• Provision of support for 6 PG(FPO)s in Mahendragarh and Rewari by implementing baseline surveys for both Districts and for their registration and starting business activities.</li> <li>• Provision of skill training: food processing (pickle making) for 30 women, hand embroidery for 30 women, crafts (file holders, jute bag, bangles, etc.) for 30 women, etc. under MEDP.</li> <li>• Provision of training (data entry operator, vegetable nursery management, dress design,</li> </ul>

<sup>26</sup> State Focus Paper 2022-23 (State – Haryana), NABARD, Haryana Regional Office, Chandigarh.

<sup>27</sup> The NGO-DARPAN is a platform that provides space for interface between NGOs/VOs and key Government Ministries/ Departments/ Bodies and is maintained by the NITI Aayog in association with National Information Centre.

NGOs	Major Activities
	cutting & tailoring, beautician & wellness training) for wage employment opportunities of rural youth (240 participants) under SDP. <ul style="list-style-type: none"> <li>• Provision of skill training (dairy activity, fabric-making bags, vermicompost technique, goat rearing, milk product, processing, marketing, etc.) for more than 900 participants under LEDP.</li> </ul>

Source: Prepared by JICA Survey Team based on their websites, etc.

### 3.3 Agriculture Production

#### 3.3.1 Land Tenure

According to the Census of India 2011, farm size distribution in the state is as follows:

**Table 3.3.1 District-wise Land Tenure**

Province	Marginal (Below 1.0 ha)	Small (1.0-- 2.0 ha)	Semi-Medium (2.0-- 4.0 ha)	Medium (4.0-10.0 ha)	Large (Over 10.0 ha)
Ambala	38.00%	26.40%	22.10%	9.60%	3.90%
Bhiwani	41.50%	23.10%	21.00%	10.20%	4.20%
Faridabad	47.60%	25.00%	17.30%	7.50%	2.60%
Fatehabad	47.50%	24.20%	18.70%	7.20%	2.40%
Gurugram	42.30%	24.10%	20.30%	9.20%	4.10%
Hisar	45.30%	23.30%	19.80%	8.70%	3.00%
Jhajjar	43.80%	25.10%	19.50%	8.60%	3.00%
Jind	42.90%	24.00%	20.70%	8.60%	3.80%
Kaithal	42.60%	23.60%	20.40%	9.10%	4.30%
Karnal	40.50%	25.20%	21.50%	9.10%	3.60%
Kurukshetra	43.20%	24.10%	20.50%	8.70%	3.50%
Mahendragarh	43.70%	24.50%	19.20%	8.60%	4.00%
Nuh	52.00%	23.10%	16.70%	6.60%	1.60%
Palwal	49.40%	22.90%	16.70%	7.50%	3.50%
Panchkula	37.90%	27.50%	23.40%	8.00%	3.20%
Panipat	41.30%	24.30%	20.20%	9.10%	5.10%
Rewari	41.5%	23.9%	20.6%	8.2%	5.7%
Rohtak	42.1%	24.5%	20.3%	8.6%	4.5%
Sirsa	47.4%	23.40%	18.60%	7.80%	2.80%
Sonipat	40.1%	25.5%	20.9%	9.6%	3.9%
Yamuna Nagar	41.2%	24.9%	20.2%	8.8%	4.9%

Source: DOH

#### 3.3.2 Water Resources Utilization and Irrigation System

According to the statistical abstract of Haryana 2020-21, district wide net area under each water resources and irrigation is as follows.

**Table 3.3.2 Net area under irrigation in Haryana 2020-21**

District	Government Canals	Tanks	Wells	Tubewells	Other sources	Total (000 ha.)	Percentage to net area sown (%)
Ambala	3	0	0	145	0	148	99.3
Bhiwani	58	0	0	180	0	238	81
Charkhi Dadri	26	0	0	70	0	96	85.7
Faridabad	0	0	0	32	0	32	100
Fatehabad	63	0	0	155	0	218	98.6

District	Government Canals	Tanks	Wells	Tubewells	Other sources	Total (000 ha.)	Percentage to net area sown (%)
Gurugram	0	0	0	85	0	85	100
Hisar	206	0	0	106	0	312	93.1
Jhajjar	52	0	0	70	0	122	93.8
Jind	218	0	0	36	0	254	100
Kaithal	76	0	0	121	0	197	100
Karnal	57	0	0	144	0	201	100
Kurukshetra	28	0	0	111	0	139	99.3
Mahendergarh	1	0	0	119	0	120	78.9
Nuh	14	0	0	71	0	85	77.3
Palwal	21	0	0	78	0	99	95.2
Panchkula	0	0	0	19	0	19	82.6
Panipat	40	0	0	57	0	97	100
Rewari	0	0	0	126	0	126	100
Rohtak	75	0	0	79	0	154	100
Sirsa	268	0	0	114	0	382	97.7
Sonipat	24	0	0	129	0	153	100
Yamuna Nagar	2	0	0	109	0	111	100

Source: Statistical Abstract of Haryana 2020-21.

It also shows how State wide water sources are shown, but it is clear that Haryana's water sources are limited to Government Canals and tubewells. And the irrigation rate is the highest of all the states at 95.35%.

**Table 3.3.3 Net area under irrigation in India 2020-21**

State	Government Canals	Private Canals	Tanks	Other Wells	Tubewells	Other sources	Total (000 ha.)	Percentage to net area sown (%)
Andhra Pradesh	1356	-	287	37	1082	117	2879	48.93
Arunachal Pradesh	-	-	-	-	-	56	56	23.83
Assam	94	11	8	52	88	172	425	15.75
Bihar	956	-	55	22	1911	113	3059	60.25
Chhattisgarh	878	-	28	16	552	54	1528	32.25
Goa	5	-	12	2	2	1	22	17.32
Gujarat	1164	-	232	1499	1900	442	5238	53.52
Haryana	1232	-	-	-	2156	-	3387	95.35
Himachal Pradesh	3	@	@	3	26	83	117	22.08
Jharkhand	4	-	73	82	24	67	249	19.29
Karnataka	1262	-	138	322	1863	650	4235	39.2
Kerala	85	1	50	119	50	105	410	20.24
Madhya Pradesh	2284	1	430	3622	4685	1495	12517	80.69
Maharashtra*	1041	-	-	-	2086	-	3128	18.71
Manipur*	-	-	-	-	-	54	54	16.31
Meghalaya	83	21	-	-	-	-	105	41.18
Mizoram*	2	14	-	-	-	-	16	10.96
Nagaland	-	-	-	-	-	120	120	31.25
Odisha	-	-	-	-	-	1137	1137	27.72
Punjab	1179	-	-	-	-	-	4127	100



State	Government Canals	Private Canals	Tanks	Other Wells	Tubewells	Other sources	Total (000 ha.)	Percentage to net area sown (%)
Rajasthan	2198	–	78	2162	4207	176	8821	48.92
Sikkim*	–	–	–	–	–	14	14	18.18
Tamil Nadu	647	1	351	1151	518	4	2672	56.4
Telangana	513	–	349	562	1341	162	2927	53.22
Tripura	6	–	2	1	8	72	89	34.9
Uttarakhand	69	@	@	3	227	18	317	49.69
Uttar Pradesh	2166	–	81	1213	10574	300	14334	87.57
West Bengal*	–	–	–	–	–	3108	3108	59.2
Other Centrally Administered Areas	170	114	11	9	37	24	366	44.74
All India 2019-20 (P)	17399	162	2185	10876	36287	8547	75456	53.93
All India 2018-19	16652	165	1821	10139	35410	8004	72191	52.15

Note: @ = less than 500 hectare, P = Provisional  
Source: Statistical Abstract of Haryana 2020-21.

### 3.3.3 Land Utilisation

According to the Agricultural Census 2010-11, land use in Haryana, India is divided into four categories: net area sown, area under current fallows, net cultivated area, and total uncultivated land, and as shown below, the distribution of land use practices does not differ much by land area owned.

**Table 3.3.4 Estimated Area by Size Classes and Land Use 2010-11**

Size Class	Net Area Sown		Area Under Current Fallows		Net Cultivated Area		Total Uncultivated Land		Total Area '000 ha)
	Area '000 ha)	Ratio (%)	Area '000 ha)	Ratio (%)	Area '000 ha)	Ratio (%)	Area '000 ha)	Ratio (%)	
Marginal	32219	46%	2724	4%	34942	50%	494	1%	70379
Semi-Medium	33778	46%	2518	3%	36296	49%	965	1%	73557
Medium	29442	45%	2469	4%	31911	49%	1448	2%	65270
Large	13864	43%	1524	5%	15388	48%	1194	4%	31970
All Classes	141279	46%	11514	4%	152793	49%	4742	2%	310328

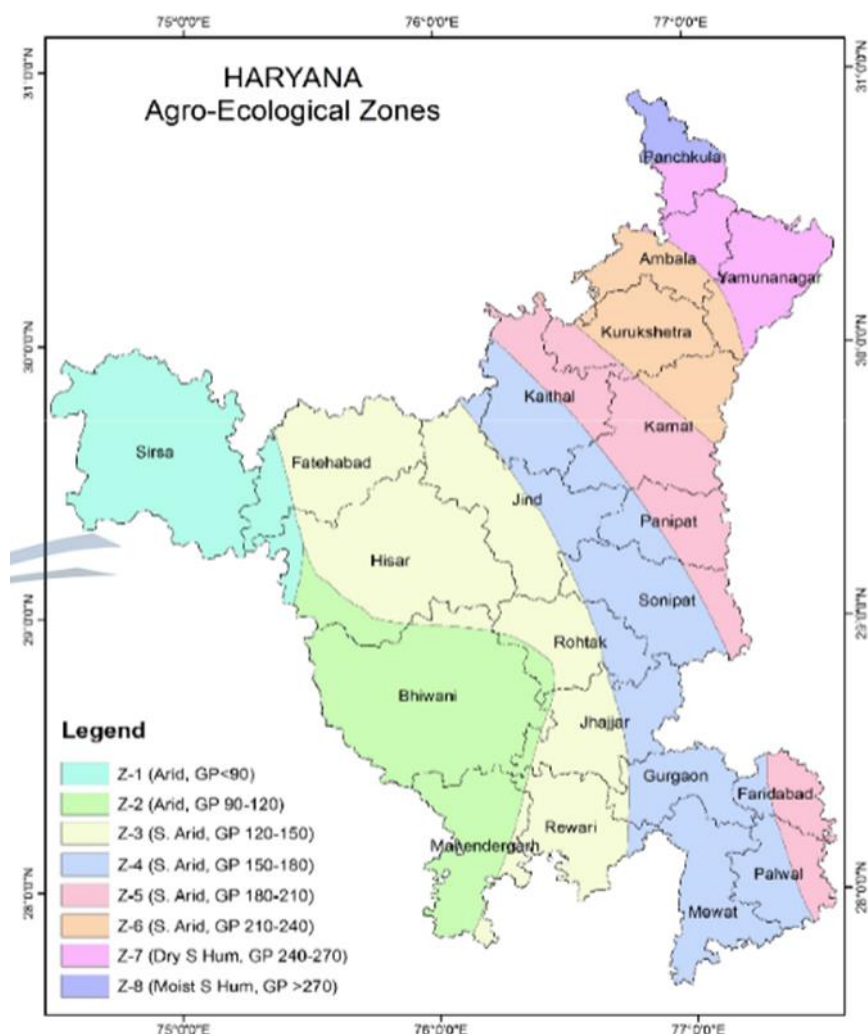
Source: Agricultural Census 2010-11

### 3.3.4 District-wise Agro-ecological Zones

The state can be divided into four main agro-ecological zones: namely, the AEZ 2.3, AEZ 4.1, AEZ 9.1 and AEZ 14.2. Northern Haryana was covered under AEZ-9.1 with sub-humid areas of Ambala, Yamuna Nagar, Panchkula, Kurukshetra and 180-240 days of growing period. Small area of north Haryana was covered under AEZ-14.2 with semi-humid climate. The major part of Haryana was covered under AEZ-4.1 with semi-arid areas of Fatehabad, Hisar, Jind, Sonipat, Kaithal, Karnal, Panipat, Rohtak, Jhajjar, Gurugram, Faridabad, Palwal, Nuh, Rewari and 120-180 days of growing period. AEZ-2.3 covered part of Haryana with semi-arid areas of Mahendragarh and Charkhi Dadri and less than 120 days of growing period. The southwestern Haryana mainly consists of arid tracts. This AEZ-2.3 covers the Sirsa and part of the Fatehabad, Hisar, and Bhiwani districts.

The Characteristics of each district are mentioned in attachment 3.3.1.

Agro-ecological zones are depicted on following map.



Source: JICA survey team

**Figure 3.3.1** Agro-ecological zones in Haryana

### 3.3.5 Cultivated Area and Production of Vegetables and Fruits

Vegetables mainly grown in Haryana are potato, onion, radish, carrot, turnip, cauliflower, spinach, Methi (fenugreek), coriander, tomato, bitter gourd, capsicum, and peas. Mango, guava, papaya, and citrus fruits like kinnow, and amla (aonla) are some of the important fruits grown in the state. The trend of cultivated area and production of vegetables and fruits in Haryana is shown as follows:

Vegetables recommended for growing in Haryana are shown as following the table.

**Table 3.3.5** General recommendation for growing of vegetables in different regions zone

Region	Place name	Vegetable Name
A. <b>Eastern Region:</b> i.) Sivalik Hills (Sub-humid more rainfall area)	Kalka, Naraingarh	Onion, potato, tomato, cauliflower, radish, and ginger
	Jagadhri, Karnal, Panipat	Potato, cauliflower, tomato, radish, and cucumber
	Ladwa & Some parts of Indri	Potato, cauliflower, radish, carrot, and cucumber
ii.) Alluvial (semi-arid medium rainfall areas)	Faridabad, Palwal, Ballabgarh, Gurugram, Mewat, Nuh, Pataudi, Sonipat, Karnal, Panipat, Kurukshetra, Kaithal,	Bottle gourd, carrot, cabbage, cauliflower, Ridge gourd, tomato, cucumber, radish, onion, and potato,

Region	Place name	Vegetable Name
	Gulla, Pehowa, Rohtak, and some part of Jind	
<b>B. Western Region:</b>		
i.) Alluvial Plain Areas (semi-arid medium to low rainfall areas)	Hisar, Rohtak, Sirsa, some part of Bhiwani, and Mahendragarh	Carrot, cauliflower, cabbage, radish, tomato, cucumber, bottle gourd, potato, and onion
ii.) Sandy-loam Areas (Dry and rain fed or low rainfall areas)	Sirsa, Hisar, Bhiwani, Rewari, Mahendragarh, Southwest part adjoining to Rajasthan border in Narnaul district	Cauliflower, radish, carrot, potato, cabbage, tomato, bottle gourd, cucumber, onion,

Source: VEGETABLE FARMING IN HARYANA: A GEOGRAPHICAL STUDY, <https://ijcrt.org/papers/IJCRT2101566.pdf>

The annual trend of cultivated area, production, and productivity of vegetables in Haryana is shown as follows:

**Table 3.3.6 Trend of Cultivated Area, Production and Productivity of Vegetables**

Crops	2017/18			2018/19			2019/20			2020/21			2021/22		
	Area (ha)	Production (t)	Productivity (t/ha)	Area (ha)	Production (t)	Productivity (t/ha)	Area (ha)	Production (t)	Productivity (t/ha)	Area (ha)	Production (t)	Productivity (t/ha)	Area (ha)	Production (t)	Productivity (t/ha)
Potato	34718	897601	25.85	34738	897861	25.85	38200	982426	25.72	30751	807398	26.26	29543	781531	26.45
Onion	29931	701527	23.44	32010	780174	24.37	23749	610469	25.71	23713	602370	25.40	24871	489476	19.68
Tomato	34905	746043	21.37	30115	643569	21.37	23923	493570	20.63	21319	440203	20.65	20937	343522	16.41
Radish	33056	531527	16.08	33080	568658	17.19	26828	516535	19.25	24497	482920	19.71	23099	441282	19.1
Carrot	26558	446001	16.79	28972	467433	16.13	22888	389763	17.03	19829	337449	17.02	20332	354665	17.44
Cabbage	21206	342466	16.15	21572	383458	17.78	17596	357026	20.29	13515	292808	21.67	12251	254486	20.77
Cauliflower	39883	699014	17.53	43615	931665	21.36	34249	675465	19.72	29024	589995	20.33	28852	583632	20.23
Chillies	19016	133848	7.04	15944	122778	7.70	14296	141380	9.89	11859	124628	10.51	11056	114467	10.35
Okra	24530	233964	9.54	24334	241460	9.92	21669	232759	10.74	15204	161446	10.62	11628	119321	10.26
Brinjal	16182	319220	19.73	16994	333950	19.65	14696	278777	18.97	10275	190920	18.58	8630	146170	16.94
Cucurbits	67752	953834	14.08	67835	938085	13.83	65219	951338	14.59	54176	721700	13.32	49451	658023	13.31
Leafy Vegetables	36819	481001	13.06	39947	470796	11.79	39531	494110	12.50	36758	464654	12.64	39430	451098	11.44
Pea	15590	135147	8.67	15586	144678	9.28	13744	178280	12.97	8366	110097	13.16	8149	118939	14.60
Others	41048	453377	11.05	33418	323408	9.68	35696	361780	10.14	33410	404662	12.11	36752	428147	11.65
<b>Total</b>	<b>441194</b>	<b>7074570</b>		<b>438160</b>	<b>7247973</b>		<b>392284</b>	<b>6663678</b>		<b>332696</b>	<b>5731250</b>		<b>324981</b>	<b>5284759</b>	

Source: DOH

Haryana data of vegetable production was reported at 5,284,759 Tons in 2022. This records a decrease from the previous number of 5,731,250 Tons for 2021. Haryana data of vegetable production is updated yearly, averaging 5,883,870 Tons from 2012 to 2022. The data reached an all-time high of 7,247,973 Tons in 2019 and a record low of 5,284,759 Tons in 2022. The decrease of area and production of vegetables from 2020 to 2022 was affected by prevalence of COVID-19 and climate change. Lockdown gave big impact to the cultivation activities. Also, rainfall dropped from the average in this period.

The district-wise cultivated area, production of major vegetables in Haryana is shown in attachment 3.3.2.

The major districts of vegetables are Yamuna Nagar, Kurukshetra, Panipat, Karnal, Sonapat, Ambala, Nuh and Jind. The major vegetables grown in the above stated districts are potatoes, onion, carrots, cauliflower, cucurbits, leafy vegetables, and radish.

Herewith introduce the potential of clustered vegetables potential in attachment 3.3.3.

### 3.3.6 Agricultural Production System

#### (1) Land Ownership

Haryana's land ownership can be divided into three types: Individual Holdings, Joint Holdings, and Institutional Holdings, each with the following characteristics.

**Individual Holdings:** Individual land holdings in agriculture refer to the land are owned and managed by an individual farmer or farm household. These holdings can vary in size and type, ranging from small family farms to large commercial operations. The individual holdings in agriculture can include arable land for growing crops such as wheat, rice, corn, soybeans, and vegetables.

**Joint Holdings:** Joint Holdings land is land owned and managed by two or more individuals or organizations. These ownerships can take many forms, such as partnerships, cooperatives, or joint ventures, and may vary in structure depending on the legal and economic context. Joint Holdings land offers several advantages, including increased efficiency, resource sharing, and risk diversification. However, shared farmland may also pose several challenges, including conflicts regarding decision-making, resource allocation, and benefit sharing.

**Institutional Holdings:** Institutional Holdings refer to the holding of agricultural assets by institutional investors such as pension funds, endowments, private equity firms, and other large investment organizations.

While institutional investment in agriculture can bring capital, expertise, and innovation to the sector, concerns have been raised that large-scale land acquisition can displace small farmers, disrupt local communities, and degrade natural resources.

**Table 3.3.7 Number and area of holdings by ownership and by size group in Haryana**

Size Group (in Hectares)	All Holding															
	Individual Holdings				Joint Holdings				Institutional Holdings				Total Holdings			
	Number	ratio	Area	ratio	Number	ratio	Area	ratio	Number	ratio	Area	ratio	Number	ratio	Area	ratio
Below 0.5	206,278	39.2%	68,899	8.7%	292,735	27.0%	93,944	3.5%	3,603	21.0%	1,338	0.9%	502,616	30.8%	164,181	4.5%
0.5-1.0	103,252	19.6%	78,435	10.0%	194,170	17.9%	147,097	5.5%	2,358	13.7%	1,993	1.3%	299,780	18.4%	227,524	6.3%
1.0-2.0	96,589	18.4%	141,299	17.9%	214,772	19.8%	314,005	11.8%	2,576	15.0%	4,136	2.7%	313,937	19.2%	459,439	12.7%
2.0-3.0	49,006	9.3%	121,616	15.4%	120,190	11.1%	299,797	11.2%	1,507	8.8%	3,695	2.4%	170,703	10.5%	425,107	11.8%
3.0-4.0	28,984	5.5%	101,839	12.9%	77,366	7.1%	271,899	10.2%	919	5.3%	3,185	2.1%	107,269	6.6%	376,923	10.4%
4.0-5.0	19,253	3.7%	87,591	11.1%	52,842	4.9%	238,733	8.9%	665	3.9%	2,976	2.0%	72,760	4.5%	329,300	9.1%
5.0-7.5	15,400	2.9%	97,832	12.4%	65,690	6.1%	407,309	15.3%	1,351	7.9%	8,326	5.5%	82,441	5.1%	513,467	14.2%
7.5-10.0	4,771	0.9%	42,998	5.5%	31,493	2.9%	274,405	10.3%	862	5.0%	7,457	4.9%	37,126	2.3%	324,861	9.0%
10.0-20.0	2,165	0.4%	32,373	4.1%	30,034	2.8%	413,289	15.5%	1,887	11.0%	30,477	20.1%	37,088	2.3%	476,139	13.2%
20.0 and above	380	0.1%	15,047	1.9%	5,458	0.5%	208,189	7.8%	1,459	8.5%	88,410	58.2%	7,297	0.4%	311,645	8.6%
Total	526,078	100.0%	787,929	100.0%	1,084,750	100.0%	2,668,667	100.0%	17,187	100.0%	151,993	100.0%	1,631,017	100.0%	3,608,586	100.0%

Source: Agriculture Census, 2015-16.

#### (2) Types of Farmers

The characteristics of agricultural activities for each area owned are as follows.

i) Marginal farmers (less than one ha)

They are considered the most vulnerable and disadvantaged group in agriculture, as they often lack access to resources, technology, credit, and markets. In some cases, marginal farmers may also be landless laborers who work as tenants or sharecroppers on small plots of land. Marginal farmers typically engage in subsistence farming, growing crops such as wheat, rice, maize, or pulses for their own consumption or local markets. They may use traditional or low-input methods, such as manual labour, organic fertilizers, or crop rotation, due to limited access to modern inputs or knowledge. Due to their small landholding size, marginal farmers face several challenges, such as low productivity, low income, and high risk of crop failure. They may also be vulnerable to climate change, pests, and diseases, which can further reduce their yields and income.

To address the needs of marginal farmers, various Government and non-Governmental organizations have launched programs and initiatives aimed at improving their livelihoods. These may include providing access to credit, seeds, fertilizers, and irrigation, as well as

training on sustainable agriculture practices, marketing, and value addition. By supporting marginal farmers, it is possible to promote inclusive and equitable agriculture that benefits small-scale producers and their communities. Also, marginal farmers may work outside as workers to earn daily wages. They work as laborers on farms outside their own fields. Marginal farmers may also rent their land to prominent farmers,

ii) Small farmers (less than 1 ha)

The type of farming activities small farmers engage in can vary widely depending on factors such as region, climate, soil, and access to resources. In general, small farmers tend to grow a variety of crops such as rice, maize, vegetables, and fruits using traditional or low-input methods. They may use organic or natural fertilizers, hand tools or animal-drawn implements, and rely on rainfall or simple irrigation systems for water supply.

iii) Small, Semi-Medium farmers (1-4ha)

Small and semi-medium farmers in India, owning up to 4 hectares, engage in both subsistence and commercial farming, including crop cultivation and livestock rearing. They use modern farming methods and may also integrate agroforestry practices or specialize in specific crops. Small-scale processing methods are employed to add value to their products. Despite facing challenges such as limited access to credit, markets, and technology, these farmers play a vital role in food security, preserving traditional practices, contributing to local economies, and ensuring a transition between small-scale and medium farming.

iv) Medium, Large-scale Farmers: (more than 4 ha)

Medium scale farmers, owning more than 4 hectares, and large-scale farmers, with more than 10 hectares, significantly contribute to agricultural output and employment. They use modern farming techniques and often have access to credit and extension services. Medium farmers bridge the gap between small farmers and large agribusinesses. Large-scale farmers also participate in contract farming and value chain activities. Both face challenges like soil fertility decline, water scarcity, and market volatility.<sup>28</sup>

With respect to horticultural crop production in Haryana, the following table shows the status of the following items by area of ownership.

- Possibility of purchasing materials.
- Availability of financing.
- Use of agricultural machinery
- Application of farming techniques
- Opportunities to learn technology
- Main sales locations

**Table 3.3.8 Horticultural crop production in Haryana**

Type of Farmers	Marginal Farmers	Small, Semi medium Farmers	Medium, Large Farmers
Area(ha)	Less than 1	1~4	4 ~ 10
i) Possibility of purchasing materials.	Yes, but limited	Yes, but limited	Yes
ii) Availability of financing.	Yes,	Yes,	Yes

<sup>28</sup> Haryana Statistical Abstract 2021-22, Directorate of Economics and Statistics, Haryana Government: <https://cdnbbsr.s3waas.gov.in/s32b0f658cbffd284984fb11d90254081f/uploads/2023/02/2023041129.pdf>

- Singh, R. P., & Chaudhary, D. P. (2018). Agricultural productivity and rural poverty in India: A state-level analysis. Journal of Rural Studies - Government of India. (2013). Agricultural census 2010-11: All India report on number and area of operational holdings. New Delhi: Department of Agriculture, Cooperation and Farmers Welfare

Type of Farmers	Marginal Farmers	Small, Semi medium Farmers	Medium, Large Farmers
Area(ha)	Less than 1	1~4	4 ~ 10
iii) Use of agricultural machinery	No because of less land holding and lack of cash availability	Yes, by borrowing from medium or large-scale farmers	Large machinery, from planting to harvesting. Most of the field workers done by using machinery
iv)) Application of farming techniques	No, no knowledge of advance techniques	Some of the farmers. like staking or support to plants, using poly tunnels for plant protection	Yes, mulching sheet, poly tunnels, polyhouse, etc.
v) Opportunities to learn technology	Yes, but very limited	Yes	Yes
vi) Main sales locations	Self-consumption or local market	Local market/Local APMC	Local market/Local APMC/ MOU with big companies

Source: JICA Survey Team based on the hearing result from farmers in local markets

### 3.3.7 Production of Fruit Tree

#### i) Growing Area of Fruits

Considering the agro-ecological conditions and the suitability of a particular area for the growth of specific fruit trees in the concerned area, Haryana is broadly divided into four areas: (a), (b), (c), and (d) zone. Thus, fruit crops grown in Haryana can be grouped into each area based on the respective crop features as show 3.4.10n below.

**Table 3.3.9 Agro-ecological Zone-wise Suitable Fruit Crops**

Regions and Zones	Place name	Fruit Name
<b>Eastern Region:</b> (a) Shivalik Hills (Sub-humid more rainfall area)	Kalka, Naraingarh	Peach, Plum, Pear, Mango, and Loquat
	Jagadhri, Karnal, Panipat	Litchi, Chiku* <sup>1</sup> , Papaya, Aonla, and Jamun
	Ladwa & Some parts of Indri	Guava
(b) Alluvial (semi-arid medium rainfall areas)	Faridabad, Palwal, Ballabgarh, Gurugram, Mewat, Nuh, Pataudi, Sonipat, Karnal, Panipat, Kurukshetra, Kaithal, Gulla, Pehowa, Rohtak, and some part of Jind	Citrus fruit, Guava, Grapes, Date, Papaya, Phalsa* <sup>2</sup> , Jamun* <sup>3</sup> , Mulberry, and Aonla* <sup>4</sup>
<b>Western Region:</b> (c) Alluvial Plain Areas (semi-arid medium to low rain-fall areas)	Hisar, Rohtak, Sirsa, Some parts of Bhiwani, and Mahendragarh	Citrus Fruit, Grapes, Phalsa, Guava, Ber* <sup>5</sup> , Aonla, Date palm, Jamun, Mulberry, Pomegranate, and Bilberry
(d) Sandy-loam Areas (Dry and rain fed or low rainfall areas)	Sirsa, Hisar, Bhiwani, Rewari, Mahendragarh	Ber, Bel* <sup>6</sup> , Giri* <sup>7</sup> , Aonla, Mulberry, Phalsa, Karonda* <sup>8</sup> , Pomegranate, and Citrus

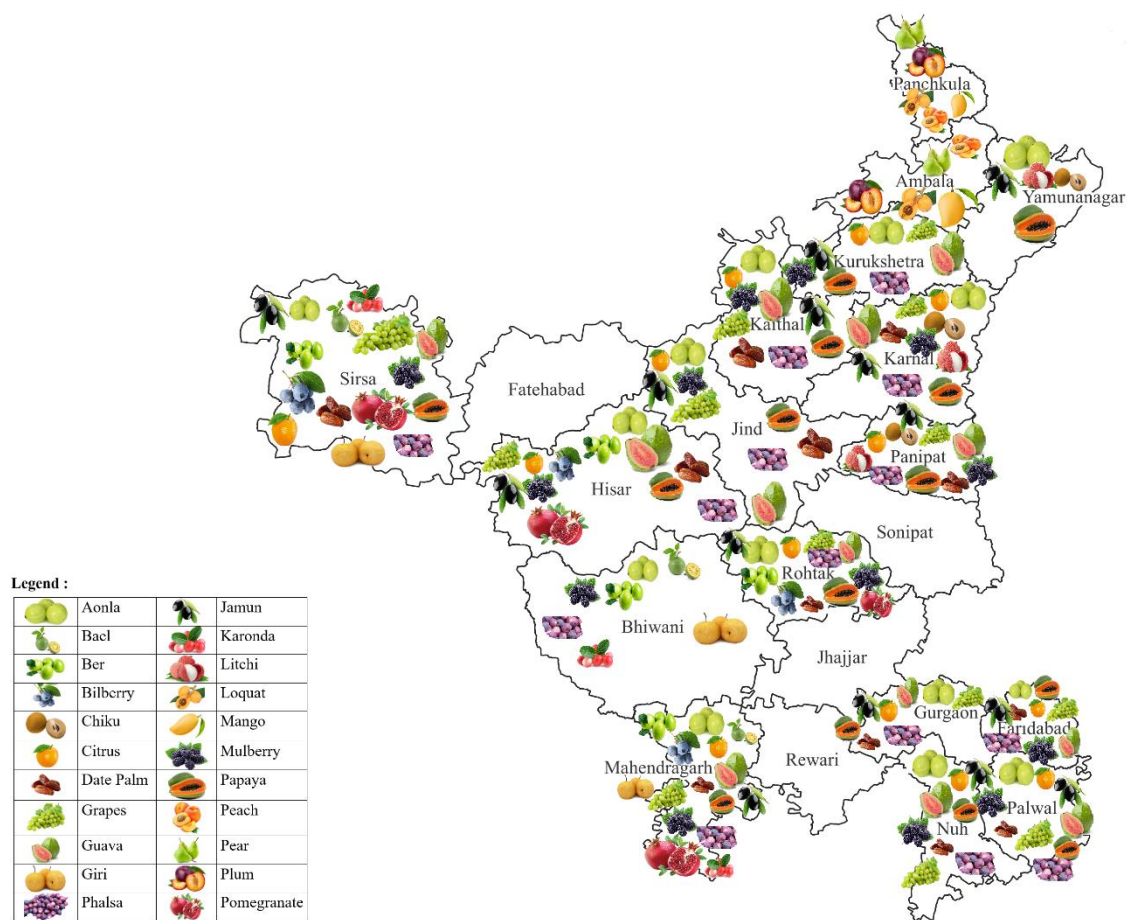
References:

Chiku\*<sup>1</sup>=Sapodilla sapote (*Manilkara zapota*), Phalsa\*<sup>2</sup>=Indian sherbet berry (*Grewia asiatica*), Jamun\*<sup>3</sup>=Java plum (*Syzygium cumini*), Aonla\*<sup>4</sup>=Amla, Indian gooseberry (*Phyllanthus emblica*), Ber\*<sup>5</sup>= Indian jujube (*Ziziphus mauritiana*), Bel\*<sup>6</sup>=Bael fruit (*Aegle marmelos*), Giri\*<sup>7</sup>=Asian pear (*Pyrus pyrifolia*), Karonda\*<sup>8</sup>=Bengal currant (*Carissa carandas*)

Source: DOH (<https://horharyana.gov.in/en/crops-packages-practices>), Packages of Practices for Fruit-Flowers-Vegetables published by CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR (CCSHAU), Hisar, 2021

The above-mentioned fruits distribution can be found in figure 3.3.2 as below map.





**Figure 3.3.2 Distribution Map of Fruits in Haryana**

Source: compiled by JICA Survey Team based on the information from DOH

ii) Planted Area and Production of Fruits

The annual trend of cultivated area, production, and productivity of major fruits in Haryana are shown as follows:

**Table 3.3.10 Trend of Cultivated Area and Production of Major Fruits**

Crops	2017/18			2018/19			2019/2020			2020/21			2021/22		
	Area (ha)	Production (t)	Productivity (t/ha)	Area (ha)	Production (t)	Productivity (t/ha)	Area (ha)	Production (t)	Productivity (t/ha)	Area (ha)	Production (t)	Productivity (t/ha)	Area (ha)	Production (t)	Productivity (t/ha)
Mango	9521	107846	11.33	9563	116447	12.18	9617	116607	12.13	9675	113418	11.72	9647	108770	11.28
Guava	12072	174402	14.45	12595	247449	19.65	13224	249112	11.33	14543	260851	17.94	15594	238514	15.30
Citrus	19931	470390	23.60	20789	549332	26.42	21817	562503	25.78	23316	517828	22.21	24398	570883	23.40
Ber	4230	44839	10.6	4288	48428	11.29	4314	41252	9.56	4399	44738	10.17	4433	46953	10.59
Grapes	40	145	3.63	39	158	4.05	41	208	5.07	42	286	6.81	42	386	9.19
Aonla	2249	16200	7.2	2198	10747	4.89	2150	15334	7.13	2152	16363	7.60	2175	17092	7.86
Chiku	1762	17645	10.01	1763	23239	13.18	1781	16065	9.02	1809	22183	12.26	1810	21828	12.06
Litchi	225	2829	12.57	221	2066	9.35	223	2546	14.62	244	3568	14.62	266	3317	12.47
Peach, Pear, Plum	688	6929	10.07	693	13690	19.75	692	10968	15.85	693	11465	16.54	677	11172	16.50
Others	3082	22159	7.19	4025	49075	12.19	4238	32235	7.61	4319	35546	8.23	4649	60556	13.03

Source: DOH

The cultivated area of fruits increased from 3,082ha to 4,649ha. It means the area increased 1.5 times within 5 years. Moreover, the production also increased from 22,159t to 60,556. It is more than 2.7 times in 5 years. Productivities of several crops such as Grapes, Aonla, Chiku, Peach, Pear, Plum, and others contributed to the increase in production. In the case of Grapes, a new variety of An-e-Shahi Grapes has a great impact of increase of yield. The same as this, low-chilling new varieties of Peach were introduced and largely cultivated in Haryana.

The district-wise cultivated area and production of major fruits in Haryana is shown in attachment 3.3.4

The major districts of fruits are Sirsa, Fatehabad, Yamuna Nagar, Hisar and Bhiwani. The major fruits grown in the above stated districts are citrus, mango, chiku and ber.

The potential of clustered fruits is shown in attachment 3.3.5.

### 3.3.8 Challenges for Horticulture

#### (1) Water-saving irrigation facilities

The irrigation system in Haryana is maintained by canals and tubewells and is one of the most advanced in India, with 95% irrigation coverage. However, the large amount of groundwater used is causing the water table to fall and the soil to become saline. As a result, opportunities to improve the quality of vegetables and fruit are being lost. If water use could be controlled, the sugar content, nutrients and flavour of fruit and vegetables could be increased and their value added.

To this end, a combination of micro-irrigation (drip or sprinkler) is one of the technologies that should be introduced. Farmers can control water application and reduce water consumption.

Water harvesting should also be developed as a preventive measure against lowering the water table.

At the same time, horticultural departments need to advise and train farmers to pursue this important and critical issue.

#### (2) Deterioration of soil condition

Soil and groundwater salinity is a major agricultural challenge in the Indian state of Haryana. The electrical conductivity (EC) of groundwater in the region varies widely, particularly in the



southern, western and central parts of the state such as Bhiwani, Mewat, Mahendragal, Rewari and Faridabad, where saline water accounts for a significant proportion.

Common agricultural practices in the region, particularly the regular and excessive use of fertilisers, are considered to be one of the causes of soil salinisation. It has been shown that intermittent fertilisation can improve the quality of vegetables and fruit, but it has also been shown that a delicate balance in the amount of fertiliser used is needed to avoid worsening soil salinity.

One proposed solution to reduce salinity problems is the use of drip irrigation combined with mulch. Mulch can reduce soil salinity by preventing the evaporation of salt water and the accumulation of salt in the soil. Planting salt-absorbing plants is also recommended. These plants not only help improve salt-affected soils, but also have economic benefits as they can be sold as nutritious vegetables.

To effectively address the problem of salt damage, emphasis should be placed on introducing drip irrigation combined with mulching, promoting the cultivation of salt-absorbing plants and providing technical training to support these efforts.

### **(3) Modernisation of Horticulture**

Modernisation and efficiency in Indian agriculture is exactly what is needed for smallholder farmers, who make up about 70% of farming households. Customised rental services, which allow farmers to rent machinery for a period of time, are widely used, but despite the availability of such services, past policies have focused on large machinery and are not suitable for all, especially small and marginal farmers. To address these challenges, policies are needed that facilitate access to appropriate machinery, improve training for women farmers, promote group purchasing, and provide market access and extension services.

The Introduction of small, efficient Japanese machinery, such as hand-operated tillers and mulch spreaders, can increase crop efficiency. Training at Krishi Vigyan Kendras (KVKs) and Centres of Excellence for targeted extension and information sharing will help farmers, especially small and marginal farmers, to adopt more efficient and appropriate farming practices.

### **(4) Access to quality inputs (Quality seeds and planting materials)**

One of the main challenges to agricultural productivity and quality is the inadequate availability of quality seeds and planting materials, which makes it difficult for farmers to obtain good seeds and improved varieties for sowing. This problem is exacerbated by the Haryana State Seed Certification Agency (HSSCA), which restricts the use of uncertified seeds. In addition, the shortage of good quality fruit seedlings and the growing popularity of seedless citrus varieties are threatening traditional varieties in Haryana. In Rajasthan and Tamil Nadu, on the other hand, varieties are being developed through grafting techniques.

Another challenge is the limited variety of flowering plants available in Haryana, despite a large market in neighbouring regions. Most of the high quality varieties come from other states. Similarly, the lack of processing facilities for spices, medicinal and aromatic plants limits the potential for local production and processing, in contrast to successful models in states such as Rajasthan.

Farmers who are unable to pay for materials before planting often resort to obtaining materials on credit from accredited seed suppliers and material dealers, using their harvests as collateral through producer groups (PGs). After the harvest, they pay the material suppliers.

In conclusion, to address these challenges, the project needs to promote activities that enable the procurement of quality seeds, materials and equipment through producer groups (PGs). This approach will improve the accessibility and quality of agricultural inputs, helping farmers to increase productivity and diversify crop varieties.

### **(5) Climate change**

- Changes in Weather Patterns: Haryana, like many other regions, is experiencing shifts in
-

its weather patterns. This includes rising temperatures and unpredictable changes in rainfall patterns. These alterations in climate can have a profound impact on the field of horticulture within the state. The extreme high temperature in summer and low, frost temperature caused by climate change should be counted in enough to be matched to project plan. A review of the data on climate change shows that for smooth implementation of the project, sufficient care needs to be taken to adapt to the changing monsoon rainfall patterns in the region (Bhiwani, Faridabad, Fatehabad, Gurgaon, Jhajjar, Jind, Karnal, Kurukshetra, Mahendragarh, Rohtak, Sirsa and parts of Sonapat), adequate attention is needed to adapt to changes in monsoon rainfall patterns.

- Delays in the onset of the monsoon, long dry spells and early cessation of the monsoon are also predicted.
- Impact on Horticulture: The changes in weather can create a challenging environment for horticultural crops in Haryana. Higher temperatures can stress plants and disrupt their growth cycles, making them more susceptible to diseases and pests. Additionally, erratic rainfall patterns can lead to water shortages or excessive moisture, further compromising crop health. A study assessing ozone-related crop yield losses for wheat, rice, cotton, and maize in Punjab and Haryana found significant yield reductions. For instance, relative yield losses for wheat ranged from 27 to 41%, and for rice from 21 to 26%. This indicates substantial losses in crop production due to environmental stressors<sup>29</sup>.
- Pest and Disease Outbreaks: One of the most significant consequences of these changing weather patterns is the increased occurrence of pests and diseases in horticultural crops. When plants are stressed due to unfavourable weather conditions, they become more vulnerable to attacks by insects, fungi, and other pathogens. As a result, farmers in Haryana often face substantial yield losses. Research on the pathogenicity of entomopathogenic fungi against *Helicoverpa armigera*, a significant pest in India, noted that agricultural production of pulses suffered an average yield loss of about 67% due to high levels of insecticide resistance in *H. armigera*<sup>30</sup>.
- Timely Pest Outbreak Alerts: To address this issue, it is crucial for the Department of Horticulture to issue pest outbreak alerts well in advance, ideally at least one month ahead of the expected outbreak. This proactive approach is essential because waiting until the pests or diseases have already struck is often too late to effectively control the situation.
- Preventive Measures Over Reactive Solutions: The rationale behind issuing early alerts is that preventive measures are always more effective and sustainable than reactive ones. Instead of resorting to the immediate application of chemicals and pesticides when an outbreak occurs, farmers can take pre-emptive actions when they receive advance warnings. These actions may include adjusting planting schedules, implementing crop rotation, enhancing soil health, and adopting integrated pest management strategies.
- Benefits of Early Alerts: By providing farmers with timely information about potential pest and disease outbreaks, the Department of Horticulture can help them reduce both the extent of damage to their crops and the financial burden associated with the use of chemicals. This not only protects the livelihoods of farmers but also promotes sustainable and environmentally friendly practices in horticulture<sup>25</sup>.
- In conclusion, the climate change in Haryana poses significant challenges to the horticulture sector, leading to an increase in pests and diseases; making these known in advance through the PG is a proactive approach for farmers to take preventive measures, ultimately reducing crop damage and chemical interventions. reduce crop damage and the need for chemical interventions. Appropriate corrective measures to mitigate this problem include, 1) Select suitable crops for vulnerable areas, 2) Apply water-saving technologies to these areas, and 3) Some areas may be affected by increased rainfall during monsoons, so project interventions may include the provision of suitable storage areas.

<sup>29</sup> <https://acp.copernicus.org/articles/15/9555/2015/>

<sup>30</sup> <https://www.walshmedicalmedia.com/open-access/pathogenicity-of-three-entomopathogenic-fungi-against-helicoverpa-armigera-2157-7471.1000114.pdf>

## **(6) Lack of infrastructure for postharvest management**

- The lack of proper infrastructure, such as cold storage facilities, transportation, and packaging facilities, makes it difficult for farmers to preserve and transport their produce to the market in high price time. The area under horticultural crops in Haryana increased from 326,000 ha in 2007 to 528,000 ha in 2017. However, storage facilities are inadequate for the amount produced, and losses due to spoilage of fresh produce are a major problem. For instance, Haryana State produced 300,000 tonnes of onions in 2015 and had only 295 packhouses compared to the required 1,695. A significant shortage of facilities was found. Therefore, it is important to provide such facilities in this project.
- Overall, horticulture activities in Haryana have a lot of potential for growth and development. Favourable climate for horticulture crops, makes Haryana one of India's leading horticultural crop-producing states, with the highest production of cucumber, carrot, and strawberry, the second highest output of radish, the third highest production of sweet pepper and bitter melon, the fourth highest production of cauliflower and the fifth highest production of muskmelon in the country. However, there is a need for the Government and other stakeholders to address the challenges faced by the sector and implement measures to promote its sustainable growth. These challenges will require a multi-faceted approach that includes investing in modern technology and infrastructure, promoting sustainable farming practices, and providing training and support to farmers.

## **3.4 Supply Chain of Vegetables and Fruits in Haryana**

### **3.4.1 Overview of the Supply Chain**

The supply chain of agricultural produce in India is characterized by a segmented structure. The supply chain involves various kinds and a lot of intermediaries in its multi-layered structure. It is reported that vegetables and fruits must pass 5 to 6 different distribution channels from the farm gates to the consumers on an average. The figure below outlines the distribution channels of vegetables and fruits in Haryana based on the collected information through the survey. Main actors in this market channel's general information is following. Please note that this is the general information, and it can vary each APMC and market channel.

#### **(1) APMC (Agricultural Produce Market Committee)**

Role: The APMC is a governmental regulatory body that oversees wholesale markets for agricultural produce. Through this system, farmers are mandated to sell their crops only at the designated APMC mandis (markets), rather than directly to consumers or retailers.

Value Addition: The APMC is intended to provide farmers with a stable market and an opportunity to sell at fair prices. However, this has often been a subject of debate.

General Facilities: APMC markets typically have basic facilities for product quality assessment, weighing, packaging, and storage.

#### **(2) Commission Agents**

Role: Commission agents act as middlemen between farmers and buyers in the APMC system. They assist in the sale of the produce and charge a commission for their services.

Value Addition: They provide a link between farmers who may not have direct access to large buyers and the buyers themselves. They handle negotiations, paperwork, and sometimes the logistics of the sale.

General Facilities: They might have offices or desks within the APMC markets and tools for record-keeping.

#### **(3) Village Aggregator**

Role: A village aggregator collects produce from various small farmers in a village or nearby areas and sells it in bulk at the APMC market or to other buyers.

**Value Addition:** They provide small farmers with an avenue to sell their produce without individually heading to the market. They aggregate the produce, which can lead to better pricing and streamlined logistics.

**General Facilities:** Storage facilities, transportation vehicles, and sometimes basic processing units.

**(4) Wholesaler**

**Role:** Wholesalers buy produce in large quantities from the APMC market or directly through commission agents and then sell it to retailers in cities and towns.

**Value Addition:** They provide a distribution mechanism, making produce available to urban retailers and, by extension, urban consumers.

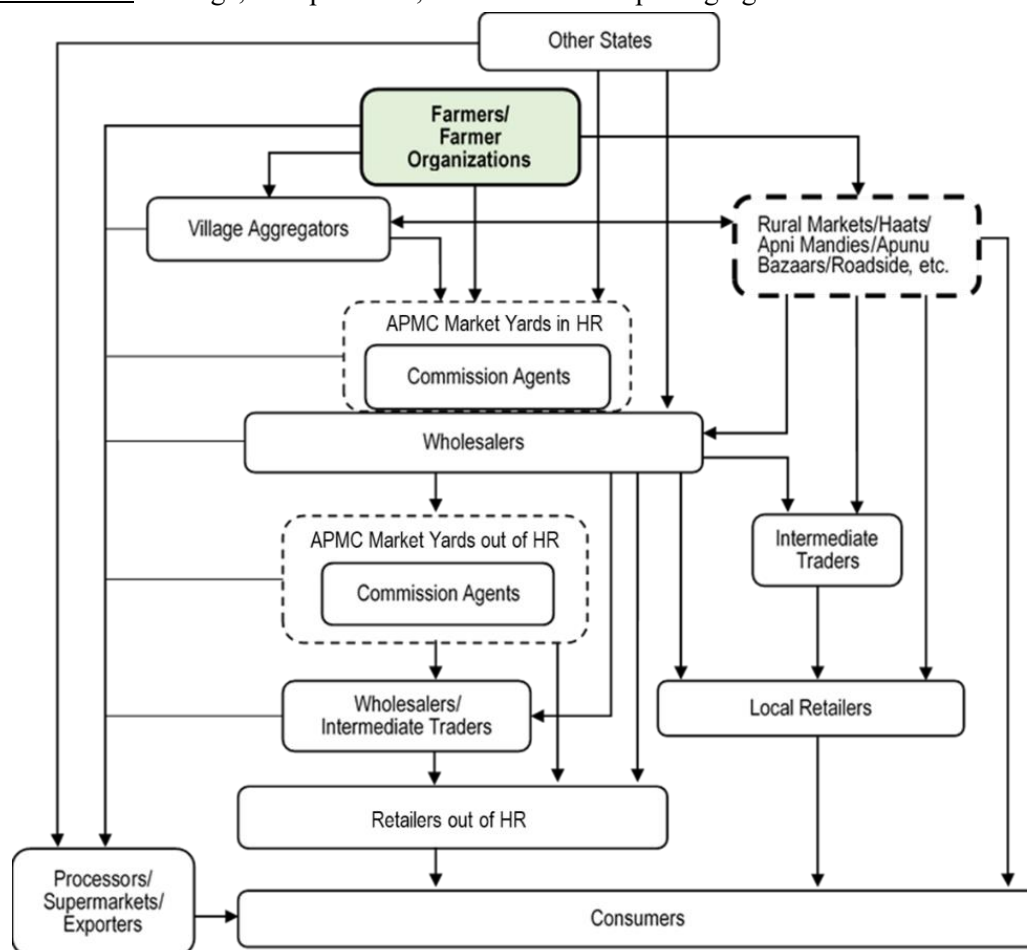
**General Facilities:** Large storage facilities, transportation, and sometimes processing units to clean or package the produce.

**(5) Intermediate Trader**

**Role:** These are traders who might buy from commission agents or wholesalers and sell to other traders or retailers, often operating in different regions or markets.

**Value Addition:** They help in distributing the produce to areas where direct supply from APMC or wholesalers might not be feasible or economical.

**General Facilities:** Storage, transportation, and sometimes repackaging units.



Source: The JICA Survey Team (※Under DOH Confirmation)

**Figure 3.4.1 Distribution Channels of Horticultural Produce in Haryana**

**3.4.2 Distribution of Horticultural Produce**

The Haryana State Government has framed a scheme namely Crop Cluster Development Programme (CCDP) to increase farmer income. Under this scheme, Small Farmers Agribusiness Consortium

Haryana (SFACH) in collaboration with Horticulture Department identified horticulture producing villages that are growing and have the potential of horticulture crops. The scheme started in 2016-17 with identification of 140 horticulture clusters with strength of 340 horticulture villages. Presently, 393 horticulture clusters are identified with the strength of 1763 horticulture villages. The nearby horticulture villages have been clubbed within a radius of 10km suitably to form a “cluster of horticulture producing villages” in the state. The idea behind the Clusterization of villages is that nearby progressive farmers can form their groups in shape of PG(FPOs/ FPCs)s in order to organise their production and marketing at horticulture villages level with proper forward & backward linkage and establishment of the Crop Cluster Agribusiness Centre (CCABC) at village level.

Regarding the need for packhouses, based on the production of horticultural crops in Haryana, it can be said that the number of packhouses required is as shown in Table 3.4.1.

**Table 3.4.1 Number of packhouse demand based on horticultural crop production in Haryana**

S. No.	Districts	Production			Packhouse demand		
		Fruits	Veg.	Total	Fruits	Veg.	Total
1	Charkhidadri	8,907	18,193	27,100	3	5	8
2	Panchkula	22,921	64,030	86,951	7	18	25
3	Faridabad	31,633	95,768	127,401	9	27	37
4	Rewari	17,844	110,693	128,537	5	32	37
5	Kaithal	11,842	137,636	149,478	3	40	43
6	Gurgaon	20,707	147,153	167,860	6	42	48
7	Narnaul (Mahendragarh)	48,462	97,743	146,205	14	28	42
8	Jhajjar	72,660	107,880	180,540	21	31	52
9	Hissar	60,892	139,172	200,064	17	40	57
10	Sonipat	96,616	92,633	189,249	28	27	54
11	Rohtak	25,738	147,117	172,855	7	42	50
12	Jind	39,613	307,644	347,257	11	88	100
13	Fatehabad	97,942	161,182	259,124	28	46	74
14	Bhiwani	70,705	183,570	254,275	20	53	73
15	Palwal	27,251	266,001	293,252	8	76	84
16	K/Keshtra	31,390	444,940	476,330	9	128	137
17	Sirsa	287,347	168,883	456,230	82	48	131
18	Karnal	53,430	443,505	496,935	15	127	143
19	Ambala	34,839	512,852	547,691	10	147	157
20	Mewat (Nuh)	18,477	639,514	657,991	5	184	189
21	Y/Nagar	123,170	667,687	790,857	35	192	227
22	Panipat	28,676	915,440	944,116	8	263	271
	All districts	1,231,062	5,869,236	7,100,298	353	1685	2038

Note: Assuming that 50% of the vegetable and fruit production in Haryana is handled in packhouses, the average daily handling volume of packhouses is 6.7 tons and the average number of operating days is 260 days per year.

Source: JICA survey team based on the data of DOH

The CCDP currently has 34 packhouses under construction and 89 approved. Table 3.4.2 shows the list of packhouses constructed in the CCDP.

**Table 3.4.2 The list of 34 Established projects under CCDP**

S.N.	District	Name of the PG(FPO)	Projected Amount (in INR Lakh)	Eligible Project Cost (in INR Lakh)	Subsidy Amount (in INR Lakh)	Commodity
1	Ambala	Optimal Agro Producer Company Limited	430.16	346.16	292.62	Tomato, Capsicum
2	Ambala	Shivalya Agrotech Producer Company Limited	456.79	456.79	395.02	Potato, Onion
3	Kurukshetra	Pehowa Vegetable Producer Company Limited	648.19	539.94	470.24	Potato, bitter gourd, peas, cauliflower, capsicum, green chilly

S.N.	District	Name of the PG(FPO)	Projected Amount (in INR Lakh)	Eligible Project Cost (in INR Lakh)	Subsidy Amount (in INR Lakh)	Commodity
4	Kurukshetra	Markandeshwar Farmer Producer Company Limited	758.05	599.02	529.37	Tomato, Potato, Onion, Green Chilly, Capsicum, Cauliflower
5	Kurukshetra	Growsmart Farmer Producer Com. Limited	695.43	599.92	530.63	Tomato , onion, potato and cauliflower
6	Kurukshetra	Crown Fruits & Vegetables Farmer Producer Company Limited	213.26	211.87	186.16	Tomato, Potato, Onion, Green Chilly, Capsicum, Cauliflower
7	Kurukshetra	M/s Khanpur jattan Farmer Producer Com. Ltd,	108.33	108.33	95.14	Tomato, Potato, Onion, Green Chilly, Capsicum, Cauliflower, Cucumber
8	Kurukshetra	Garvik Farmer Producer Company Limited	322.23	322.23	274.07	Carrot, Tomato, Cauliflower, Onion, Potato, Capsicum
9	Kurukshetra	Kurukshetra Vegetable Producer Company Limited	211.27	209.26	180.08	Carrot, Tomato, Cauliflower, Onion, Potato, Capsicum, cucumber, peas, mango, muskmelon, leafy vegetable, gauva
10	Kurukshetra	Kaulapur Farmer Producer Com.Ltd,	599.87	599.87	479.9	Potato and onion
11	Karnal	Progrowers Producer Company Limited	549.64	544.68	436.05	Tomato, Cucurbits, Okra
12	Karnal	Karnal Vegetable Farmer Producer Company Limited	237.94	237.07	206.62	Tomato, Cucurbits
13	Hisar	Chuli Khurd Farmer Producer Company Limited	219.5	219.5	194.49	Guava, citrus, onion, potato, cucurbits
14	Hisar	Shree Daadu Ram Farmer Producer Company Limited	219.62	219.62	192.73	Potato, Cucurbits, Kinnow, Guava, Leafy Vegetables
15	Hisar	Matter Shyam Farmer Producer Company Limited	218.4	218.15	188.58	Mushroom, Kinnow
16	Yamuna Nagar	Sili Kalan Farmers Producer Company Limited	239.21	238.93	206.87	Tomato, Cauliflower, Capsicum, Potato, Cucurbits, Garlic
17	Yamunanagar	M/s Radour Farmer Producer Com. Ltd,	210.53	208.41	181.72	Tomato
18	Yamuna Nagar	Jamalpur Farmer Producer Company Limited	329.21	328.67	280.31	Tomato, Cauliflower, Potato,
19	Panipat	Priyank & Samrath Fruit & Vegetables Producer Company Limited	285.38	284.35	248.24	All seasonal vegetable
20	Sonipat	M/s Aterna Farmer Producer Com.Ltd	599.52	556.28	448.18	Baby corn, Vegetables
21	Mahendergarh	Nakai Seed Producer Company Limited	499.86	499.86	425.44	Cucurbits
22	Mahendergarh	Bhayo natha Farmer Producer Company Limited	294.49	294.49	249.06	Citrus, Pea, Potato, Tomato, Guwava, Cucurbits
23	Mahendergarh	Dalanwas Farmer Producer Company Limited	284.2	283.22	239.97	Tomato,Potato,Carrot, Cucurbits
24	Mahendergarh	Rawat jaivik Farmer Producer Company Limited	284.76	284.76	242.85	Carrot,Onion,Potato,Cucur bits

S.N.	District	Name of the PG(FPO)	Projected Amount (in INR Lakh)	Eligible Project Cost (in INR Lakh)	Subsidy Amount (in INR Lakh)	Commodity
25	Kaithal	Kaithal Vegetable Farmer Producer Company Limited	222.45	219.57	188.67	All seasonal vegetable
26	Kaithal	Kharaudi Baghwani Producer Company Limited	241.71	241.71	210.38	Pea, Potato, Cauliflower, cabbage, chilli, cucumber, radish, tomato
27	Bhiwani	Bamla Farmers Producer Company Limited	236.22	234.57	204.13	Carrot, Potato
28	Bhiwani	Auxagri Farmer Producer Company Limited	327.22	327.22	261.77	Kinnow, Onion
29	Rewari	Dhawana herbs Farmer Producer Company Limited	253.2	253.2	219.27	Potato, tomato, cauliflower, onion, capsicum, cucurbits
30	Sirsa	Kharisureran Farmers Producer Company Limited	340.1	331.77	287.17	Kinnow and vegetables
31	Sirsa	Sirsa Farmer Producer Company Limited	586.47	544.25	461.8	Citrus, Potato, Green Chilli, Onion, Leafly Vegetable, Tomato, Peas, Okra
32	Sirsa	Sirsa Unique Farmer Producer Company Limited	220.13	213.85	186.59	Citrus, Potato, Green Chilli, Onion, Leafly Vegetable, Garlic, Tomato, 3-60 his 3-60 tunitir, Cupcicum
33	Nuh	ZIH High Value Vegetables Farmers Producer Company Limited	208.87	208.87	183.23	Tomato, cucumber, brinjal, capsicum, bottlegourd, cabbage, onion, peas, chilli
34	Fatehabad	Arshal Agro & Food Processing Producer Company Limited	543.76	507.2	405.76	Potato, Peas, Garlic, chilli, okra, tomato, onion, 3-60 his 3-60 a, cauliflower, brinjal, capsicum, mushroom, cucurbits (muskmelon, cucumber, pumpkin)
		<b>Total</b>	<b>12095.97</b>	<b>11493.59</b>	<b>9783.11</b>	

Source: DOH

Nineteen projects cost Rs. 100-300 lakh, 12 projects cost Rs. 300-600 lakh, and three projects cost Rs. 600-800 lakh. 70% of which are funded by grants from the CCDP and 30% by the shareholder.

To ensure sustainable packhouse operations, Forward and Backward Linkages must be identified in the value chain of the target crop at the time of application for packhouse construction.

In addition, consultants called CBBOs (Cluster-based Business Organizations) will be hired with government funds to assist in the formation of Forward and Backward Linkages. Table 3.4.3 shows the constituent shareholders of the PGs that operate each packhouse.

**Table 3.4.3 Number of share-holders per PG share amount**

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Source: DOH

### 3.4.3 APMC Market Model and APMC Mandi

During the period between the 1960s and 70s, most of the States of India enacted the Agricultural Produce Market Regulation Acts (APMR Acts). The drawbacks of regulated markets left most of the farmers in dire situations. To relieve the farmers from distress sale, Agriculture Marketing Reforms (2002) recommended the APMC Act to be amended. As a result, GOI designed a Model Agriculture Produce Market Committee (APMC) Act in 2003.

The stated APMC Act focuses on regulating, controlling, and monopolising the agriculture market, while the contents differ slightly from State to State. Except for National Strategic Food commodities procured by the Government, the APMC approved mandies transact almost all other agri-commodities.

Under the APMC Act 2003 the market committees were held responsible for ensuring transparency in the transactions, a suitable pricing system of the market area, providing market lead extension services to farmers ensuring payment of the products to the farmers on the same day, promoting agriculture processing, thereby, increasing the value of the produce and to promote in the establish public-private partnership (PPP) in these markets.

Commission Agents in APMC mandies charge commission on sales, which ranges from 1-2.5% in food grains and 4-8% in case of fruits and vegetables. APMCs are authorized to collect market fee from the buyers/traders on the sale of notified agricultural produce in lieu of the services provided by APMCs. The market fee is usually 1-2%.

Under the APMC Act 2003 the market committees were held responsible for ensuring transparency in the transactions, a suitable pricing system of the market area, providing market lead extension services to farmers ensuring payment of the products to the farmers on the same day promoting agriculture processing thereby increasing the value of the produce, this person the information of available and dates for selling the agriculture produce to the market, and to promote in the establish public-private partnership (PPP) in these markets.

Salient features of APMC Act 2003:

- i) The State is divided into several market areas. Each area is headed by a separate agriculture produce Market Committee, responsible for imposing its marketing regulation including fees
- ii) Other than APMC markets, New Market channels are established
- iii) Provision for notification of special markets in any market area for specified commodities
- iv) Provision of contract farming
- v) Availability of private wholesale markets
- vi) Provision of direct purchase
- vii) Single point level of market fee on the sale of notified agriculture commodities in any market



area

- viii) Resolving disputes between private market/ consumer market and market
- ix) Revenue earned by the APMC to help in the creation of marketing infrastructure

However, not all states have passed the bill. Some states have passed but neither framed rules nor notified it.

Presently there are 214 APMC market yards in 22 districts of Haryana trading in cereal crops, fruits and vegetables and spices and medicinal plants in these mandies.

### 3.4.4 Wholesale Price of Horticulture Crops in APMC Mandi

Minimum and maximum wholesale prices of the selected horticultural crops in APMC Azadpur Mandi, Haryana are listed in Table 3.4.4. APMC Azadpur Mandi is one of the largest agricultural produce markets in Delhi, India. It is run by the Agricultural Produce Market Committee (APMC) and serves as a major hub for the distribution of fruits, vegetables, and other agricultural produce from all over India. The market operates on a wholesale basis, with farmers and traders selling their produce in bulk to retailers and distributors. The market is known for its bustling activity and plays a significant role in the economy of the region.

The table shows the minimum and maximum wholesale prices (per kg) of various crops in India and their seasonal differences. The " $\Delta$ Max - Min" column indicates the ratio between the maximum and minimum prices.

The highest seasonal difference is observed in the case of ladyfinger with a difference of Rs 98/kg between the minimum and maximum prices. Similarly, tomatoes, watermelon, and gourd also show significant seasonal differences. Among the crops listed, mango has the maximum price of Rs 700/kg, followed by apple and orange. Spices such as garlic and ginger have the lowest seasonal differences, indicating that their prices are relatively stable throughout the year.

**Table 3.4.4 Pattern of the Price Changes in APMC Azadpur Mandi in Haryana**

No	Crop	Seasonal Difference		
		Min (Rs/kg)	Max (Rs/kg)	$\Delta$ Max - Min (Rs/kg)
1	Potato	2.00	30.00	28.00
2	Onion	5.00	45.00	40.00
3	Cabbage	0.75	30.00	29.25
4	Salad (Lettuce)	4.00	100.00	96.00
5	Cucumber	4.00	50.00	46.00
6	Cauliflower	2.00	50.00	48.00
7	Tomato	1.00	72.00	71.00
8	Capsicum	5.00	85.00	80.00
9	Lady finger (Okura)	2.00	100.00	98.00
10	Gourd	1.00	40.00	39.00
11	Peas	9.00	200.00	191.00
12	Garlic	10.00	180.00	170.00
13	Ginger	8.00	85.00	77.00
14	Coriander	3.00	130.00	127.00
15	Apple	6.25	200.00	193.75
16	Mango	5.00	700.00	695.00
17	Watermelon	2.00	80.00	78.00
18	Orange	5.00	500.00	495.00
19	Malta	8.00	133.50	125.50
20	Kinnow	2.00	70.00	68.00

Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

### 3.4.5 Demand Forecast of Horticultural Produce and Promising Crops

Future demand for agricultural crops in a certain area is theoretically estimated using the following information, which covers at least over the last decade continuously.

- Consumption of the said produce
- Income (GDP) per capita

• Population

In order to do the demand forecast the correlation between the forecasted trend of population and gross domestic product (GDP) is analyzed; apart from that the consumption and gross domestic product (GDP) is also analyzed.

Gathering information related to consumption of produce is very complex as no such information is maintained by the State(s) therefore, forecasting demand becomes a complex process not only in India but also in countries having sophisticated statistical information system.

Country-wise information of the consumption (supply) is available in FAO's database, although the information only covers limited agricultural crops.

Table 3.4.5 and Table 3.4.6 show available information concerning FAOSTAT. Figure 3.4.2 shows indexes of the information to compare their trend in a decade (2010–2020).

**Table 3.4.5 Per Capita Supply of Horticultural Produce in India 2010-2020 (unit: kg/year)**

Crops	Potatoes & products	Tomatoes & products	Onions	*All vegetables (no Potato)	Apples & products	**All fruits
2010	22.78	9.2	10.12	79.18	1.69	53.67
2011	23.12	11.94	11.95	80.26	1.73	51.61
2012	23.43	13.37	10.97	84.45	1.76	52.30
2013	23.77	12.87	12.67	87.48	1.79	55.19
2014	24.13	12.87	12.74	88.69	2.11	58.20
2015	24.9	11.33	12.5	87.95	1.74	54.35
2016	25.06	12.78	13.09	90.65	1.92	54.69
2017	25.48	14.16	14.14	90.92	1.8	58.13
2018	26.03	13.35	14.51	91.60	1.78	59.72
2019	25.59	12.72	14.28	91.22	1.73	60.24
2020	24.95	13.61	16.79	87.63	1.96	59.66
Average growth rate	0.9%	4.6%	5.5%	1.0%	2.0%	1.1%

\*includes: Sugar (Raw Equivalent); Beans, Peas, Vegetables, other; Coffee and products; Tea (including mate); Pepper; Cloves; Spices, Other (only)

\*\*includes: Cassava and products; Oranges, Mandarines; Grapefruit and products; Citrus, Other; Bananas; Dates; Fruits, other (only)

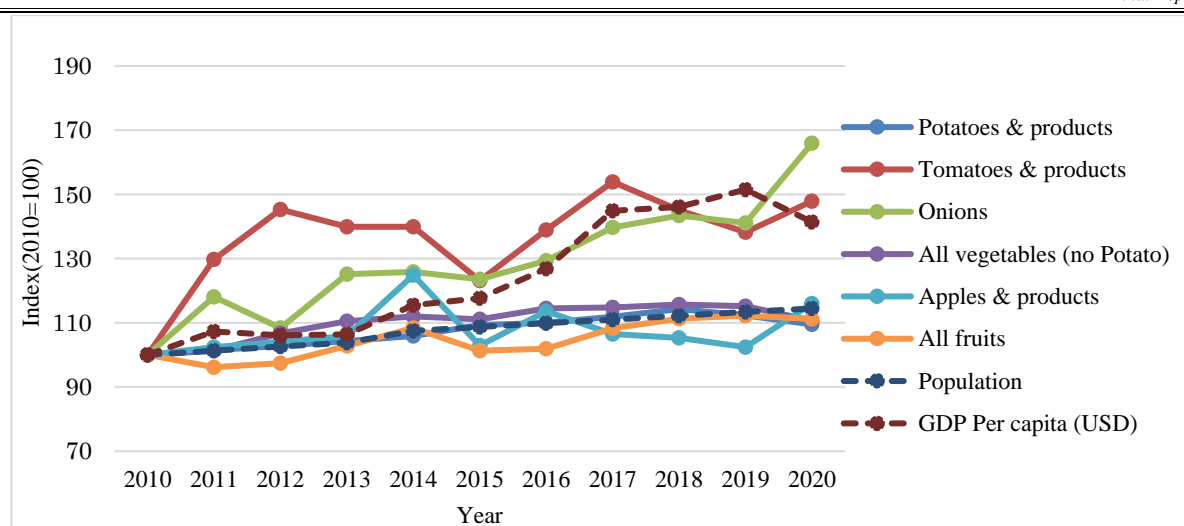
Source: FAOSTAT (<http://www.fao.org/faostat/en/#data>)

**Table 3.4.6 Population and Per Capita GDP in India 2010-2020**

	Population (x 1,000)	GDP per capita (USD)
2010	1,205,625	1351
2011	1,221,156	1450
2012	1,236,687	1434
2013	1,252,140	1438
2014	1,295,601	1560
2015	1,310,152	1590
2016	1,324,517	1714
2017	1,338,677	1958
2018	1,352,642	1974
2019	1,366,417	2047
2020	1,380,004	1910

Per Capita GDP source: <https://www.macrotrends.net/countries/IND/india/gdp-gross-domestic-product>

Source: FAOSTAT

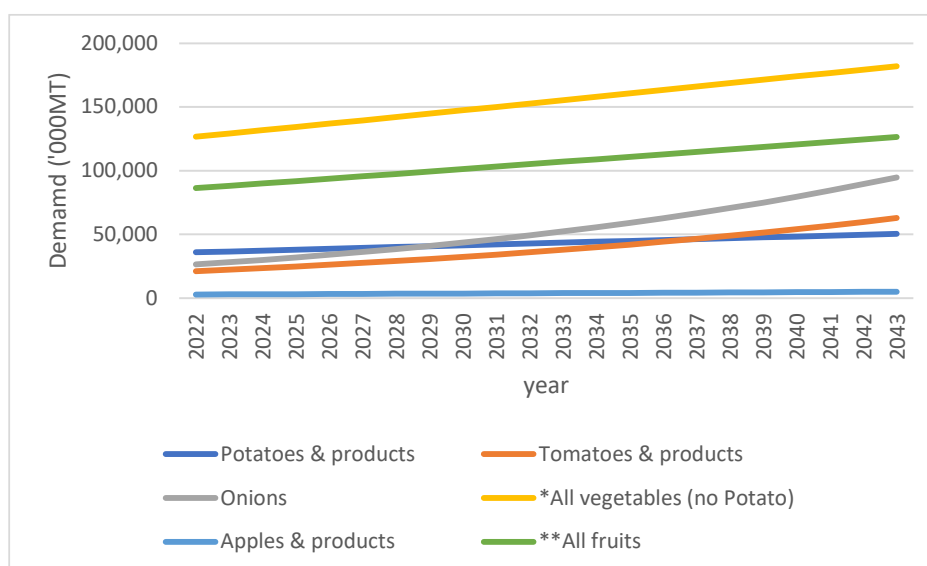


Source: FAOSTAT

**Figure 3.4.2 Per Capita Consumption, Per Capita GDP and Population Index (100 = 2009)**

In order to forecast the demand for horticultural crops in India, the assumptions described below were made.

- 1) Assumption 1: Projected demand for horticultural crops based on future population and per capita consumption of horticultural crops and their growth rate.
- 2) Assumption 2: To simplify the model for demand forecasting, the rate of increase in horticultural crop consumption per head of population is assumed constant, and the rate of increase is the average rate of increase between 2010 and 2020.
- 3) Assumption 3: As noted in Assumption 2, while horticultural crop consumption per capita is expected to increase, it is assumed to settle at a certain level in the long term. With this in mind, demand forecasts are made using the upper limit of horticultural crop consumption per capita as the global maximum value of food supply quantity for each crop<sup>31</sup>.



Source: FAOSTAT

**Figure 3.4.3 Horticultural crop demand forecasting**

<sup>31</sup> FAOSTAT, Food Balances (2010-)

**Table 3.4.7 Horticultural crop demand forecasting**

	Potatoes & products	Tomatoes & products	Onions	*All vegetables (no Potato)	Apples & products	**All fruits
2022	36,017	21,111	26,504	126,805	2,888	86,491
2023	36,645	22,265	28,198	129,171	2,968	88,186
2024	37,324	23,508	30,033	131,721	3,054	90,011
2025	38,007	24,814	31,980	134,292	3,142	91,852
2026	38,693	26,186	34,044	136,878	3,231	93,708
2027	39,380	27,626	36,233	139,478	3,322	95,576
2028	40,070	29,139	38,553	142,092	3,415	97,458
2029	40,762	30,726	41,010	144,718	3,510	99,350
2030	41,455	32,393	43,614	147,356	3,606	101,255
2031	42,150	34,140	46,371	150,004	3,704	103,170
2032	42,844	35,973	49,289	152,659	3,804	105,094
2033	43,539	37,894	52,377	155,322	3,905	107,026
2034	44,234	39,907	55,644	157,988	4,008	108,964
2035	44,927	42,016	59,099	160,658	4,112	110,907
2036	45,619	44,224	62,751	163,326	4,219	112,854
2037	46,309	46,535	66,611	165,995	4,326	114,804
2038	46,998	48,956	70,692	168,667	4,436	116,760
2039	47,684	51,488	75,002	171,335	4,546	118,717
2040	48,367	54,136	79,552	173,997	4,659	120,673
2041	49,047	56,906	84,357	176,655	4,773	122,630
2042	49,724	59,803	89,430	179,309	4,888	124,587
2043	50,396	62,830	94,781	181,952	5,005	126,540

Source: FAOSTAT

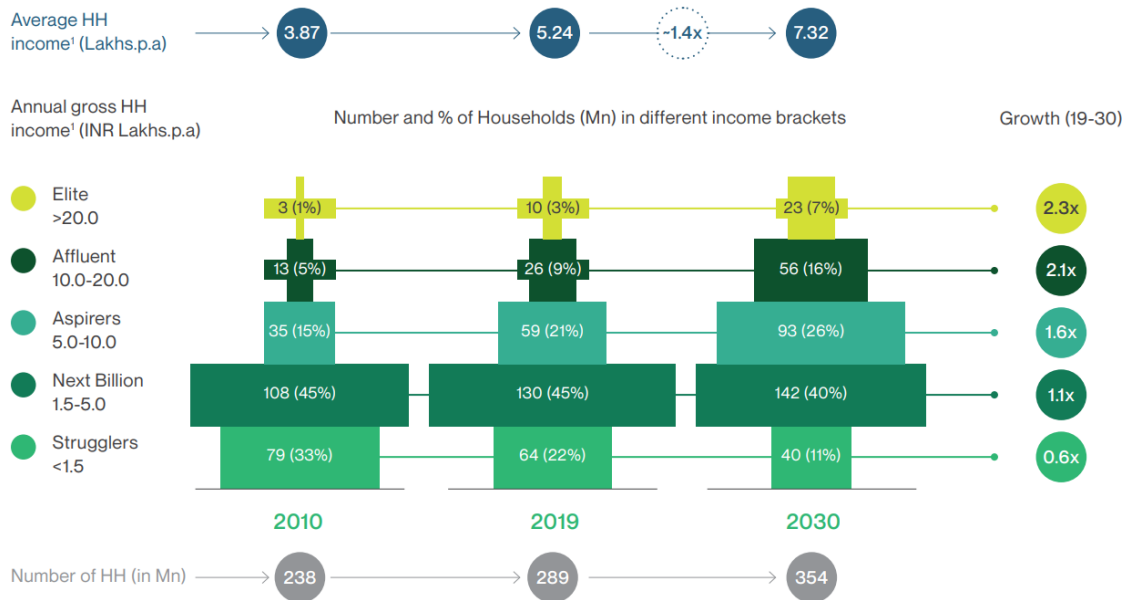
The above figure shows the following trend and demand forecast in India. The above figure shows the following trend in India in 2010-2020.

- i) Population has steadily increased (about 13% in a decade).
- ii) Per Capita GDP (income) has highly increased (about 70% in a decade).
- iii) Per Capita Consumption of all vegetables (no potato) and that of all fruits have steadily increased, although income elasticities of them are becoming low and likely to remain on a plateau after 2014.
- iv) Per Capita Consumptions of tomato and that of onion have increased in parallel with the income growth, while the consumption of both crops has shown a modest increase in the recent year.
- v) All vegetables (no potato) have increased with growth in population; we can observe a modest growth in the last decade parallel to the population growth.
- vi) All fruits have shown fluctuation over the last decade there has been a very little overall increase in consumption.

Figure 3.4.4 illustrates the rise in the proportion of middle- and upper-income households, implying an increase in the demand for high-quality products. Demand for high quality commodities is expected to

be linked to demand for high value-added agricultural products from packhouses where quality control and traceability are available.

Average household income is projected to increase 1.4-fold from 2019 to 2030. In particular, the consumption of high-quality horticultural products will increase as the number of middle- and upper-income households increases.

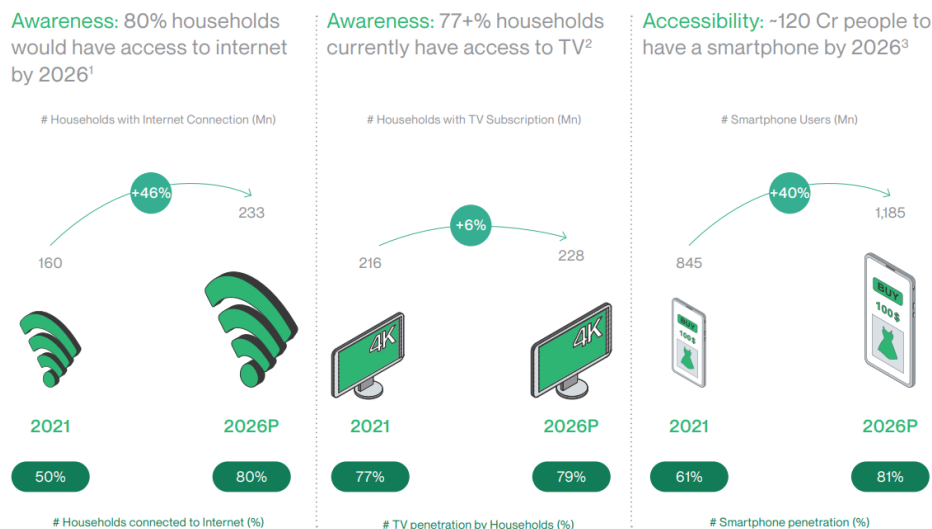


Note: Annual household gross income are based on 2019 prices.

Source: BCG, Racing Towards the Next Wave of Retail in India, April 2<sup>7</sup>h 2022

**Figure 3.4.4 Average household income**

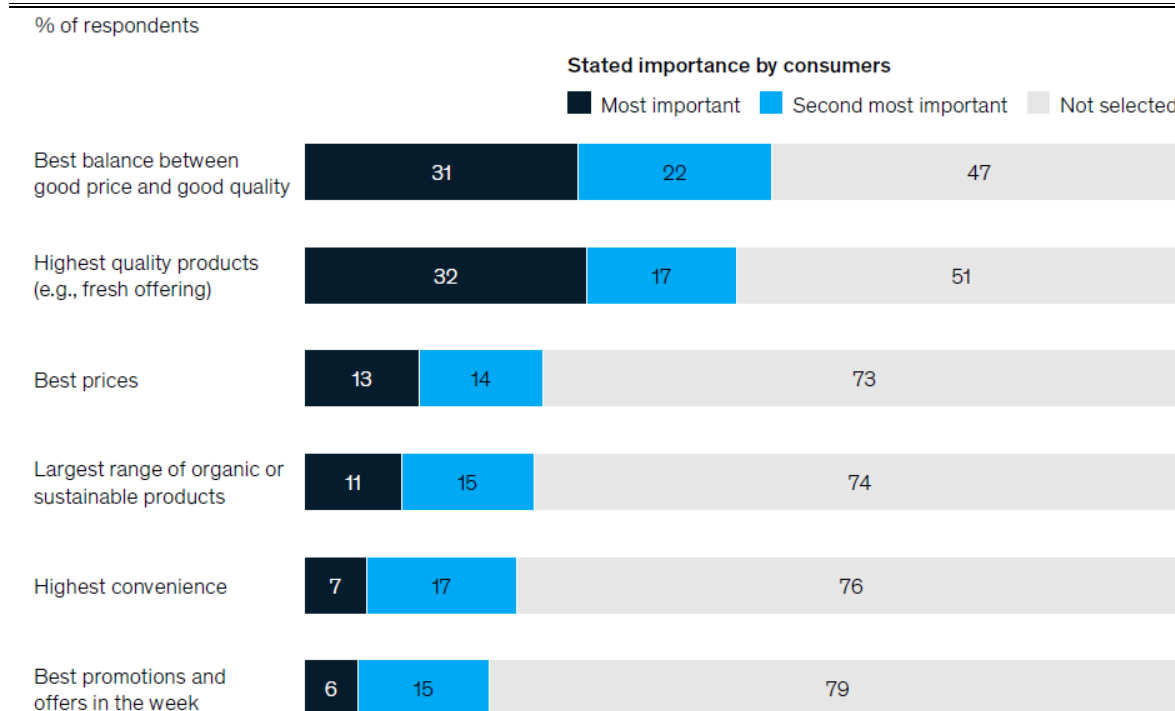
The expansion of the online market can be a significant factor influencing the demand for high-quality products by providing access to information and a wide array of products. Figure 3.4.5 indicates an increase in internet users, suggesting a subsequent rise in online market customers. The growth of the online market can act as a catalyst, offering many customers access to information and a diverse range of products. Therefore, it may intensify a recent shift in customer’ preferences, with a greater emphasis on quality (Figure 3.4.5, 3.4.6 and 3.4.7)



Note: 1. Omdia internet user forecast | Includes households connected by fixed or mobile broadband 2. Omdia TV forecast | Includes both Free and Pay TV 3. Statista

Source: BCG, Racing Towards the Next Wave of Retail in India, April 27<sup>th</sup> 2022

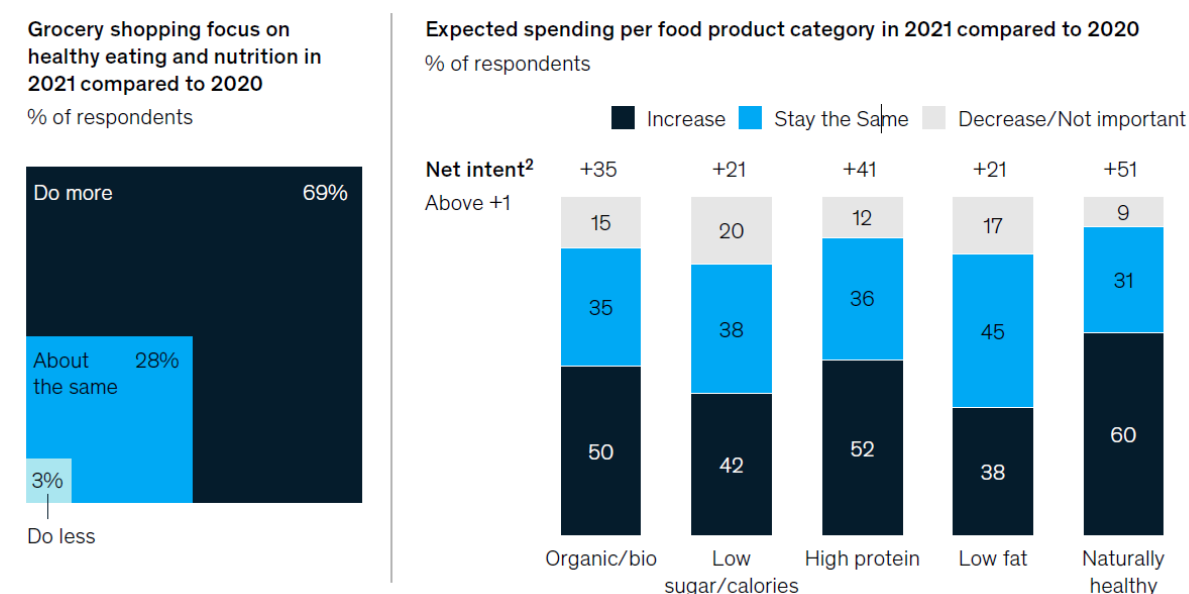
**Figure 3.4.5 Accessibility & Awareness to increase with higher smartphone and TV penetration & internet adoption**



Note: n = 1,091, sampled and weighted to match India's general population 18+ years  
Source: McKinsey & Company The state of grocery retail in India January 2022,

**Figure 3.4.6 Factors influence where to shop for groceries**

Net spending intent has improved across healthy and organic food with overall increase in focus on health and nutrition.



Net intent is calculated by subtracting the % of respondents stating they expect to decrease spending from the % of respondents stating they expect to increase spending.

Source: McKinsey & Company The state of grocery retail in India January 2022,

**Figure 3.4.7 Change in net spending intent towards healthy and organic food**

### 3.4.6 e-NAM (National Agriculture Market) and Quality Standards

GOI in its Union budget 2014-15 announced NAM which is a National Agriculture Market, a Pan India Electronic trading platform that connects the existing APMC(s) for making an integrated national market for agriculture commodities.

e-NAM<sup>32</sup> was launched by the Prime Minister of India in April 2016. It is operated through an online portal that is linked to various state APMCs and other wholesale markets. The system removes information (price) differences between buyers and sellers by providing real-time price estimates based on demand and supply. The operation of the e-NAM project is through an online portal that is linked to different State Mandies through software. The process of participation does not involve any transaction costs, the participating States make it free. This system is helpful as it bypasses the Commission Agents (Arhatiya) and the local and regional mandies in the process.

The objectives of APMC include; developing an efficient market system, specifying procedures and systems for infrastructure creation, and promoting processing of agricultural produce and their exports.

Salient features:



Source: Preparatory Survey on Himachal Pradesh Crop Diversification Project Phase-II (HPCDP II) in Republic of India, Final Report, JICA, March 2021

**Figure 3.4.8 e-NAM Transaction Procedure**

The quality standards and specifications for 203 commodities on the e-NAM portal is done with respective testing range i.e., range I or II or III. There are no penalties mentioned for shortcomings in case of quality. Majority of parameters on which the produce will be tested are physical in nature. The produce will be tested on its respective testing range as per the testing standards decided by DMI (Directorate of Marketing and Inspection).

As per inquiry to Haryana State Agricultural Marketing Board (HSAMB), out of 114 APMC mandies, 108 mandies use e-NAM and approximately 70% transactions are made through e-NAM.

### 3.4.7 Post-harvest Losses

Post harvest loss refers to food loss that occurs during transportation, processing, shipping, and marketing after harvest. Although there are many food losses during the production stage, they are considered poor quality and are recognized as losses during the production stage.

Table 3.4.4 provides estimates of post-harvest losses for various crops in India, including cereals, pulses, oilseeds, fruits, vegetables, plantation crops, and livestock. The overall total losses for all crops range from 3.08% to 15.88%. Compared to other crops, fruits and vegetables have relatively higher losses, indicating a need for more attention and efforts to reduce post-harvest losses in these sectors.

Among the fruits, guava has the highest percentage of losses at 15.88%, followed by mango at 9.16%, grapes at 8.63%, citrus at 9.69%, papaya at 6.7%, and sapota at 9.73%. Among the vegetables, tomato has the highest percentage of losses at 12.44%, followed by cauliflower at 9.56%, cabbage at 9.37%, potato at 7.32%, green pea at 7.45%, mushroom at 9.51%, tapioca at 4.58%, and onion at 8.2%.

**Table 3.4.8 Estimates of the Post-harvest Losses for Different Crops in India**

No.	Crop	Production (million tons)	Price (₹/tons)	Overall Total Loss (%)	Estimated Value of the Losses <sup>33</sup> (₹ crore)	Monetary Value of Losses (₹ crore)	
<b>Cereals</b>						24,941	73,093
1	Paddy	112.76	19,381	5.53	12,085	33,655	
2	Wheat	99.87	19,336	4.93	9,520	29,159	
3	Maize	28.75	15,505	4.65	2,073	6,865	
4	Pearl millet	9.21	14,381	5.23	693	1,987	
5	Sorghum	4.8	19,817	5.99	570	1,427	
<b>Pulses</b>						6,902	13,457
6	Pigeon pea	4.3	45,483	6.36	1,244	2,934	
7	Chickpea	11.23	46,700	8.41	4,411	7,867	
8	Black gram	3.56	47,319	7.07	1,191	2,527	
9	Green gram	0.16	53,945	6.6	57	129	

<sup>32</sup> Source: <https://byjus.com/free-ias-prep/e-nam/>

No.	Crop	Production (million tons)	Price (₹/tons)	Overall Total Loss (%)	Estimated Value of the Losses.33 (₹ crore)	Monetary Value of Losses (₹ crore)
Oilseeds					9,070	9,493
11	Cottonseed	11.62	33,802	3.08	1,210	2,475
12	Soybean	10.93	33,789	9.96	3,678	2,327
13	Safflower	0.06	28,979	3.24	6	12
14	Sunflower	0.22	32,442	5.26	38	46
15	Groundnut	9.25	41,808	6.03	2,332	2,514
Fruits					25,083	75,295
17	Banana	30.81	19,794	7.76	4,732	16,771
18	Citrus	11.52	33,475	9.69	3,737	11,068
19	Grapes	2.92	57,930	8.63	1,460	4,635
20	Guava	4.05	28,598	15.88	1,839	3,127
21	Mango	21.82	51,645	9.16	10,322	30,426
22	Papaya	5.99	18,563	6.7	745	3,002
23	Sapota	1.18	29,455	9.73	338	938
Vegetables					17,374	54,615
24	Cabbage	9.04	10,843	9.37	918	2,647
25	Cauliflower	8.67	16,848	9.56	1,396	3,944
26	Green pea	5.42	37,555	7.45	1,516	5,699
27	Mushroom	0.49	1,08,493	9.51	506	1,329
28	Onion	23.26	18,857	8.2	3,597	11,974
29	Potato	51.31	13,843	7.32	5,199	19,036
30	Tomato	19.76	15,267	12.44	3,753	8,387
31	Tapioca	4.95	21,540	4.58	488	1,599
Plantation crops and spices					31,033	36,059
32	Areca nut	0.83	1,85,504	4.91	759	924
33	Black pepper	0.07	3,51,404	1.18	27	148
34	Cashew nut	0.82	3,63,514	4.17	1,238	1,788
35	Dry chilies	2.15	84,154	6.51	1,177	1,086
36	Coconut	16.41	2,74,455	4.77	21,487	27,023
37	Coriander	0.71	31,893	5.87	133	136
38	Sugar cane	379.9	1,941	7.89	5,818	4,424
39	Turmeric	1.13	78,260	4.44	393	531
Livestock					53,422	53,422
41	Fish	12.6	1,38,222	7.9	13,735	13,735
42	Meat	7.7	8,42,109	4.7	30,447	30,447
43	Milk	176.4	45,600	0.9	7,398	7,398
Total					1,67,825	3,15,434

Source: Supply-side Problems in Food Loss and Waste Issues in Mitigation through Cold Chain (2022)

ICAR-CIPHET (Indian Council of Agricultural Research -Central Institute of Post Harvest Engineering & Technology) conducted a survey and statistically compared changes between 2005-07 and 2013-14.

Losses of wheat, mustard, groundnut, mango, guava, and mushrooms decreased significantly, as did tapioca, areca nut, black pepper, and cilantro. However, losses for corn, sorghum, chickpeas, soybeans, sunflowers, citrus, sapota, cauliflower, cashew nuts, marine fish, meat, and poultry increased significantly.

Average losses for food grains, oilseeds, and fruits and vegetables combined ranged from 3.08% to 15.88% during 2005-14. According to this study food loss rates are sparse across crops. Pulses, Eggs, Milk, Meat, and Marine Fishery showing increasing loss rates. On the other hand, Cereals, Oilseeds, Fruits, Vegetables, and Inland Fishery showed declining loss rates.

**Table 3.4.9 National Food Loss Estimates, 2005–2014**

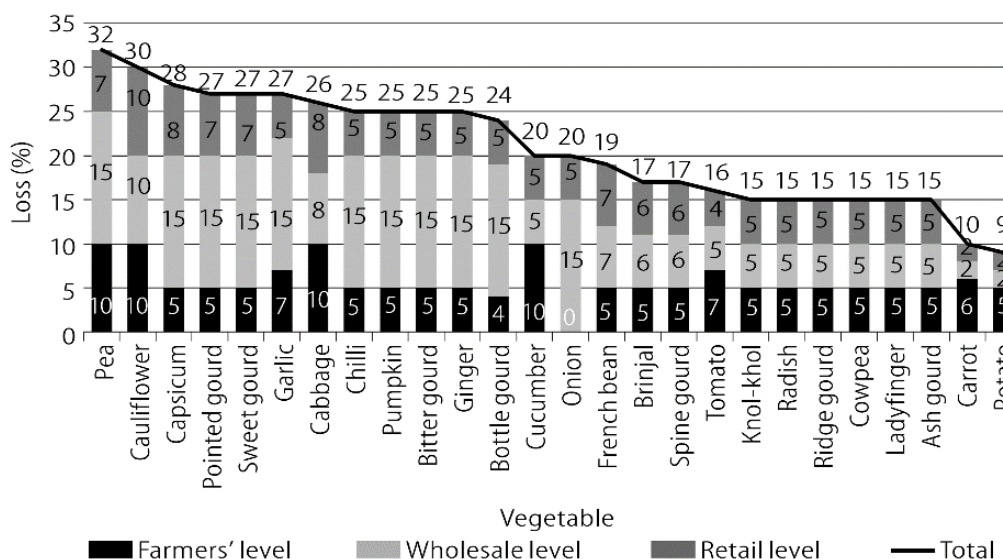
COMMODITY	2005–07	2013–14
	(Percentage of losses)	
Cereals	3.87–5.93	4.65–5.59
Pulses	4.28–6.04	6.36–8.41
Oilseeds	5.77–18.04	6.70–15.88
Fruits	2.75–10.06	3.08–9.96
Vegetables	6.88–12.47	4.58–12.44



Eggs	6.55	7.19
Milk	0.77	0.92
Meat (Sheep & Goat)	2.23	2.71
Inland Fishery	6.92	5.23
Marine Fishery	2.78	10.52

Source: FOOD LOSS AND WASTE IN INDIA: THE KNOWN AND THE UNKNOWN (2021)

According to the Small Farmers Agribusiness Consortium (SFAC), a survey of field operations showed that the losses in the midstream of the value chain are the majority of all losses. These losses range from 9% to 32% for vegetables (Figure 3.4.9). For example, in case of the peas, 10% loss happens at the farmer's level, 15% loss at the wholesale level and 7% at the retailer level.

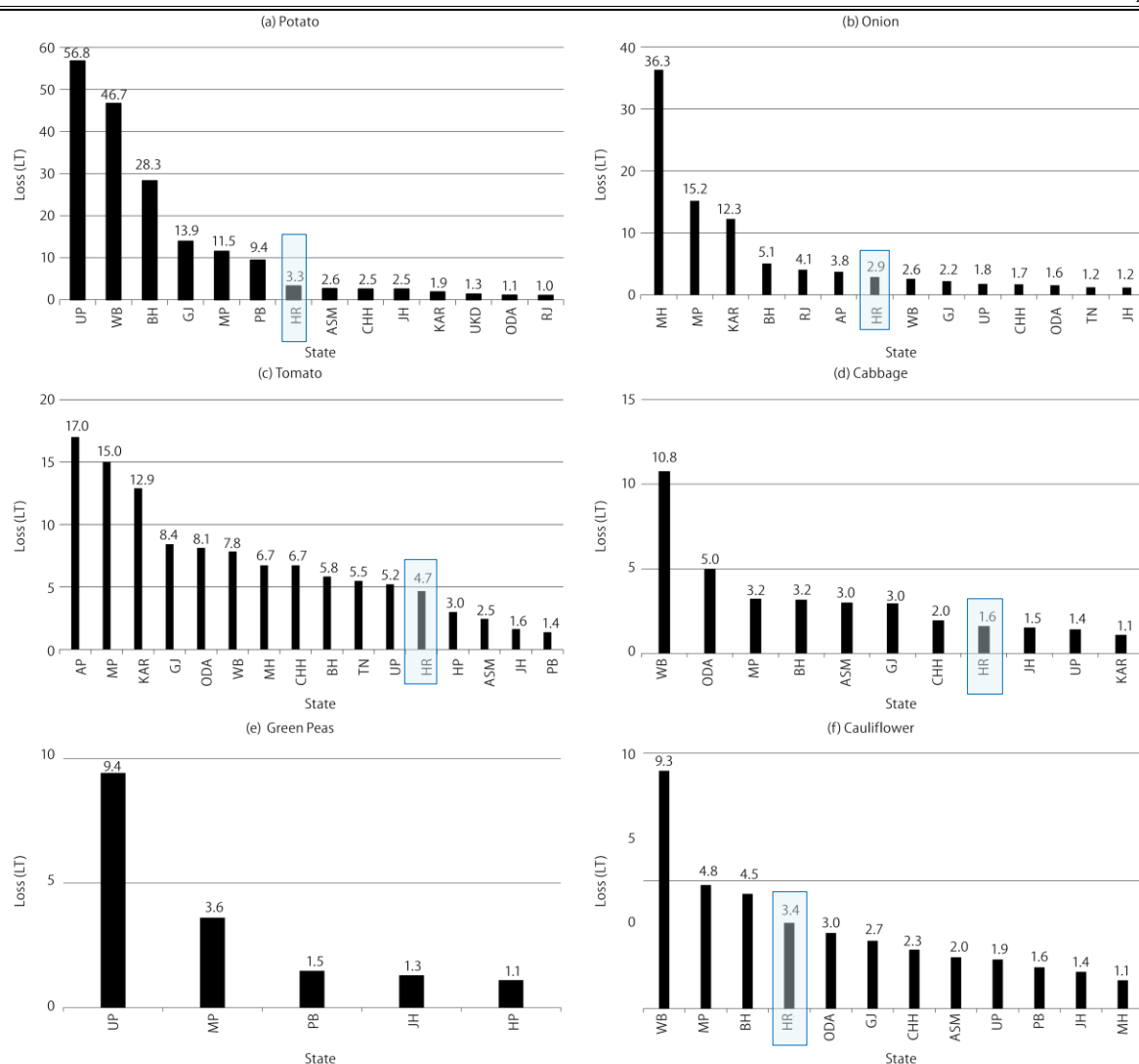


Source: Status of Farmers' Income: Strategies for Accelerated Growth: Inter-linkages between Input Costs, Diversification, Capital Formation and Income-Volume II, Gol (2017)

**Figure 3.4.9 Food Loss Estimates in Vegetables in Remote Areas by Small Farmers' Agribusiness Consortium**

The losses in vegetables are compared on Figure 3.4.10. Compared to other states, vegetable loss in Haryana (HR) is middle to low amounts. According to a study by the Indian Council of Agricultural Research, the highest losses of fruits and vegetables occur in Bihar, followed by Assam, Uttar Pradesh, and Jharkhand. In contrast, states such as Punjab, Haryana, and Maharashtra have relatively lower losses. Major factors of the losses are considered below.

- i) Harvesting and handling practices: Poor harvesting and handling practices, such as using inadequate equipment, lack of training and education, and poor hygiene, can contribute to higher levels of loss and waste.
- ii) Inadequate infrastructure: States with poor infrastructure, such as inadequate storage facilities, poor transport facilities, and inadequate supply chain management, are more likely to experience higher levels of food loss and waste.
- iii) Inadequate infrastructure and lack of technology adoption: States that have not embraced modern technology and farming practices are more prone to food loss and waste. Technologies such as cold storage, refrigeration, and packaging can help preserve fruits and vegetables for longer periods, reducing the amount of waste.
- iv) Climate and environmental factors: States that are more susceptible to natural disasters, such as floods, droughts, and cyclones, are more likely to experience higher levels of food loss and waste.
- v) Market demand and supply: States with high demand for certain fruits and vegetables may experience more loss due to the pressure to meet market demand, which can lead to overproduction and subsequent waste.



LT = lakh tonnes, UP = Uttar Pradesh, WB = West Bengal, BH = Bihar, GJ = Gujarat, MP = Madhya Pradesh, PB = Punjab, HR = Haryana, ASM = Assam, AP = Andhra Pradesh, CHH = Chhattisgarh, JH = Jharkhand, KAR = Karnataka, UKD = Uttarakhand, ODA = Odisha, RJ = Rajasthan, TN = Tamil Nadu, HP = Himachal Pradesh, and MH = Maharashtra  
Source: Supply-side Problems in Food Loss and Waste Issues in Mitigation through Cold Chain (2022)

**Figure 3.4.10 Losses in Vegetables across States in India (lakh tonnes), 2018**

### 3.4.8 Agribusiness Related to Supply Chains of Vegetables and Fruits

#### i) Digital Transformation (DX) Related Industries

Ministry of Agriculture & Farmers Welfare has commenced the work for creating “Agristack” in the country. Agristack is an ecosystem for facilitating the delivery of digital services to farmers established by Government and AgriTechs, Agri Startups, PG(FPO)s and other entities. The purpose of Agristack is to facilitate the farming and to create higher returns for the farmers. Agristack is consisted of various databases, policies, data sharing, IT systems regulators. Details of components are listed below.

- Unique Farmer ID
- Electronic Farm Record
- Geo referenced village maps
- Real Time Crop Data
- Consent framework for sharing of farmers database
- Unified Farmers Service Interface (UFSI)
- Protocols
- APIs

- Core Registries
- Master Codes
- Weather Data
- Real Time Prices
- DBT System
- GIS
- ICAR’s digital, data repository on-farm practices
- Government & Private Parties’ IT applications to use the above building blocks to deliver services to farmers
- Sandbox
- Data Exchanges

Memorandum of Understandings (MoUs) for Proof of Concepts (PoCs) for Agristack with various companies for development of use cases have been signed.

**Table 3.4.10 MoU signed Companies for POCs for Agristack**

No.	Name of the Company	Focus Area
1	Microsoft India Pvt. Ltd	For consolidating agriculture ecosystem across the value chain (farm to fork) to empower the farmer using Data Analytics in 100 villages.
2	ESRI India Technologies Limited	For the Establishment & Launch of the “Nation Agriculture Geo Hub” and for using their ‘ArcGIS’ platform enabling a GIS layer over Farmers’ Database.
3	Amazon Web Services India	For digital services across the agriculture value chain and creating an innovation ecosystem around digital agriculture
4	Star Agribazaar Technology Private Limited	For collaborating with Department of Agriculture on a pilot project to promote digital agriculture
5	Patanjali Organic Research Institute Private Limited	For farm management and farmers service
6	JIO Platforms Ltd	For taking up primary intervention module, i.e., advisory (basic as well as advanced) service in first phase
7	ITC Limited	For building a Customized ‘Site Specific Crop Advisory’ service and Digitization of Dairy Value Chain and support Wheat crop operations
8	Cisco Commerce India Pvt Ltd	For conceptualizing a Proof of Concept in effective knowledge sharing between farmers, administration, academia and industry
9	NCDEX e-Markets Ltd (NeML)	For a digital marketplace to contribute effectively towards increasing the income of farmers and improve farm efficiency/efficiency of the agriculture sector
10	Ninjacart – 63Ideas Infolabs Pvt Ltd	for developing and hosting the Agri Marketplace Platform
11	Artificial Intelligence Unit of National Entrepreneurship Network (Wadhvani AI)	Scale the Pest Management Solution for Cotton Farmers to about 50,000 lead farmers and 500000+ cascade farmers in 2022 Kharif season. Create AI/ML solutions.

Source: Ministry of Agriculture & Farmers Welfare

Survey team contacted some agri-tech companies and Agribazaar and Cropin showed interests to make partnerships with DOH and horticulture PG(FPO)s in Haryana. Hence, Agribazaar and Cropin are researched in detail to find out the possibility of partnership. Especially, Agribazaar is currently dealing with commodities on the online platform but expanding its business to horticulture, which has a high possibility of future partnership with PGs in Haryana.

#### Business of Star Agribazaar Technology

- **Online Trading Platform:** Star Agribazaar Technology provides an online platform where farmers can list their produce, and buyers such as traders, processors, and exporters can discover and purchase agricultural commodities. The platform enables transparent price discovery and simplifies the buying and selling process for all parties involved.
- **Quality Assurance:** To ensure that the agricultural commodities listed on the platform meet the required quality standards, Star Agribazaar Technology implements a robust quality assurance process. This includes physical inspections, sample testing, and certification of produce, providing confidence to buyers about the quality of the products they purchase.

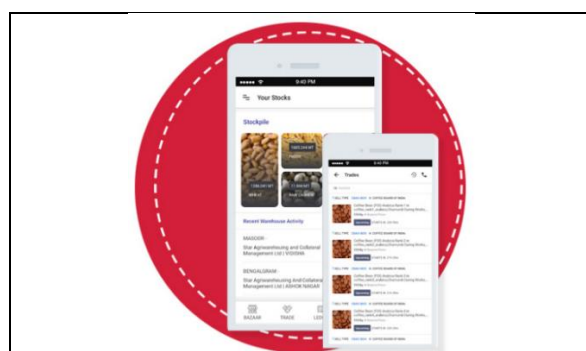
- **Logistics and Warehousing Solutions:** Star Agribazaar Technology also offers logistics and warehousing solutions to help facilitate the transportation and storage of agricultural commodities. This includes arranging transportation for goods, providing warehousing facilities, and managing inventory for sellers.
- **Financing Solutions:** The company provides financing solutions to farmers and other stakeholders in the agricultural supply chain. This includes working with financial institutions and banks to offer credit facilities, enabling farmers to access funds for working capital, equipment, and other essential resources.
- **Market Information and Advisory Services:** Star Agribazaar Technology offers market information and advisory services to help farmers and other stakeholders make informed decisions about their agricultural activities. This includes providing insights on market trends, crop prices, and best practices for cultivation and post-harvest management.

Cropin is an Indian agTech company that provides data-driven farming solutions and digital tools to help farmers enhance productivity, minimize risk, and ensure sustainable growth. Cropin focuses on relatively large-scale farmers as their business model and has a possibility to utilize their technology with a demonstration fields.

**Table 3.4.11 Surveyed Agricultural Equipment and Materials Company**

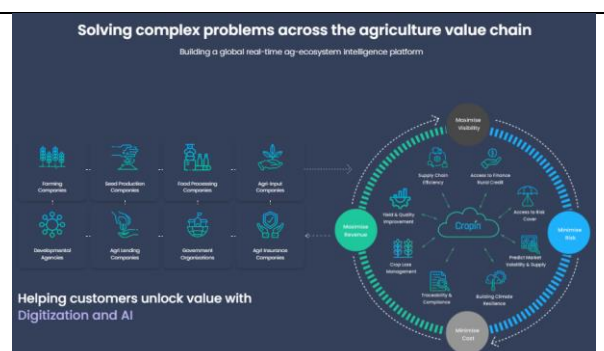
Company Name	Location of the company	Business Description	Possible Partnership
Star Agribazaar Technology Private limited	Headquarter: Mumbai (Maharashtra) Karnal/ Gurugram District, etc.	<ul style="list-style-type: none"> <li>• Star Agribazaar Technology is an Indian agtech company that operates an online marketplace platform for agricultural commodities.</li> <li>• With the marketplace platform, farmers can use the transparent market channel and commission is charged only to the buyer.</li> </ul>	<ul style="list-style-type: none"> <li>• Horticulture PGs in Haryana uses the online platform and realize more transparent transactions</li> <li>• Agribazaar arranges the third-party logistics and warehouses and help PGs to expand market channels</li> </ul>
Cropin Technology Solutions	Gurugram District	<ul style="list-style-type: none"> <li>• Farm Management Software/ Remote Sensing and Satellite Imagery to help farmers for managing their day-to-day operations, monitor crop growth, and optimize resource usage.</li> <li>• Weather Forecasting and Crop Modeling</li> <li>• Traceability of Crops with QR code</li> </ul>	<ul style="list-style-type: none"> <li>• Set up a demonstration fields under DOH and utilize Cropin technology. Do comparison between yields of with/without their technology and analyze cost effectiveness.</li> </ul>

Source: JICA Survey Team



Source: Agribazaar

**Figure 3.4.11 Agribazaar Input and Output Marketplace**



Source: Cropin

**Figure 3.4.12 Business Model of Cropin**

ii) Agricultural Equipment and Materials Companies

Agricultural equipment and materials businesses in Haryana have been growing due to the increased focus on modernizing agriculture and improving agricultural productivity in the state. Investment trends in the sector are focused on developing and supplying advanced farm machinery, equipment, and agricultural inputs such as seeds, fertilizers, and pesticides. Unique

points of Haryan’s agricultural equipment and materials market compared to other states include:

- Haryan’s proximity to the National Capital Region (NCR), provides easy access to markets and suppliers.
- A strong focus on mechanization and technology adoption in agriculture is driven by the stat’s progressive policies.
- Haryan’s role as a hub for agriculture-related research and development, with several agricultural universities and research institutions in the State.

Sakata Seed India is a subsidiary of Sakata Seed Corporation, a leading Japanese company that sells high-quality vegetable seeds.

**Table 3.4.12 Surveyed Agricultural Equipment and Materials Company**

Company Name	Location of the company	Business Description	Possible Partnership
Sakata Seed	Gurugram District	<ul style="list-style-type: none"> <li>• Sakata Seed India does not distribute fruits seeds just sells vegetable seeds.</li> <li>• Sakata Seed India has approximately 400 distributors in 29 States in India. Each district has more than 10 distributors, which also have direct sales to farmers.</li> <li>• 25 distributors in Haryana.</li> <li>• Digital market is under planning, but still, traditional trades are major in India.</li> </ul>	<ul style="list-style-type: none"> <li>• Sales of high-quality vegetable seeds to farmers and PG in Haryana.</li> <li>• Set up a demonstration fields under DOH and utilize Sakata seeds. Do comparison between yields of Sakata seed’s vegetables and traditional seeds and analyze cost effectiveness.</li> </ul>
Taiyo India	Rajasthan State	<ul style="list-style-type: none"> <li>• Taiyo manufactures of rotovalor blades and blade shafts in Rajasthan</li> <li>• Taiyo L Type blade is made with an extremely tough steel spring steel (SUP6) and has Taiyo’s original twist. This product has an average useful life that is 50% longer than the useful life of common blades.</li> </ul>	<ul style="list-style-type: none"> <li>• Sales of high-quality rotovalor blades to farmers and producer groups in Haryana.</li> <li>• Do comparison between yields with Taiyo rotovalor blades and local blades and analyze cost effectiveness in pilot farm</li> </ul>
Escorts Kubota	Faridabad District	<ul style="list-style-type: none"> <li>• Escorts Kubota is recognized for its contributions to the agricultural machinery sector, particularly in the realms of tractors and other agricultural machinery</li> </ul>	<ul style="list-style-type: none"> <li>• Sales / lease of high-quality tractor to farmers and producer groups in Haryana.</li> <li>• Do trial of the Kubota tractor in pilot farm</li> </ul>

Source: JICA Survey Team



Source: Taiyo

**Figure 3.4.13 Taiyo L Type blade**



Source: Escorts Kubota

**Figure 3.4.14 Escorts Kubota Tractor**

iii) Food Processing Industries

**Mega Food Park Scheme**

Haryana has a strong food processing industry, processing products such as wheat, rice, pulses, vegetables, fruits, milk, and meat. The State Government has initiatives like the Haryana State Industrial and Infrastructure Development Corporation and incentives like subsidies and tax

exemptions. The Mega Food Park Scheme<sup>34</sup> aims to increase value addition and market access. The Haryana Mega Food Park is expected to employ 5,000 people and benefit 25,000 farmers.

**Table 3.4.13 Outline of the Mega Food Parks in Haryana**

District Name	Company Name	Status	Investment Leverage (Rs. in Cr.)	Direct Employment Granted (in Nos.)	Farmers Benefited (in Nos.)	Processing Capacity (LMT) PA*	Preservation Capacity (LMT) PA*
Rohtak	Haryana State Cooperative Supply and Marketing Federation Limited (HAFED)	Ongoing	129.75	5,000	25,000	0.08	0.66
Sonipat	Haryana State Industrial and Infrastructure Development Corporation Ltd.	Ongoing	110.64			0.03	1.1

Source: Ministry of Food Processing Industries, India

\* (LMT) PA : Lakh Metric Tonnes Per Annual

The HSIIDC Sonipat Mega Food Park aims to attract investments in the food processing sector by providing a conducive environment for businesses to operate and grow. By offering modern infrastructure, advanced facilities, and business support services. HSIIDC is not an operator of the facilities and finding a lessee to operate the entire facility. The Mega Food Park is not designed to lease partially, for example parts of cold storage, hence relatively large-scale companies should be suitable as the operator.

**Table 3.4.14 Surveyed Food Processing Company**

Company Name	Location of the company	Business Description	Possible Partnership
HSIIDC	Sonipat District	<ul style="list-style-type: none"> <li>• Mega Food Park in Sonipat, Haryana aims to boost the growth of the food processing industry in the state.</li> <li>• The construction of facility is completed and finding a lessee for entire facility to start the operation.</li> <li>• Main facilities are described on attachment 3.4.2</li> <li>• Assumed lease price is around 1.0-1.5 crore in a year.</li> </ul>	<ul style="list-style-type: none"> <li>• Sub-lease some parts of facility from the lessee</li> <li>• Having a partnership as a buyer between PGs and the lessee (operator of the Mega Food Park)</li> </ul>

Source: Ministry of Food Processing Industries, India

### **Agro Processing Cluster**

Also, agro processing clusters<sup>35</sup> scheme is designed to promote the development of modern infrastructure and common facilities for food processing units. It is based on a cluster approach, linking producers or farmers with processors and markets through a supply chain enhanced with modern amenities. Each cluster includes basic infrastructure like roads, water, power supply, and drainage, as well as core facilities like warehouses, cold storages, and grading systems. A minimum of five food processing units, each with an investment of at least Rs. 25 crore, are established within these clusters, alongside the development of common infrastructure. A land area of at least 10 acres, acquired by purchase or lease for a minimum of 50 years, is required for setting up an Agro Processing Cluster.

Various entities, including government bodies, Public Sector Undertakings (PSUs), joint ventures, NGOs, cooperatives, self-help groups, farmer producer organizations, private sectors, and individuals, can establish these clusters. These entities, known as Project Execution

<sup>34</sup> The Mega Food Park Scheme is an initiative by the Government of India to establish food processing infrastructure and supply chain management in order to increase the value addition of agricultural and horticultural produce and to facilitate their market access.

<sup>35</sup> Agro Processing Cluster (APC) is a group of food processing units located in a designated area that share common facilities and services. The APC scheme is implemented by the Ministry of Food Processing Industries, Government of India, with the objective of creating modern infrastructure facilities for food processing in order to enhance the value addition and promote exports of processed foods.

Agencies (PEAs), are eligible for financial assistance under the scheme, subject to certain terms and conditions. The PEAs are responsible for the overall implementation of the projects, which includes preparing detailed project reports, land procurement, arranging finance, infrastructure development, and ensuring external infrastructure linkages. While PEAs can sell or lease plots within the cluster to other food processing units, the common facilities must remain communal and cannot be sold or leased out.

Main components of infrastructures are described as below.

① Basic Enabling Infrastructure

This includes essential facilities such as roads, water supply, power supply, drainage, and Effluent Treatment Plants (ETPs).

② Core Infrastructure/Common Facilities

Warehouses, cold storages, Individual Quick Freezing (IQF) facilities, tetra packaging units, and setups for sorting and grading.

③ Food Processing Units

At least five food processing units are required, with a collective minimum investment of Rs. 25 crore. These units should be established concurrently with the development of the common infrastructure.

**Table 3.4.15 Outline of the Agro Processing Clusters in Haryana**

District Name	Company Name	Status	Investment Leverage (Rs. in Cr.)	Direct Employment Granted (in Nos.)	Farmers Benefited (in Nos.)	Processing Capacity (Lakh Metric Tons / annual)	Preservation Capacity (Lakh Metric Tons / annual)
Hisar	Shree Shyam Snacks Food Private Limited	Completed	7.23	82	4,000	0	0.055
Karnal	Karnal Food Pack Cluster Limited	Ongoing	23.11	264	4,000	0.396	0.0836

Source: Ministry of Food Processing Industries, India

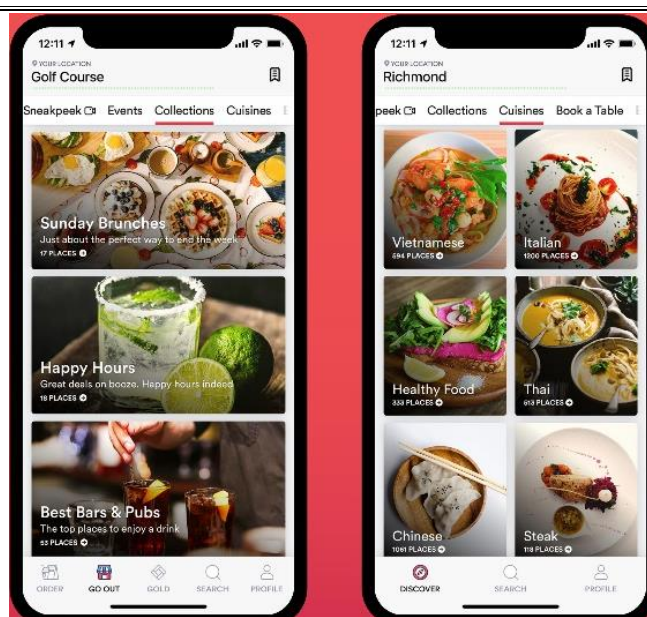
iv) Food Industries

The food industry in Haryana is experiencing growth, driven by various factors such as changing consumer preferences, increasing disposable incomes, urbanization, and growing demand for processed and packaged foods. Investments in the food industry are being made across different segments, including food processing, food retail, quick service restaurants (QSRs), food delivery, and food tech startups. This growth is driven mainly from below factors:

- **Skilled Workforce:** Haryana has a focus on skill development and education, including specialized institutions for food technology and hospitality management. This helps ensure the availability of a skilled workforce for the food industry.
- **Rapid Urbanization:** Haryana is witnessing rapid urbanization, with the development of new cities like Gurugram, Faridabad, and Sonapat. This urban growth is driving the expansion of food retail, QSRs, and food delivery services in the state.
- **Investment trends in Haryana's food industry** are influenced by factors such as the growth of organized food retail, the adoption of advanced food processing technologies, the increasing focus on food safety and quality, and the rising popularity of online food delivery platforms.

For example, Zomato is a leading food delivery and restaurant discovery platform in India, founded in 2008. The company connects consumers, restaurants, and delivery partners, offering a range of services aimed at enhancing the overall dining experience for users.





Source: Zomato

**Figure 3.4.15 Zomato Food Delivery Application**

v) Cold Storage Industries

**Surveyed Companies**

Every food business operator, including food storage facilities, in the Haryana is required to be licensed under the Food Safety and Standards Authority of India (FSSAI). The state has a significant number of licensed storage facilities for horticultural produce, mainly concentrated in the districts of Sonipat, Panipat, Karnal, and Ambala. The establishment of these storage facilities not only ensures the safe storage of horticultural produce but also helps in reducing post-harvest losses and increasing the shelf life of the produce.

ITE IceBattery is a Japanese company specializing in the development and manufacturing of innovative thermal energy storage solutions. Their main product, the IceBattery is designed to store and release energy in the form of cold or heat, depending on the application. With IceBattery, cold-chain with moisture control can be improved in Haryana.

**Table 3.4.16 Surveyed Cold Chain Company**

Company Name	Location of the company	Business Description	Possible Partnership
ITE	New Delhi	<ul style="list-style-type: none"> <li>The IceBattery is a thermal energy storage device that uses phase change materials to store and release energy as needed.</li> <li>The IceBattery can be used as cold storages or in reefer trucks</li> </ul>	<ul style="list-style-type: none"> <li>ITE sells IceBattery for cold storage and transportation to enhance farmer 's bargain power</li> <li>Do comparison between sales prices with/without IceBattery and analyze cost effectiveness in pilot farm</li> </ul>
Snowman Logistics	Chandigarh	<ul style="list-style-type: none"> <li>Snowman Logistics is India's first Cold Supply Chain Company with a nationwide presence.</li> <li>They offer a comprehensive range of integrated logistics services, including warehousing, transportation, distribution, and consultancy.</li> </ul>	<ul style="list-style-type: none"> <li>Snowman advises / manages the cold-chain to operate hub facilities</li> </ul>
Condair	Kolkata West Bengal State	<ul style="list-style-type: none"> <li>In the context of cold storage humidification, Condair offers solutions to manage the moisture content in cold storage environments, which is critical to maintaining the quality and shelf life of stored produce.</li> <li>They provide a range of humidifiers and</li> </ul>	<ul style="list-style-type: none"> <li>Condair sells moisture control equipment to prolong shelf life of crops</li> <li>Do comparison between sales prices with/without moisture control equipment and</li> </ul>



		related services to achieve optimal humidity levels, ensuring that produce retains its weight and quality through the supply chain	analyze cost effectiveness in pilot farm
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Source: JICA Survey Team

## IceBattery® Cold Chain Platform Multiple Temperature Cold Chain Logistic



Source: ITE

Figure 3.4.16 Usage of IceBattery



Source: Condair

Figure 3.4.17 Condair RS resistive steam humidifier



Source: Condair

Figure 3.4.18 JetSpray Compact low capacity air & water spray humidifier

Mainly to understand the usage of cold chain in Haryana, queried to some hotels (restaurant), which turns out that hotel (restaurant) does not use the reefer truck to procure vegetables and fruits. They procure from local markets with ambient temperature truck because the use of reefer trucks increases costs, making crops less cost-competitive due to the added expenses.

Table 3.4.17 Surveyed Hotel (Restaurant)

Company Name	Location of the company	Business Description	Possible Partnership
Mango Grove Hotel	Chandigarh	<ul style="list-style-type: none"> <li>Mango Grove Hotel is one of the best hotels in Chandigarh with middle size restaurant</li> <li>The restaurant purchase fruits and vegetables from local vendors with ambient temperature truck</li> </ul>	<ul style="list-style-type: none"> <li>N/A (hotel usually buys fruits and vegetables from vendors)</li> </ul>
Westin Hotel	Chandigarh	<ul style="list-style-type: none"> <li>The Westin Hotels &amp; Resorts is a luxury hotel chain owned by Marriott International</li> </ul>	<ul style="list-style-type: none"> <li>N/A (hotel usually buys fruits and</li> </ul>

Company Name	Location of the company	Business Description	Possible Partnership
(Marriot Group)		The restaurant purchase fruits and vegetables from local vendors with ambient temperature truck	vegetables from vendors)

Source: JICA Survey Team

General equipment and facility for cold chain and warehouse are summarized on Table 3.4.18. Cold chain and warehouse companies are listed up on Table 3.4.19 and Table 3.4.20.20. As shown on Attachment 3.4.3, there are around 180 private cold storage in Haryana, especially in Kurukshetra and Sonapat district.

**Table 3.4.18 General Facility for Cold Chain and Warehouse**

Facility	Description
Cold Storage Rooms	Temperature-controlled spaces ranging from walk-in coolers to large warehouses.
Refrigerated Transport	Vehicles with cooling systems, from small vans to large trucks, for transporting temperature-sensitive products.
Blast Freezers	Rapidly cool food products, reducing spoilage-inducing reactions.
Pallets and Racks	Organize storage in warehouses for efficient space utilization and easy product access.
Temperature & Humidity Monitors	Devices that continuously record temperature and humidity levels.
Air Curtains	Prevent warm air ingress at cold storage entrances, maintaining internal temperature.
Packaging Stations	Designated areas for packing products in controlled environments before transport.
Docking Stations	Minimize exposure of temperature-sensitive products during loading/unloading.
Warehouse Management Systems	Software for managing inventory, tracking products, and optimizing operations.
Backup Power Systems	Ensure continuous power supply, given the critical nature of maintaining temperatures.

Source: JICA survey team

**Table 3.4.19 Cold Chain Companies and Facilities in Haryana**

District	Company Name	Status	Investment Leverage (Rs. in Cr.)	Direct Employment Granted (in Nos.)	Farmers Benefited (in Nos.)	Processing Capacity (LMT) PA	Preservation Capacity (LMT) PA
Bhiwani	Microtrol Sterilisation Services pvt. ltd.	Completed	10.09	100	9,552	0	0
Faridabad	Nutrimed dairy LLP	Ongoing	20.44	NA	NA	0.76	0
Gurugram	Transport Corporation of India ltd.	Completed	34.42	100	9,552	0	0.29
Gurugram	Beejapuri Dairy private limited	Ongoing	18.89	NA	NA	1.51	0.01
Gurugram	Bveg Foods private limited	Ongoing	23.67	NA	NA	0.22	0.05
Hisar	Fresh Food processing	Completed	9.04	100	9,552	0	0.11
Nuh	VSM Food Cold chain and processors LLP	Completed	21.48	100	9,552	0	0.11
Nuh	*Freshena Foods private limited	Ongoing	11.37	NA	NA	0.22	0.05
Palwal	Hind terminals private limited	Completed	29.89	100	9,552	0	0.28

District	Company Name	Status	Investment Leverage (Rs. in Cr.)	Direct Employment Granted (in Nos.)	Farmers Benefited (in Nos.)	Processing Capacity (LMT) PA	Preservation Capacity (LMT) PA
Palwal	M.J. Logistics Services Ltd.	Completed	17.17	100	9,552	0.11	0.15
Panchkula	Ambrozia Frozen Foods	Ongoing	9.29	NA	NA	0.11	0
Panipat	RM Delicious Foods	Ongoing	11.4	NA	NA	0.32	0.01
Rewari	Aligned Industries Ltd.	Completed	14.81	100	9,552	0	0.03
Sirsa	ZandersRresorts private limited	Ongoing	16.81	NA	NA	0.38	0
Sonipat	Sterling Agro Industries Ltd	Ongoing	16.91	100	9,552	0.38	0.01
Sonipat	Skylark Foods private limited	Completed	8.8	100	9,552	0.46	0.02
Sonipat	Shell Mount Fresh	Completed	15.44	100	9,552	0.16	0.12
Sonipat	Suri Agro Fresh Pvt. Ltd.	Completed	13.68	100	9,552	0	0.33
Sonipat	Jivo Wellness private limited	Ongoing	38.33	NA	NA	0.76	0.14
Yamuna Nagar	Syra Foods	Ongoing	23.54	NA	NA	0.49	0.02

\* (LMT) PA : Lakh Metric Tonnes Per Annual

Source: Ministry of Food Processing Industries, India

**Table 3.4.20 Warehouse Companies and Facilities in Haryana**

District	Warehouse Name	Name and Address	Capacity (MT)
Hisar	Central Warehousing Corporation	CW, Mandi Adampur, Mandi Adampur	17,250
Hisar	Central Warehousing Corporation	CW Hisar, Sirsa Road	28,400
Hisar	Central Warehousing Corporation	CW, Uklana, Near Grain Market, HSAMB Godow, Sirsa Road, Uklana	5,000
Jind	Central Warehousing Corporation	CW, Narwana, New Anaj Mandi, Narwana	6,000
Karnal	Central Warehousing Corporation	CW Karnal-III, CW, Karnal-III, near new grain market, Bazida Jattan Road	72,100
Karnal	Central Warehousing Corporation	CW Karnal-I, Matak Majri, Near Old Grain Market	12,600
Karnal	Central Warehousing Corporation	CW Indri, Near New Grain Market	15,180
Kurukshetra	Central Warehousing Corporation	CW Kurukshetra, Opposite District Jail, Sector-5	5,000
Sirsa	Central Warehousing Corporation	CW, Sirsa, Plot no.7-22, HSIIDC Complex, Near Delhi Pull, Hisar Road	23,700
Sonipat	Central Warehousing Corporation	CW, Gohana, Jind Road, Near Kandhran Mod, Gohana	9,915
Sonipat	StarAgriWarehousing Collateral Management Limited	JAIN WAREHOUSE, Godown No 1 & 2, Khatauni No 172, Village-Baay, Tehsil-Ganaur	1,500
Sonipat	Central Warehousing Corporation	CW, Barhi, Plot No. 475-478, HSIDC Complex GT Road Barhi	26,600
Sonipat	Central Warehousing Corporation	CW Sonipat, Rohtak Road Near Kalupur Chungi	19,280
Yamuna Nagar	Central Warehousing Corporation	CW, Jagadhri, Plot no. 08 to 11 and 30 to 33, HSIDC Complex Manakpur	35,273

Source: Ministry of Food Processing Industries, India

### **Demand Analysis for Cold Chain**

As a reference, demand analysis for cold chain in Pan India is described here. Table 3.4.21 shows that market size of the cold chain will continuously expand for ten more years. The Indian Cold Chain Market is experiencing significant growth due to several key drivers:

### **Expansion of Organized Food Retail:**

The growth of organized retail is a major factor propelling the cold chain market in India. As this sector expands, consumers gain access to a diverse range of fresh produce, dairy, meat, poultry, and other temperature-sensitive items. Organized retail chains recognize the importance of establishing robust cold chain infrastructure for effective supply chain management.

**Advancement in the Processed Food Sector:**

There is a noticeable increase in consumer demand for processed foods. In response, the Indian government is focusing on setting up numerous mega food parks, which is expected to positively impact the development of the cold chain industry.

**Shift to Horticulture Crops:**

Farmers are increasingly leaning towards cultivating fruits and vegetables due to the higher risks and investments associated with grain crops. These horticulture crops often require refrigeration, which in turn is likely to stimulate the growth of cold storage facilities.

**Table 3.4.21 Pan Indian Cold Chain Market Size**

Index	Key Statistics
Market Size in 2023	INR 2,052.7 billion
Market Forecast in 2032	INR 5,596.9 billion
Market Growth Rate (CAGR) in 2024-2032	11.4%

*Source: Indian Cold Chain Market Report by Segment, Product, Sector, Organised and Unorganised, and State 2024-2032*

While there have been a number of packhouses built by private companies, the following points can be considered as the significance of the packhouses to be built under the project.

1. Differences in project objectives

While the focus of the private companies is on warehousing (i.e. making profit from pre-cooling, cold storage, etc.), the main objective of the Haryana project is to improve the collection and transportation capacity of the growers. (The aim is to collect more, store it in good condition and sell it at a higher price through economies of scale and uniform standards and quality). This fundamental difference distinguishes the project's approach from that of private operators.

2. Operational unit of the packhouse.

Basically, the project's packhouse operation differs from that of the private sector operator because the project's packhouse operation is PG-led (originated) and its policy is to buy member farmers' produce at a better price than other private companies and also to support production.

There are also isolated cases of cooperation on favourable terms rather than competition, as in the Producer Group (PG) contracts.

4. systems and payments

The private operator's packhouse facilities have also raised the issue of slow cash conversion of delivered crops. However, in the packhouses to be developed under the project, the system will be developed at the same time and timely payment will be possible, which is recognised as a benefit of the packhouses to be developed under the project.

5. production system and location of collection and dispatch facilities

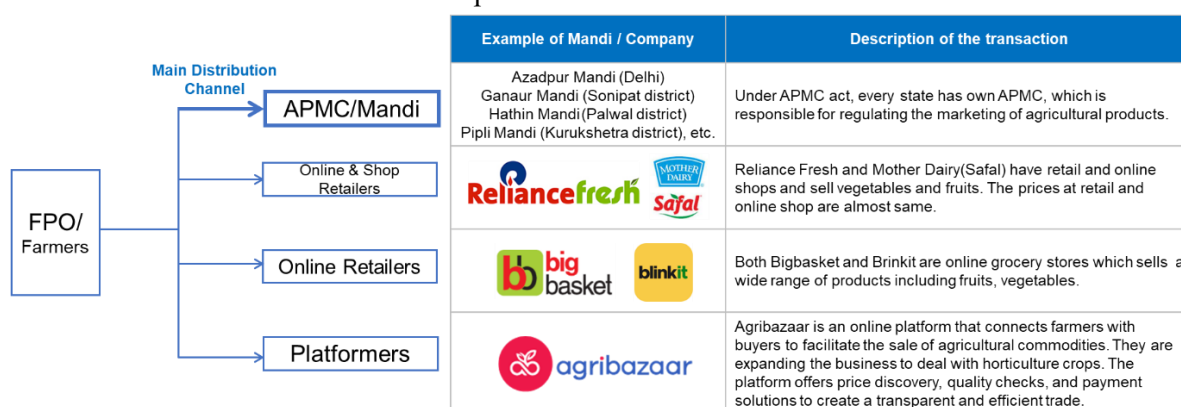
Private sector packhouses are often built close to the shipping destination and there was a problem that the production system and the collection and shipping facilities were not linked. On the other hand, the project plans to build packhouses in areas (clusters) where there is already sufficient production. This gives the project the advantage that the packhouses planned for the project will operate in areas where there is demand from the outset.

The above points are considered to be the differences between the packhouses to be developed under the Project and those operated by private operators.

vi) Vegetable and Fruits Retail Companies

In Haryana, the vegetable and fruit retail sector include various types of businesses, ranging from traditional markets and street vendors to modern retail chains and online platforms. These businesses cater to the diverse needs of the local population by providing fresh fruits and vegetables to consumers.

Even though traditional Mandi is still the main distribution channel for PGs/farmers, some PG has contracted with retail companies. The classification of market channels is described in Figure 3.4.19. Agribazaar has a unique business model, they do not purchase crops but only facilitate the transaction as the platformer.



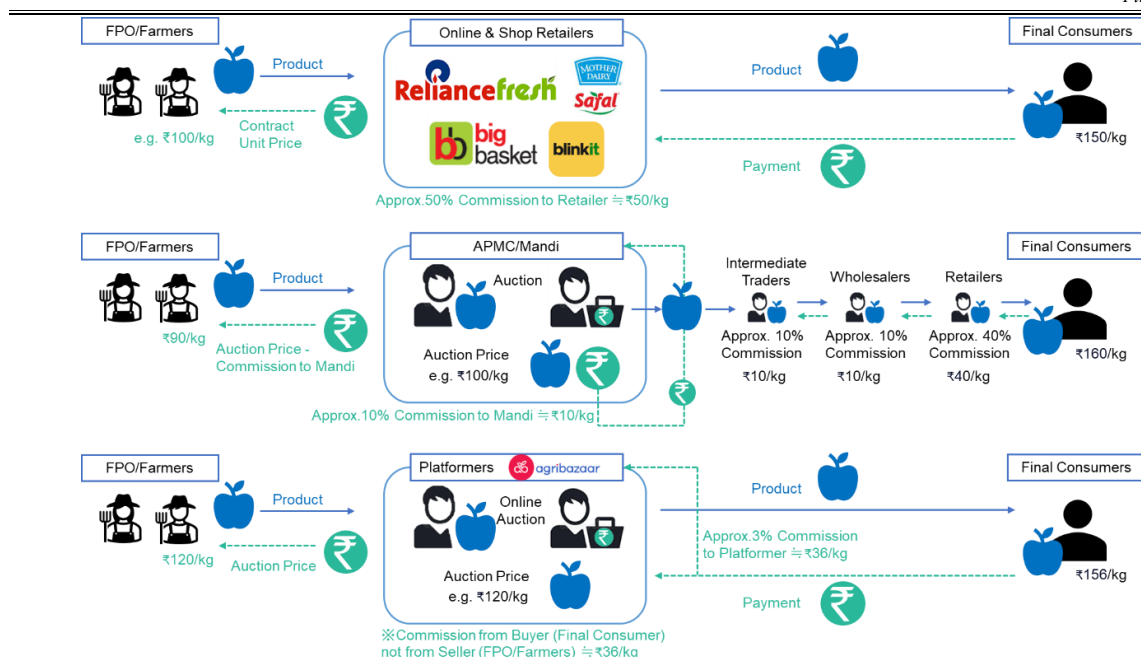
Source: JICA Survey Team

**Figure 3.4.19 Classification of Market Channel**

The traditional transaction is conducted using the following procedure and this system has been criticized for its inefficiencies and for the role of middlemen. This is described in Figure 3.4.19.

- ① **Arrival of Produce:** The farmers bring their agricultural produce to the Mandi. This produce can be their own, or they could be acting as middlemen for other farmers.
- ② **Auction Process:** The agricultural produce is then auctioned. The auction can be opened or closed. The price is shouted out loud in an open auction, while in a closed auction, it's written on a slip of paper.
- ③ **Role of Commission Agents:** The auction is conducted by licensed middlemen or commission agents. The agents represent both the buyer and the seller, facilitate the bargaining process, and agree on the final price. They charge a commission for their services, which is a percentage of the selling price.
- ④ **Payment and Delivery:** Once the deal is finalized, the buyer pays the commission agent, who after deducting their commission, pays the farmer. The buyer then arranges for the transportation and delivery of the produce.

Compared to the traditional transaction, direct contracts with retailers are more transparent. In addition, the Agribazaar model charges commission to buyers, hence the income to farmers can be increased compared to the traditional transactions (Figure 3.4.20).



Source: JICA Survey Team

Figure 3.4.20 Commission Comparison on Each Market Channel

Table 3.4.22 Surveyed Retail Company

Company Name	Location of the company	Business Description	Possible Partnership
Reliance Fresh	Shops located all over the Haryana	<ul style="list-style-type: none"> <li>Reliance Fresh operates over 2,700 grocery stores and sells over 200 metric tons of Fruits and over 300 metric tons of Vegetables every day.</li> <li>Reliance Fresh also has online stores and the prices of crops are almost same as in the grocery store and online store</li> </ul>	<ul style="list-style-type: none"> <li>Making a partnership between Reliance Fresh and PGs to make direct transaction agreement</li> </ul>
Safal	Shops located all over the Haryana	<ul style="list-style-type: none"> <li>Safal, a brand owned by Mother Dairy Fruit &amp; Vegetable Pvt. Ltd., is one of the largest organized retail networks in India specializing in fresh fruits and vegetables.</li> <li>Safal also has online stores, and the prices of crops are almost same as in the grocery store and online store.</li> </ul>	<ul style="list-style-type: none"> <li>Making a partnership between Safal and PGs to make direct transaction agreement</li> </ul>

Source: JICA Survey Team

#### vii) J-Method Farming

J-Method Farming is a concept that tries to demonstrate Japanese excellent agricultural technologies as a package, which was established by the Ministry of Agriculture, Forestry and Fisheries the Government of Japan (MAFF). The purpose of J-Method Farming is to support overseas expansion of the Japanese agriculture sector to realize the improved agricultural productivity and safety of farm products in developing countries and improve the supply-demand balance.

There are demonstration fields (Table 3.4.18) that raise some crops with Japanese agriculture methodology and agriculture materials. From the operations of the demonstration field, some lessons learned have accumulated as described below.

- The necessity of close monitoring and training to use Japanese agriculture materials: In the demonstration field, some Japanese agriculture materials are used under local NGO's operation. To use the agriculture materials effectively, not only the training of usage of the materials but also a basic level of agriculture techniques shall be educated to the local operator.
- Targets of the productions from the demonstration field: To analyse the effectiveness of the usage of high-technology equipment, materials, and services, certain amounts of



production shall be required. Before making a demonstration field, required production to analyse cost effectiveness shall be calculated and design the fields.

- The necessity of a sustainable business model: The majority of participating Japanese companies do not have local procurement or manufacturing facilities in India. Hence, their production should be imported from Japan, which makes their prices relatively high and cannot compete with local products. To make the demonstration field as sustainable business, a scheme that each company business can make profits in short term shall be considered.
- Synergy between participated companies: In addition to the above point, if a scheme to realize synergy between participated companies, it will bring better impact to the beneficiaries (farmers/PGs) and also to participated companies.

**Table 3.4.23 J-Method Farming Demonstration Field**

Item	Description
Project Site:	Anand District of Gujarat, India
Planted Area:	30 Acre
Cultivated Variety:	Cherry tomato, Cauliflower, Radish, Pumpkin, Watermelon
Participant Companies:	Farmland renovation and ploughing, seed, pest control, bio stimulant and water-saving technology, soil enrichment and fertilizer, farming consultation, IT, cold chain and marketing

Source: Ministry of Agriculture, Forestry and Fisheries the Government of Japan (MAFF)



Source: "J-Methods Farming" MAFF Japan 2022 Nov

**Figure 3.4.21 Gujarat Model Farm**



Source: "J-Methods Farming" MAFF Japan 2022 Nov

**Figure 3.4.22 Food Sampling Event**

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Under the J-Method Farming projects, some Japanese companies are participated shown in attachment 3.4.4.

### 3.4.9 Summary of Desktop Survey and Hearing Survey for Private Sector Partnership

Above private companies' information and additional companies' information are summarized in this section. Considering with some PG(FPO)'s challenges/needs, DOH's policy and survey team's suggestion, some potential collaboration with private companies is categorized. Then, based on the partnership category, private sector's services and products are summarized.

#### i) **PG(FPO)'s challenges/needs related private sector's services and products**

As shown on Table 3.4.24, survey team visited 4 PGs and asked their challenges and needs for their usual business operation.

**M/s Kharisureran FPC Ltd** is a leading Kinnow PG in Sirsa. Their challenges and needs are following.

#### **Challenges**

- Price volatility of Kinnow's wholesale price and unstable income
- Less income in Kinnow's off season. Okura is produced at the off season, still 90% income comes from Kinnow
- Large loss of Kinnow due to abnormal high temperature (there was a case 50% loss in the past)
- High commission to intermediate traders

#### **Needs**

- Good Kinnow nursery tree
- Good fertilization and irrigation system
- Good farm management to prevent large loss of Kinnow
- Expansion of sales channel including exports
- Extension of shelf life of Kinnow
- Fund without interest
- Drying technology for Okura for maintain the revenue in case Kinnow price goes down

**Crown Fruits and Vegetables FPO** mainly produces potatoes and have a contract with McCain Foods Global that is world-largest frozen potatoes product makers. Their challenges and needs are following.

#### **Challenges**

- Lack of marketing skills and resources to sell crops in markets other than local markets or other marketing streams such as private companies / customers.
- Low selling rate of crops in local market.

#### **Needs**

- Cold storage to keep the potatoes for a long time to sell the crops in high wholesales price
- Value addition opportunity available on crop after harvest.

**Bhiwani Vegetable FPO** is the first vegetable PG in Bhiwani and mainly produces coloured capsicum and green capsicum. Their needs are following. The founder Mr. Amit visited Japan and got interested in partnership with Sakata seeds.

#### **Needs**

- High-quality seeds
- Exports of products







- Drying, freezing machinery for vegetables

**Aterna Organic FPC** is one of the most successful farms in Haryana. The founder, Kanwal Singh Chauhan is known for his contributions to crop diversification in the agriculture industry and in January 2019, he was awarded Padma Shri, India's fourth highest civilian award. Aterna Organic PG mainly sells frozen sweet corn and green peas for pan India, also exports to China and Canada. Mr. Chauhan visited Japan under this project's programme and got interested to introduce of Japanese cold storage management system.

**Needs**

- Advanced Japanese cold storage management system

**Table 3.4.24 Surveyed PGs for private sector partnership**

PGs Name	District	Main Crop	Main Facility	Photo of the PGs
M/s Kharisureran FPC Ltd.	Sirsa	Kinnow	<ul style="list-style-type: none"> <li>• Sorting machine for Kinnow (5ton/hour)</li> <li>• Packinghouse for Kinnow</li> <li>• 6 ton pre-cooling chamber</li> <li>• 30 ton warehouse×2</li> <li>• 2,000 plastic crates</li> </ul>	
Crown Fruits and Vegetables FPO	Kurukshetra	Potato	<ul style="list-style-type: none"> <li>• Sorting machine for Potato</li> <li>• Packinghouse for Potato</li> <li>• Warehouse</li> </ul>	
Bhiwani Vegetable FPO	Bhiwani	Coloured capsicum/ Green capsicum	<ul style="list-style-type: none"> <li>• Net house for capsicum</li> <li>• Drip irrigation system for capsicum</li> <li>• Warehouse mainly for onion</li> </ul>	
Aterna Organic FPC Ltd.	Sonipat	Baby corn/ Sweet corn/ Green Pea	<ul style="list-style-type: none"> <li>• Cold storage for frozen sweet corn and green pea</li> <li>• Individual quick freezer</li> <li>• Sweet corn /Green pea sorting machine</li> <li>• Reefer truck ×2</li> </ul>	

Source: JICA Survey Team

**ii) DOH's policy for engagement of private sector**

As summarized section 4.3.1, survey team executed some pilot projects with Indian and Japanese private companies and shared the results with DOH. Director general got interested to perform pilot projects in yen-loan phase. Hence, considering the DOH's intention, to enhance the partnership between private companies and producer groups, demonstration trials fields or some budget for perform pilot projects shall be prepared.

⑤ **Survey team's suggestion for private sector engagement**

iii)

Based on survey on PG, survey team found out some express and implied challenges of the producer groups. To mitigate the challenges, some suggestions are summarized as below.

**Producer Group's challenges**

- Excessive capability of the facility: By visiting some PGs, it was found that the subsidized facilities were not fully used, such as sorting machine, cold storage. This might be because of the ①limited harvesting seasons of the crops, ②less varieties of crops in a PG due to CCDP. As mentioned above, PGs seek the other crops to sell when the main crops are off-season and also try to add-value and prolong the shelf-life by processing the crops.

**Suggestions**

- Proper estimation of the facility capability by knowledge sharing among producer groups: When introducing some facilities, consultants support to develop the business plan that includes the specification of the facility. In addition of the consultant's supports, if producer groups can share their actual operating ratio of the facility, which might help to introduce necessary specifications of the facilities for new producer groups.
- Allocation the subsidy to the operational expenditure: If the subsidy to the capital expenses were properly reduced, it is suggested more budget to be allocated to operational expenditure, such as purchasing new agriculture materials that increase productions. Subsidies for operational can promote opportunities with more varieties of private companies' service and products.

**Producer Group's challenges**

- Conservatives to introduce new technology: In India, many farmers are conservative when it comes to adopting new technology. This conservatism primarily stems from the risk associated with potential crop loss, which directly translates to a reduction in income. Besides this primary concern, other factors contribute to their cautious approach towards new technology. Some of these factors include a lack of understanding or familiarity with the new technology, high initial investment costs, and a lack of assurance regarding the technology's effectiveness or return on investment.

**Suggestions**

- Educational Initiatives: Implement educational programs to enhance farmer's understanding and skills regarding new technologies. This could include hands-on training sessions, workshops, and providing accessible resources and materials to bridge the knowledge gap.
- Financial Support and Incentives: Offer financial incentives such as grants, subsidies, or low-interest loans to reduce the initial investment burden. Moreover, establishing assurance mechanisms like insurance against crop loss due to technological failure could provide a safety net, encouraging more farmers to adopt new technologies.

**Producer Group's challenges**

- Income Stagnation Due to Lack of Cold Storage Facilities: Especially among small-scale farmers, the absence of cold storage facilities leads to selling their produce to private enterprises with large cold storage facilities at lower prices, which in turn does not contribute to income improvement.

**Suggestions**

- Lend government-owned cold storage facilities to farmers as a hub: Lend government-owned cold storage facilities to farmers as a hub facility, allowing multiple farmers to use

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the facility in small lots. This setup enables farmers to store their produce until prices escalate, thereby allowing them to sell at higher prices and improve their income.

iv) **Category of collaboration with private companies**

Based on the challenges and needs of the producer group, the intentions of the DOH, and the recommendations of the survey team, the following categories of private sector collaboration were delineated.

- ① **Private sector engagement for the advice / management of production, facilities, logistics and marketing for the producer groups:** Enhancing production, facility management, logistics, and marketing is essential for the producer groups to become more efficient, profitable, and competitive. Engaging private sector expertise can provide professional advice and management skills necessary for these improvements. Also, knowledge sharing system and service are also categorized under this concept.
- ② **Private sector engagement for transactions with producers, wholesalers, and retailers:** Building a robust and transparent transaction network with producers, wholesalers, and retailers is crucial for ensuring fair pricing and market access. Private sector engagement, especially digital transaction can facilitate better market linkages, providing a more reliable and sustainable revenue stream for the producer groups.
- ③ **Private sector sells agricultural equipment and materials to farmers and producer groups:** Access to modern agricultural equipment and materials is pivotal for improving the productivity and quality of agricultural produce. The private sector can provide the necessary tools, technology, and materials, aiding in modernizing the agricultural practices of the producer groups.
- ④ **Utilization of Pilot farm for Testing and Trials:** Pilot farm serve as a platform for testing, displaying, and demonstrating new agricultural equipment, materials, and services. Engaging private companies in conducting these trials can not only provide validation and credibility to their products but also educate and expose the producer groups to the latest agricultural innovations and practices.

v) **Surveyed private companies and potential partnership**

The expected partnerships between private companies surveyed, producer groups in Haryana state, and DOH, are summarized on Table 3.4.20, following the categorization mentioned above. To facilitate the partnership, DOH's initiative are important and required actions by DOH are suggested. Also, what services and products are expected to Japanese companies from producer groups is described.

**DOH's initiative:** As part of the DOH's initiative, it is essential to provide opportunities, both online and offline, to introduce private companies' services and products to producer groups, establish pilot farms, and distribute appropriate subsidies. These steps will facilitate better exposure and adoption of beneficial services and products, ensuring that the producer groups are well-equipped and supported for enhanced agricultural productivity and sustainability.

**Expectation to Japanese companies:** The trust level towards the quality of Japanese products and services is high among farmers in Haryana state, although there is a perception of high costs. In cases where products are locally manufactured, considering the durability, the total cost can be lower compared to Indian products. It's desirable for Japanese companies to appeal more to the market on this aspect, and it would be favourable to have subsidy schemes from the DOH for the introduction of such high-quality products.

**Table 3.4.25 Surveyed private companies and potential partnership**

No	Survey Method	Category	Company Name	Headquarter	Business Description	Partnership
1	Interview	Agri-tech	Star Agribazaar Technology Private limited	India	<ul style="list-style-type: none"> <li>• Star Agribazaar Technology is an Indian agtech company that operates an online marketplace platform for agricultural commodities.</li> <li>• With the marketplace platform, farmers can use the transparent market channel and commission is charged only to the buyer.</li> </ul>	<ul style="list-style-type: none"> <li>• ①Agribazaar arranges the third-party logistics and warehouses and help PGs to expand market channels</li> <li>• ②Horticulture producer groups in Haryana uses the online platform and realize more transparent transactions</li> </ul>
2	Interview	Agri-tech	Cropin Technology Solutions	India	<ul style="list-style-type: none"> <li>• Farm Management Software/ Remote Sensing and Satellite Imagery to help farmers for managing their day-to-day operations, monitor crop growth, and optimize resource usage.</li> <li>• Weather Forecasting and Crop Modeling</li> <li>• Traceability of Crops with QR code</li> </ul>	<ul style="list-style-type: none"> <li>• ④Do comparison between yields of with/without Cropin technology and analyze cost effectiveness in pilot farm</li> </ul>
3	Desktop Survey	Agri-tech	Sagri	Japan	<ul style="list-style-type: none"> <li>• Satellite data analysis and business creation through machine learning</li> <li>• Havinga partnership with the major Indian agricultural firm Lawrence Dale Agro Processing India</li> </ul>	<ul style="list-style-type: none"> <li>• ④Do comparison between yields of with/without their technology and analyze cost effectiveness in pilot farm</li> </ul>
4	Desktop Survey	Agri-tech	Ninja Cart	India	<ul style="list-style-type: none"> <li>• Ninjacart is an Indian agri-tech startup that is focused on solving supply chain inefficiencies in the agricultural sector.</li> <li>• They have developed a technology-driven platform that connects farmers directly with retailers, eliminating intermediaries and ensuring fresh produce reaches the market at competitive prices.</li> </ul>	<ul style="list-style-type: none"> <li>• ②Horticulture producer groups in Haryana uses the online platform and realize more transparent transactions</li> </ul>
5	Desktop Survey	Agri-tech	Absolute	India	<ul style="list-style-type: none"> <li>• Absolute specializes in precision agriculture solutions using phytology, microbiology, and AI technology.</li> <li>• The software solutions control farm hardware systems and collect data regularly from various sources such as IoT devices, sensor suites, hardware</li> </ul>	<ul style="list-style-type: none"> <li>• ④Do comparison between yields of with/without their technology and analyze cost effectiveness in pilot farm</li> </ul>

No	Survey Method	Category	Company Name	Headquarter	Business Description	Partnership
					systems, and satellites.	
6	Interview	Agricultural Equipment and Materials	Sakata India	Japan	<ul style="list-style-type: none"> <li>• Sakata Seed India does not distribute fruits seeds just sells vegetable seeds.</li> <li>• Sakata Seed India has approximately 400 distributors in 29 States in India. Each district has more than 10 distributors, which also have direct sales to farmers.</li> <li>• 25 distributors in Haryana.</li> <li>• Digital market is under planning, but still, traditional trades are major in India.</li> </ul>	<ul style="list-style-type: none"> <li>• ③Sales of high-quality vegetable seeds to farmers and producer groups in Haryana.</li> <li>• ④Do comparison between yields of Sakata seed's vegetables and traditional seeds and analyze cost effectiveness in pilot farm</li> </ul>
7	Interview	Agricultural Equipment and Materials	Taiyo India	Japan	<ul style="list-style-type: none"> <li>• Taiyo manufactures of rotovator blades and blade shafts in Rajasthan</li> <li>• Taiyo L Type blade is made with an extremely tough steel spring steel (SUP6) and has Taiyo's original twist. This product has an average useful life that is 50% longer than the useful life of common blades.</li> </ul>	<ul style="list-style-type: none"> <li>• ②Sales of high-quality rotovator blades to farmers and producer groups in Haryana.</li> <li>• ④Do comparison between yields with Taiyo rotovator blades and local blades and analyze cost effectiveness in pilot farm</li> </ul>
8	Desktop Survey	Agricultural Equipment and Materials	Escorts Kubota India	Japan	<ul style="list-style-type: none"> <li>• Escorts Kubota Limited is recognized for its contributions to the agricultural machinery sector, particularly in the realms of tractors and other agri machinery</li> </ul>	<ul style="list-style-type: none"> <li>• ②Sales / lease of high-quality tractor to farmers and producer groups in Haryana.</li> <li>• ④Do trial of the Kubota tractor in pilot farm</li> </ul>
9	Interview	Processing	Haryana State Industrial and Infrastructure Development	India	<ul style="list-style-type: none"> <li>• Mega Food Park in Sonapat, Haryana aims to boost the growth of the food processing industry in the state.</li> <li>• The construction of facility is completed and finding a lessee for entire facility to start the operation.</li> <li>• Assumed lease price is around 1.0-1.5 crore in a year.</li> </ul>	<ul style="list-style-type: none"> <li>• ①Sub-lease some parts of facility from the lessee</li> <li>• ②Making a partnership as a buyer between producer groups and the lessee (operator of the Mega Food Park)</li> </ul>
10	Interview	Processing	Vista Processed Foods	India	<ul style="list-style-type: none"> <li>• Vista Processed Foods Pvt Ltd that washes, cut and packs the crops and deliver to the retailers.</li> </ul>	<ul style="list-style-type: none"> <li>• ②Making a partnership as a buyer</li> </ul>
11	Interview	Processing	Godrej Agrovet	India	<ul style="list-style-type: none"> <li>• Godrej Agrovet is part of Godrej Group, one of the largest Indian conglomerates. The company has interests in diversified</li> </ul>	<ul style="list-style-type: none"> <li>• ②Making a partnership as a buyer</li> </ul>

No	Survey Method	Category	Company Name	Headquarter	Business Description	Partnership
					<p>agriculture related businesses.</p> <ul style="list-style-type: none"> <li>They operates across five business verticals which include animal feed, crop protection, oil palm, dairy and poultry and processed foods.</li> </ul>	
12	Interview	Farm management	Amar Agro	India	<ul style="list-style-type: none"> <li>Amar Agro is progressive iceberg lettuce farmers who has dealt with international fast foods restaurants such as McDonald's, Subway, KFC and Burger King.</li> </ul>	<ul style="list-style-type: none"> <li>①Sub-lease some parts of facility from the lessee</li> </ul>
13	Interview	Farm management	EPSON	Japan	<ul style="list-style-type: none"> <li>EPSON has partnership with JICA and disseminates projectors</li> </ul>	<ul style="list-style-type: none"> <li>① EPSON projector can be used to share the knowledge and experiences of the production among producer groups</li> </ul>
14	Interview	Cold Chain	ITE	Japan	<ul style="list-style-type: none"> <li>The IceBattery is a thermal energy storage device that uses phase change materials to store and release energy as needed.</li> <li>The IceBattery can be used as cold storages or in reefer trucks</li> </ul>	<ul style="list-style-type: none"> <li>②ITE sells IceBattery for cold storage and transportation to enhance farmer's bargain power</li> <li>④Do comparison between sales price with/without IceBattery and analyze cost effectiveness in pilot farm</li> </ul>
15	Desktop Survey	Cold Chain	Snowman Logistics	India	<ul style="list-style-type: none"> <li>Snowman Logistics is India's first Cold Supply Chain Company with a nationwide presence.</li> <li>They offer a comprehensive range of integrated logistics services, including warehousing, transportation, distribution, and consultancy.</li> </ul>	<ul style="list-style-type: none"> <li>①Snowman advises / manages the cold-chain to operate hub facilities</li> </ul>
16	Phone Interview	Cold Chain	Condair	Switzerland	<ul style="list-style-type: none"> <li>In the context of cold storage humidification, Condair offers solutions to manage the moisture content in cold storage environments, which is critical to maintaining the quality and shelf life of stored produce.</li> <li>They provide a range of humidifiers and related services to achieve optimal humidity levels, ensuring that produce retains its weight and</li> </ul>	<ul style="list-style-type: none"> <li>②Condair sells moisture control equipment to prolong shelf life of crops</li> <li>④Do comparison between sales prices with/without moisture control equipment and analyze cost effectiveness in pilot farm</li> </ul>

No	Survey Method	Category	Company Name	Headquarter	Business Description	Partnership
					quality through the supply chain	
17	Shop Visit	Retail	Reliance Fresh	India	<ul style="list-style-type: none"> <li>• Reliance Fresh operates over 2,700 grocery stores and sells over 200 metric tons of Fruits and over 300 metric tons of Vegetables every day.</li> <li>• Reliance Fresh also has online stores and the prices of crops are almost same as in the grocery store and online store</li> </ul>	<ul style="list-style-type: none"> <li>• ②Making a partnership between Reliance Fresh and producer groups to make direct transaction agreement</li> </ul>
18	Shop Visit	Retail	Safal	India	<ul style="list-style-type: none"> <li>• Safal, a brand owned by Mother Dairy Fruit &amp; Vegetable Pvt. Ltd., is one of the largest organized retail networks in India specializing in fresh fruits and vegetables.</li> <li>• Safal also has online stores, and the prices of crops are almost same as in the grocery store and online store.</li> </ul>	<ul style="list-style-type: none"> <li>• ②Making a partnership between Safal and producer groups to make direct transaction agreement</li> </ul>

Source: JICA Survey Team

### 3.5 Digital Transformation for Agriculture

#### 3.5.1 Current Status of Digital Transformation Market in India and Haryana.

##### (1) Online Marketplace

India is known the land of farmers ranging from large to marginal farmers. These small and marginal farmers with less availability of land and required skills / knowledge, still follow traditional practices of Farming. Also, lack of nearby marketplace, Standard and real time trad facility, improper guidance to the farmers, the non-availability of cold storage services for perishable crops, and the lack of transportation facilities are some of the reasons behind the incompetence of Indian agriculture in achieving the status of a major contributor to Indian GDP.

To support the Farmers and address the above issue with digital and technological transformation, Government of India initiated multi-level and multi domain program to built complete ecosystem and facilities for farmers to facilitate and provide ease of doing farming and support services. Some of the examples like – InDEA building block program, “Agristack” program, Direct Benefit to Transfer (DBT), availability of GIS and geographic information through ministries-controlled services (with Satellite imaginary), Internet facility and the most notable is the start-ups policy with all supportive ecosystems.

The start-ups in the agriculture field and its associate services doing great job to provide digital environment for farmers and other Agri business industries a range of services from farming to their storage, transportation to product processing, product insurance to online trading and even support system with real time information etc.

The Online marketplace kind of digital platform to all farmers, buyer-sellers, and Government Authorities to operate trading activities of crops and farming products with various of services related with on real time and anytime anywhere basis with geographical limitation.

Below are few names from the large list of these start-ups in India.

**Table 3.5.1 The list of large start-ups in India**

No.	service name	Company Name	Service overview
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1	Ninjacart.	631Ideas Infolabs Pvt. Ltd.	End-to-end services for agricultural products.
2	Cropin.	Cropin Technology Solutions Pvt. Ltd.	Cropin is a SaaS company providing agricultural solutions.

Source: JICA Survey Team

### 3.5.2 Current status of Digital Transformation initiatives.

Agricultural DX utilisation is being promoted in India and that platforms for integrated management of agricultural information, such as the AgriStack project, are being developed under central government initiative.

#### (1) AgriStack

Agri Stack is a digital foundation set up by the government to easily bring together different stakeholders to use data and digital services to improve Indian agriculture and enable better results and outcomes for farmers. It is an initiative to bring together high-quality data and make this data easily available to the stakeholders who need it, so that they can use the data to create new services. Evolving from the InDEA 2.0 architecture idea by MeitY, Agri Stack is an initiative by the Agriculture and Farmers Built by the Ministry of Welfare in an open manner and in a federated structure— keeping states at the center of the design and ensuring a participatory and inclusive design to ensure that the sector evolves collectively to help shape the next decade of agriculture in India.

The Agristack is an ecosystem for facilitating the delivery of digital services to farmers by Government as well as by AgriTech, Agri Startups, PGs and the“"Agristack is a collaborative system of—

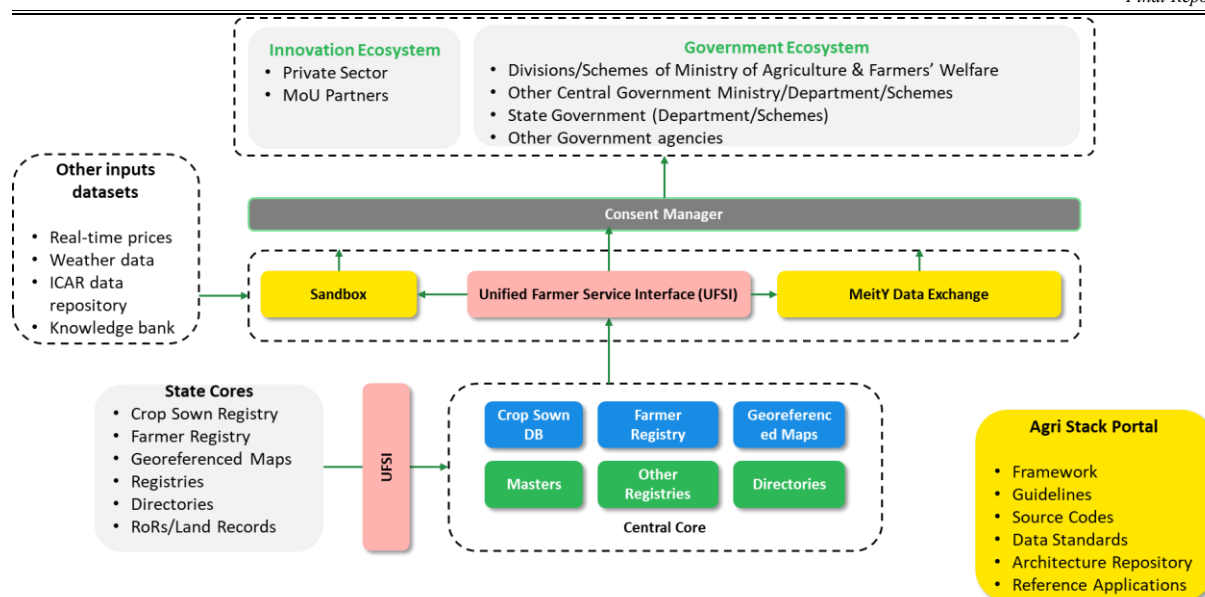
- Various Databases.
- Policies, Data Sharing, etc.
- IT systems— Centre, State, and other private service providers
- Regulators

**Table 3.5.2 Summary of AgriStack**

Objectives	<ul style="list-style-type: none"> <li>• Improve Government benefits/schemes delivery so they reach all Indian farmers faster and more easily</li> <li>• Create a presence-less layer for quick identification and authentication of the farmers</li> <li>• Lower the cost and risk of agricultural services for farmers and agri-credit, finance, inputs, and other service providers</li> <li>• Enabler easier scheme convergence between agri-allied Ministries and State Governments to better serve the Indian Farmers</li> <li>• Accelerate innovation in products &amp; services by Agri-Techs with easier access to high-quality data</li> </ul>
Major available data	<ul style="list-style-type: none"> <li>• Farmers database with dynamic linking of Land Records.</li> <li>• Geo referencing of Village Maps.</li> <li>• GIS Base Real Time Crop Survey.</li> </ul>

Source: JICA Survey Team





Source: Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers' Welfare, Government of India on Roles of States/UTs for enabling the Agri Stack, 7<sup>th</sup> September 2022

**Figure 3.5.1 Visualized view of AgriStack (Phase-I)**

AgriStack is a federated structure and ownership of data is with the States only. Access to federated Farmers' database is with Government only. No private company is involved in developing the federated Farmers' database. As of now, the federated database is being built by taking the publicly available data as existing in the Department and in various data silos in Government. Memorandum of Understandings (MoUs) for Proof of Concepts (PoCs) with various companies for development of use cases have been signed and accordingly carried out. The details of these MoU/Agreements are shown in following table:

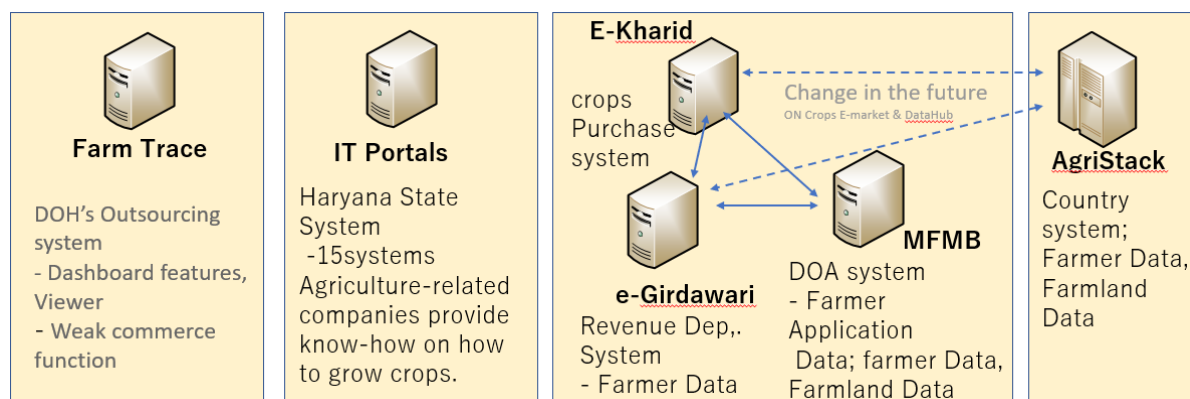
**Table 3.5.3 Details of MoU entered by the Department of Agriculture and Farmers Welfare with leading Technology/Agri-tech/StartUp companies to develop Proof of Concepts (PoCs):**

No	Name of the Company	Focus Area
1	Microsoft India Pvt. Ltd	for consolidating agri ecosystem across the value chain (farm to fork) to empower the farmer using Data Analytics in 100 villages.
2	ESRI India Technologies Limited	for Establishment & Launch of "Nation Agriculture Geo Hub" and for using their 'ArcGIS' platform enabling a GIS layer over Farmers' Database.
3	Amazon Web Services India	for digital services across the agri value chain and creating an innovation ecosystem around digital agriculture
4	Star Agribazaar Technology Private limited	for collaborating with Department of Agriculture for a pilot project to promote digital agriculture
5	Patanjali Organic Research Institute Private Limited	for farm management and farmers service
6	JIO Platforms Ltd	for taking up primary intervention module, i.e., advisory (basic as well as advanced) service in first phase
7	ITC Limited	for building a Customized 'Site Specific Crop Advisory' service and Digitization of Dairy Value Chain and support Wheat crop operations
8	Cisco Commerce India Pvt Ltd	for conceptualizing a Proof of Concept in effective knowledge sharing between farmers, administration, academia and industry
9	NCDEX e-Markets Ltd (NeML)	for a digital marketplace to contribute effectively towards increasing the income of farmers and improve farm efficiency/efficiency of the Agriculture sector
10	Ninjacart – 63Ideas Infolabs Pvt Ltd	for developing and hosting the Agri Marketplace Platform
11	Artificial Intelligence Unit of National Entrepreneurship Network (Wadhvani AI)	Scale the Pest Management Solution for Cotton Farmers to about 50,000 lead farmers and 500000+ cascade farmers in 2022 Kharif season. Create AI/ML solution.

Source: [pib.gov.in/PressReleaseIframePage.aspx?PRID=1883173](http://pib.gov.in/PressReleaseIframePage.aspx?PRID=1883173)

## (2) Existing Systems in Haryana

Several existing systems for agricultural information have been introduced in Haryana.



Source: JICA Survey Team

**Figure 3.5.2 Existing systems for agricultural information**

The details of those systems are summarized in following table:

**Table 3.5.4 Existing systems in Haryana**

No.	Name of the system	Function of the system
1	MFMB (Meri Fasal Mera Byora)	MFMB portal developed by National Informatics Centre (NIC) Haryana and governed by the Agriculture Department, Haryana for farmers to self-report crop sown information along with land & bank account details.
2	E-Kharid	This is a portal owned by the Food and Civil Supplies Department, Haryana. This is a digital procurement portal. For the state farmers Haryana State government started an online portal for selling their crop, to sell the crop through the Haryana E-Kharid Online Portal farmers have to register their crop details first during the sowing time and E-Kharid Farmer Registration is also mandatory during the selling time. The main aim to start this portal is to provide the good price of the Farmers crop. Through the E Kharid/ E Procurement process state government want to bring complete transparency in all procurement levels. Farmers who want to sell their crop through the Ekharid portal can register on the official website and get the appropriate price of their produce. Only Grains like wheat are being bought by Govt. via E-Kharid and mostly Vegetables are bought by private / local buyers which holds a major part of the trading (approximately 80%). Traders buy the crops via bidding and sell them to companies. Farmers/PG not selling directly to the companies. Also, the entire process until J-form (an output receipt of E-Kharid application) generation is being carried out manually.
3	E-Girdawari	E-Girdawari is the platform governed by the Department of Revenue, Haryana. This platform (with mobile application support) is used to capture the details of the Khasra-Girdawari (Harvest Inspection) by the Revenue Department twice in a year for updating land records through their officers (i.e., Patwari). However, no records like the GPS coordinates or the images of the crop were kept in the record. The farmers are not capable (trained) of running and handling available applications (even PGs (Producer Groups) struggling for optimum usage of these application / portals). In this scenario, the proper training and capacity building programme is also required and recommended to the targeted PGs (in first Phase) and then to farmers (in extended phase). There is no system (digital) aid accessible, and most of the record-keeping process is done manually on paper before being digitised in excel and kept on. Additionally, there are not enough sensors or high-quality equipment, and it is run by untrained personnel. They had a particularly good response from Indiamart.com So, they are very much interested in selling crops online.
4	Farm Trace	It's a dedicated portal designed and developed for Department of Horticulture (Haryana) through outsourced model. The prime functionality of this portal to provide registration and onboarding facility to farmers and Producer Groups. However, this is under development and not fully functional at the time of discussion with DoH Authorities.
5	IT Portals	Department of Horticulture, Haryana also maintaining and managing few webportal for different and dedicated services like. <a href="http://www.Hortharyana.gov.in">www.Hortharyana.gov.in</a> (a Department

No.	Name of the system	Function of the system
		Official Web site and <a href="http://www.khushalbagwani.hortharyana.gov.in">www.khushalbagwani.hortharyana.gov.in</a> (with links of other important government websites and functional modules to access digital services being implemented or provided under government umbrella.

Source: JICA Survey Team

### 3.5.3 Status of laws and regulations regarding Digital Transformation of Agriculture:

There is no dedicated Law for Digital Transformation (DX) for Agriculture activities. However, Government of India initiated the “Agristack” the digital foundation to make it easier to bring various stakeholders together to improve agriculture in India and enable better outcomes and results for the farmers by using data and digital services.

It is an effort to bring together high-quality data and to make this data easily available to the stakeholders that need it so that they can create new services using the data. It is based on the India Digital Ecosystem Architecture(InDEA) 2.0 Architecture by MeitY, Agri Stack is being built by the Ministry of Agriculture & Farmers Welfare in an open manner, with a federated structure – keeping States at the centre of the design, ensuring participatory and inclusive design to ensure the sector evolves collectively to help shape the next decade of agriculture in India.

Creation of Agri Stack- On 2<sup>nd</sup> June 2022, Discussions held in the Conference of Chief Secretaries in Dharamshala regarding creation of Agristack Digital Agriculture. In the initial stage of setting up Agristack, three basic building blocks consisting of the following important IT systems/ databases will have to be put in place by the States: Farmers database with dynamic linking of Land Records. 2. Geo referencing of Village Maps. 3. GIS Base Real Time Crop Survey.

In this meeting it was emphasized that a Digital Agriculture Mission institutional framework has been put in place at DA&FW. A Joint Committee has been set up which is chaired by Mr. Rajeev Chawla, Former Additional Chief Secretary, Government of Karnataka, now working as Chief Knowledge Officer & Advisor, and having senior officers from DOAFW and Department of Land Resources (DoLR). (Order issued on this regard is enclosed). This Unit will work closely with the State Government and provide support and hand holding for completion of the three tasks. Also, it is, therefore, requested to set up two Committees, as per the suggestions given below:

- 1) Steering Committee: To be chaired by Chief Secretary, the committee should have the Secretary Revenue, Secretary Agriculture, Secretary IT and Secretaries of other departments besides other members who will be related to this work, along with representation from Government of India. The Steering Committee may meet once in two months to review the progress of the work done in the State.
- 2) Implementation Committee: This Committee will have Secretary Revenue, Secretary Agriculture, Director (IT)/ Director / Commissioner (Land records), Director/Commissioner (Agriculture) and other officers, as per the requirements of the State as members, and could be co-chaired by the Secretary Agriculture & Secretary Revenue.

On 25th July 2022, Committee for Kisan Credit Card (KCC) loans has been constituted through office memorandum issued by the Ministry of Finance, Government of India. Also on 19th September 2022, 'Conference on Agri stack' held on 30th September,2022 at New Delhi to discuss Agristacke project-regarding with the agenda:

- 1) Introduction to Agri Stack and Importance of the 3 Core Registries, namely The Farmers' Registry, the Crop Survey Registry, and the Georeferenced Village Maps Registry.
- 2) Discussion broad Principles to create the 3 Registries.
- 3) Timelines to be kept in mind for complete implementation of these 3 Registries.
- 4) Funding requirement - One time and recurring one
- 5) Constitution of Agristack Steering Committee, appointment of Nodal Officers and holding of the se committee meetings. 6. Status of preparation of these 3 Registries in different states.

Government of India Also amended/ passed various acts and rules to the various department, services, and building blocks involved in this Architecture. Few are:

The Ministry of Agriculture has signed a Memorandum of Understanding with Microsoft to run a pilot programme for 100 villages in 6 states.

- The MoU requires Microsoft to create a 'Unified Farmer Service Interface' through its cloud computing services.
- This comprises a major part of the ministry's plan of creating 'AgriStack' (a collection of technology-based interventions in agriculture), on which everything else will be built.

UIDAI ACT<sup>36</sup> – provide Unique Identity of each Indian citizen with all verifiable data for further usage to provide digital access.

Digital India Program – It a part of Digital India Program linked with various services like BHIM<sup>37</sup> (for UPI Transaction), Digi locker (government control digital document management system) and various digital education programs for rural and urban targeted people.

Unique Land Parcel Identification Number - The Unique Land Parcel Identification Number (ULPIN) scheme has been launched in 10 States in the year 2021 and will be rolled out across the country by March 2022. It is also linked with UIDAI to connect land record with citizens through their ID.

Government's schemes such as Pradhan Mantri Fasal Bima Yojana (PMFBY), PM-KISAN and Soil Health Card will be integrated through a common database along with land record details over a period of time.

### 3.5.4 Challenges for Digital Transformation

Since existing system only supports manual interaction limited to geographical reach, it does not offer any worldwide marketing platforms to find potential customers at the best prices. It is advised that the suggested platform interface with the "Agri Stack" programme and offer a global reach for selling crops with an easy business process, liberal rules, and standardised procedures.

E-marketplace, which is currently lacking in the current arrangement, would be at the centre of this new suggested system based on centralised databases and collaboration. currently lacking in the current arrangement, would be at the centre of this new suggested system based on centralised databases and collaborative application environments.

The Accounting is being managed at PG (Farmer Producer Organisations) with the help of Tally software. There is no centralised accounting system available linked with the "e-Kharid" or other platform.

The crux of this proposed architecture was introduced covering a broad concept of a centralised Data Centre linked with Lead Pack House facilities and Various application interfaces to supply facilities of "E-Market Place" to Buyers & Sellers (i.e., direct access to all One stop Shop for marketing, bids, auctions with consistent and uniform purchase procedures, predictive analysis and suggestions, and Predictive analysis and suggestions, and informative Dashboards etc.

## 3.6 Gender Related Issues in Haryana

### 3.6.1 Basic indicators

The below table shows gender and district-wise population as well as sex ratios (number of females per 1,000 males). Since there were preferences to have boys particularly in rural Haryana, sex ratios in some Districts in Haryana were very low<sup>38</sup>. Thanks to many Government' schemes/measures such as the Beti Bachao Beti Padhao scheme described later, this situation of low sex ratio in Haryana has been improved, but has not yet reached to Indian average.

<sup>36</sup> The Unique Identification Authority of India (UIDAI) is a statutory authority established under the provisions of the Aadhaar (Targeted Delivery of Financial and Other Subsidies, Benefits and Services) Act, 2016 ("Aadhaar Act 2016") on 12 July 2016 by the Government of India, under the Ministry of Electronics and Information Technology (MeitY). The Aadhaar Act 2016 has been amended by the Aadhaar and Other Laws (Amendment) Act, 2019 (14 of 2019) w.e.f. 25.07.2019 ([Unique Identification Authority of India - Unique Identification Authority of India | Government of India \(uidai.gov.in\)](https://uidai.gov.in/)).

<sup>37</sup> Bharat Interface for Money (BHIM) is an app that makes payment transactions simple, easy and quick using Unified Payments Interface (UPI). It enables direct bank to bank payments instantly and collect money using a Mobile number or Payment address. Bharat Interface for Money app is currently available on Android and it is downloadable from Google Playstore, for smart phones ([Services – Digital India](#)).

<sup>38</sup> Opinion from Vice President of Shri Swami Rama Foundation Trust (NGO).

**Table 3.6.1 Population and Sex Ratio in Haryana**

District		Population				Sex Ratio (Females per 1,000 Males)			
		2001 Census		2011 Census		2001 Census	2011 Census	NFHS -4	NFHS -5
		M	F	M	F				
1	Ambala	542,977	471,434	598,703	529,647	868	885	846	930
2	Bhiwani	758,253	666,769	866,672	767,773	879	886	NA	985
3	Charkhi Dadri	NA	NA	966,110	843,623	NA	NA	NA	964
4	Faridabad	1,084,138*	906,581*	495,360	446,651	836*	873	826	890
5	Fatehabad	427,862	378,296	816,690	697,742	884	902	908	908
6	Gurugram	470,504*	400,035*	931,562	812,369	850*	854	812	871
7	Hisar	830,520	706,597	514,667	443,738	851	872	883	939
8	Jhajjar	476,475	403,597	713,006	621,146	847	862	894	982
9	Jind	642,282	547,545	571,003	503,301	852	871	894	977
10	Kaithal	510,513	435,618	797,712	707,612	853	881	889	929
11	Karnal	683,368	590,815	510,976	453,679	865	887	881	970
12	Kurukshetra	442,328	383,126	486,665	435,423	866	888	892	941
13	Mahendragarh	423,578	388,943	571,162	518,101	918	895	876	936
14	Nuh	524,872*	468,745*	554,497	488,211	893*	907	933	914
15	Palwal	NA	NA	299,679	261,614	NA	880	879	943
16	Panchkula	256,939	211,472	646,857	558,580	823	873	780	936
17	Panipat	528,860	438,589	474,335	425,997	829	864	846	917
18	Rewari	403,034	362,317	568,479	492,725	899	898	894	885
19	Rohtak	509,038	431,090	682,582	612,607	847	867	916	942
20	Sirsa	593,245	523,404	781,299	668,702	882	897	913	909
21	Sonipat	695,723	583,452	646,718	567,487	839	856	830	844
22	Yamuna Nagar	559,444	482,186	598,703	529,647	862	877	867	923
Haryana		11,363,953	9,780,611	13,494,734	11,856,728	861	879	876	926
India		532,223,090	496,514,346	623,270,258	587,584,719	933	943	991	1,020

Note: \* - Provisional, NA - not available

Note: Nuh, Palwal, Charkhi Dadri were officially notified as districts of Haryana by the Government of Haryana state in 2005, 2008, 2016 respectively. Hence the data is not available.

Source: Statistical Abstract of Haryana (2009-2010, Census 2001) (2021-2022, Census 2011), National Family Health Survey-5

The literacy rate of women has also been improved as shown in the below table through various initiatives and schemes. Literacy rate of women is still lower than that of men though gaps between them were decreased (from 22.76 percent points in 2001 census, to 18.12 percent points in the 2011 census, to 11.8 percent points in NFHS-5).

It was commented by a General Manager of NABARD which has supported women through SHG-related activities that the status of women in Haryana has changed drastically with having more confidence through SHG-related activities (starting from saving to receiving trainings, and investing economic activities, sharing their experiences with other members, etc.). It also seems that society in rural Haryana which used to be a closed society has been gradually changed and the number of cases where women are culturally prohibited from going out is very limited.

**Table 3.6.2 Gender-wise Literacy Rates (age 15-49 years old) in Haryana**

District		2001 Census		2011 Census		NFHS-5	
		Male	Female	Male	Female	Male	Female
1	Ambala	82.31	67.39	87.34	75.50	NA	85.0
2	Bhiwani	80.26	53.00	85.65	49.24	NA	78.8

District	2001 Census		2011 Census		NFHS-5	
	Male	Female	Male	Female	Male	Female
3	Charkhi Dadri	NA	NA	NA	NA	83.6
4	Faridabad	85.14	65.53	88.61	73.84	82.3
5	Fatehabad	68.22	46.53	76.14	58.87	71.1
6	Gurugram	87.97	67.49	90.46	77.98	85.4
7	Hisar	76.57	51.08	82.2	62.25	77.7
8	Jhajjar	83.27	59.65	89.31	70.73	88.2
9	Jind	73.82	48.51	80.81	60.76	81.3
10	Kaithal	69.15	47.31	77.98	59.24	70.9
11	Karnal	76.29	57.97	81.82	66.82	84.0
12	Kurukshetra	78.06	60.61	83.02	68.84	83.0
13	Mahendragarh	84.72	54.08	89.72	64.57	81.1
14	Nuh Nuh	61.18	23.89	69.94	36.60	41.9
15	Palwal	75.10	40.76	82.66	54.23	68.3
16	Panchkula	80.87	65.65	87.04	75.99	84.9
17	Panipat	78.50	57.97	83.71	67.00	83.8
18	Rewari	88.45	60.83	91.44	69.57	86.0
19	Rohtak	83.23	62.59	87.65	71.72	85.8
20	Sirsa	70.05	49.93	76.43	60.40	70.6
21	Sonipat	83.06	60.68	87.18	69.80	87.3
22	Yamuna Nagar	78.82	63.39	83.84	71.38	85.8
	Haryana	78.49	55.73	84.06	65.94	91.5
	India	75.26	53.67	82.14	65.46	84.4

Source: Statistical Abstract of Haryana (2009-2010, Census 2001) (2021-2022, Census 2011), National Family Health Survey-5.

## (1) Initiatives for gender mainstreaming

### (a) Women and Child Development Department (WCD), Haryana

Women and Child Development Department (WCD), as a nodal agency, formulates plans, policies and programs and coordinates with both government and non-government organizations for achieving the goals of the development of women and children. WCD implements various schemes such as in the below table.

Some activities such as the celebration of Poshan Maah (nutrition month) are carried out by WCD with involvement of other government departments including DOH. However, it seems that WCD does not formulate policies/plans for targeting female farmers and/or agricultural sector and provide guidelines and trainings for officers of other departments including DOH and DOA on gender sensitization and mainstreaming<sup>39</sup>.

**Table 3.6.3 Major Schemes Implemented by WCD**

	Scheme	Objectives/Focus Area
1.	Beti Bachao Beti Padhao	To prevent gender biased sex selective elimination, ensure survival and protection of the girl child and to ensure education and empowerment of girl child.
2.	Pardhan Mantri Matru Vandhana Yojana	Provide partial cash compensation for the wage loss to Pregnant Women and Lactating Mothers (PW&LM) who are not in regular employment so that they could take adequate rest before and after delivery of the first living child and their health seeking behaviour could be improved.
3.	Apki Beti Hmari Beti	To bring about change in the societal attitude towards the birth of the girl child, improve child sex ratio in Haryana, improve enrolment and retention of girl children in schools, assist the girls to undertake income generating activities and raise the age at marriage of girls.
4.	Onestop Centre	To provide integrated support and assistance to women affected by violence, both in private

<sup>39</sup> Hearing from officers of WCD and DOH.

	Scheme	Objectives/Focus Area
		and public spaces under one roof. To facilitate immediate, emergency and non-emergency access to a range of services and counselling support under one roof to fight against any forms of violence against women.
5.	Kishori Sakti Yojana	To improve nutritional and health status and self-development of girls in the age group of 11-18 years. To provide the adolescent girl with the required linkage with education, life skills, literacy and numeracy skills through the non-formal stream of education, to stimulate a desire for more social exposure and knowledge, etc.
6.	Poshan Abhiyan	Emphasis on nutritional status of adolescent girls, pregnant women, lactating mothers and children (0-6 years age) through preventing/reducing stunting, under-nutrition, prevalence of anaemia, low birth weights (LBW).

Source: <https://wcdhry.gov.in/schemes-for-women/#>

### (b) National Gender Resource Centre in Agriculture (NGRCA)

NGRCA was setup in the Department of Agriculture & Farmers Welfare (DA&FW), Ministry of Agriculture & Farmers Welfare in 2005-06 and is located in the Directorate of Extension, Krishi Vistar Sadan, Pusa, New Delhi.

NGRCA is a focal point to converge all gender related activities & issues in agriculture & allied sectors, within and outside the DA&FW; add gender dimension to agriculture policies & programmes; render advocacy/advisory services to the States/UTs; undertaking and supporting training, research, and advocacy to mainstream gender issues in agriculture and natural resource management. In actual, gender mainstreaming efforts have been taken for various schemes in agriculture, horticulture, and allied sectors as the below table. These schemes have been implemented by DOA, DOH and related institutes in Haryana.

**Table 3.6.4 Gender Mainstreaming Efforts**

	Schemes	Gender Mainstreaming Efforts
1.	Supports to State Extension Programs for Extension Reforms in the form of ATMA	<ul style="list-style-type: none"> <li>• Allocation of minimum 30% of resources to women farmers and extension functionaries.</li> <li>• Women farmers are to be involved in different decision-making bodies at district and block level.</li> </ul>
2.	Integrated Schemes for Agricultural Marketing (ISAM)	<ul style="list-style-type: none"> <li>• Women are eligible for subsidy at 33.33% as against 25% for others.</li> </ul>
3.	National Food Security Mission (NFSM)	<ul style="list-style-type: none"> <li>• As per its operational guidelines, at least 30% of funds are to be made for women farmers.</li> </ul>
4.	Mission for Integrated Development of Horticulture (MIDH)	<ul style="list-style-type: none"> <li>• It has been instructed to target at least 30% of funds for women farmers/beneficiaries as subsidy, training purposes, etc.</li> </ul>
5.	Sub Mission on Agricultural Mechanization (SMAM)	<ul style="list-style-type: none"> <li>• State Governments have been directed to earmark 30% of total funds allocated for women beneficiaries.</li> <li>• 10% more assistance for women beneficiaries to procure agricultural machinery, implements and equipment.</li> <li>• Gender-friendly tools and equipment were developed and sent to all States and UTs.</li> </ul>
6.	National Mission for Sustainable Agriculture (NMSA)	<ul style="list-style-type: none"> <li>• At least 50% of the allocation is to be utilized for small and marginal farmers of which at least 30% are women beneficiaries/farmers.</li> </ul>

Source: *Gender Perspective in Agriculture (2021-22)*, NGRCA, *Final\_Revised\_Gender\_Perceptive.pdf* ([krishivistar.gov.in](http://krishivistar.gov.in))

### (c) Horticultural Department (DOH), Haryana

DOH together with DOA and other related organizations has carried out various schemes some of which take gender mainstreaming measures and training targeting female farmers as described later. While NGRCA was established at the union level for addressing gender related activities & issues in agriculture & allied sectors, it seems that neither such units are set, nor personnel are assigned in DOH for addressing these gender mainstreaming issues (although personnel are assigned for dealing with internal harassment issues).

The below table shows category and gender-wise number of DOH staff. There is no quota for number of female staff, and staff of DOH is selected fully through competition on their qualification. Female staff accounts for 33.3% of total HQ staff and around 23% of Class I & II Field staff. It seems that limited number of female staff does not so much affect communication with female farmers<sup>40</sup>.

**Table 3.6.5 Number of DOH Officers by Category and Gender**

Category		Filled Numbers			
		Male	Female	Unknown	Total
HQ	Class I	7	0	0	7
	Class II	16	12	0	28
	Class III	21	14	0	35
	Class IV	12	2	0	14
	Sub-Total	56	28	0	84
Field	Class I	22	2	0	24
	Class II	61	23	1	85
	Class III	0	0	141	141
	Class IV	0	0	369	369
	Sub-Total	83	25	511	619
Total		139	53	511	703

Source: Prepared by JICA Survey Team based on list of officers provided by DOH as of November 2022.

### 3.6.2 Gender and Agriculture

Women are the backbone of the rural agricultural economy, participating in agriculture, looking after livestock, bringing up the children, and actively handling the other household chores. However, their contribution to agricultural and rural development is seldom rewarded. Their ownership of and access to socioeconomic resources (e.g., land titles ownership, bank accounts, credits, training, information, etc.) and control power on decision-making are limited<sup>41</sup>.

#### (1) Women working in agriculture sector.

The below table shows gender-wise working population in total, as cultivators and agricultural laborers in 2001 Census and 2011 Census (results of latest Census is not available).

Total number of cultivators was decreased by around 18% from 2001 to 2011. This decrease could be thought to be due to the situation that an increasing number of farmers sold or gave their lands and quit cultivating farmlands owned by them/their household members. It could also be supposed that some of male cultivators were converted to agricultural laborers, other workers such as manual workers, etc. According to hearing from an NGO (Shri Swami Rama Foundation Trust) whose coverage Districts (Panchkula and Ambala) are relatively near to urban areas, such cases could be observed in about 10 % of households as men work outside as manual workers (e.g., security guards, drivers, welders, factory workers, etc.), while women stay home with doing some agricultural activities particularly animal raising due to their small size farmlands. It is recently observed that women also start going to city and industrial areas for working purposes.

The actual number of women working as cultivators and agricultural laborers decreased by around 32% from 2001 to 2011. It could be thought that the decrease in female cultivators is also due to above-mentioned farmlands issues. Progress in farm mechanization may have decreased women's work opportunities as agricultural laborers. Despite this decrease, women accounts for 27.9% of cultivators and 31.9% of agricultural laborers in 2011. In addition, 55.9% of women working population still work in agricultural sector (as cultivators and agricultural laborers) in 2011. Therefore, it could be said that women still play certain roles in agricultural sector, thus measures for considering them should be taken.

40 Comments from some officers of DOH. Cluster Project Coordinator (CPC) employed by SFACH/DOH for supporting Biwan Women FPO is a man. According to comments from Director and members of that PFO, they do not have any difficulty and hesitation of communicating with him.

41 Sumit, Meera Rani and Neera Verma, "Innovation in Agriculture with Reference to Women in Rural Haryana, India", Plant Archives Vol. 20, Supplement 2, 2020.



**Table 3.6.6 Gender-wise Working Population in Haryana**

District		Total Workers (No.)			Cultivators (No.)			Agricultural Laborers (No.)			% of working population in agriculture sector against total working population		
		Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
1	Ambala	320,120	52,019	372,139	49,414	3,457	52,871	49,592	7,701	57,293	30.9%	21.4%	29.6%
2	Bhiwani	430,678	192,328	623,006	184,450	104,093	288,543	66,337	37,451	103,788	58.2%	73.6%	63.0%
3	Charkhi Dadri	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	Faridabad	476,933	102,296	579,229	22,833	4,872	27,705	22,007	7,281	29,288	9.4%	11.9%	9.8%
5	Fatehabad	263,498	105,585	369,083	92,058	40,192	132,250	63,094	34,903	97,997	58.9%	71.1%	62.4%
6	Gurugram	432,456	112,260	544,716	41,842	14,204	56,046	19,113	7,984	27,097	14.1%	19.8%	15.3%
7	Hisar	488,321	203,300	691,621	165,785	95,335	261,120	89,883	54,330	144,213	52.4%	73.6%	58.6%
8	Jhajjar	250,020	76,514	326,534	81,291	31,098	112,389	31,176	13,669	44,845	45.0%	58.5%	48.2%
9	Jind	368,277	155,145	523,422	150,710	79,677	230,387	63,265	38,806	102,071	58.1%	76.4%	63.5%
10	Kaithal	292,696	81,203	373,899	104,344	23,672	128,016	58,862	26,789	85,651	55.8%	62.1%	57.1%
11	Karnal	411,646	104,416	516,062	96,503	15,785	112,288	95,557	38,166	133,723	46.7%	51.7%	47.7%
12	Kurukshetra	268,556	68,224	336,780	63,466	5,442	68,908	59,888	26,002	85,890	45.9%	46.1%	46.0%
13	Mahendragarh	232,935	105,649	338,584	88,508	60,638	149,146	21,343	16,977	38,320	47.2%	73.5%	55.4%
14	Nuh	224,642	65,322	289,964	77,019	27,218	104,237	36,260	19,018	55,278	50.4%	70.8%	55.0%
15	Palwal	241,464	68,099	309,563	69,851	21,655	91,506	38,891	21,794	60,685	45.0%	63.8%	49.2%
16	Panchkula	164,865	46,614	211,479	19,285	7,397	26,682	9,975	2,852	12,827	17.7%	22.0%	18.7%
17	Panipat	328,667	83,651	412,318	57,738	14,382	72,120	44,406	17,952	62,358	31.1%	38.7%	32.6%
18	Rewari	235,326	102,401	337,727	66,206	36,492	102,698	15,596	12,619	28,215	34.8%	48.0%	38.8%
19	Rohtak	272,646	73,321	345,967	72,913	22,819	95,732	26,605	9,963	36,568	36.5%	44.7%	38.2%
20	Sirsa	369,462	132,541	502,003	123,471	40,826	164,297	97,815	49,227	147,042	59.9%	67.9%	62.0%
21	Sonipat	391,085	132,094	523,179	103,111	39,233	142,344	66,919	34,814	101,733	43.5%	56.1%	46.7%
22	Yamuna Nagar	342,343	46,890	389,233	58,324	3,192	61,516	64,657	8,594	73,251	35.9%	25.1%	34.6%
	<b>Haryana (2011)</b>	<b>6,806,636</b> <b>(76.3%)</b>	<b>2,109,872</b> <b>(23.7%)</b>	<b>8,916,508</b> <b>(100.0%)</b>	<b>1,789,122</b> <b>(72.1%)</b>	<b>691,679</b> <b>(27.9%)</b>	<b>2,480,801</b> <b>(100.0%)</b>	<b>1,041,241</b> <b>(68.1%)</b>	<b>486,892</b> <b>(31.9%)</b>	<b>1,528,133</b> <b>(100.0%)</b>	<b>41.6%</b>	<b>55.9%</b>	<b>45.0%</b>
	<b>Haryana (2001)</b>	<b>5,715,526</b> <b>(68.2%)</b>	<b>2,661,940</b> <b>(31.8%)</b>	<b>8,377,466</b> <b>(100.0%)</b>	<b>1,855,547</b> <b>(61.5%)</b>	<b>1,162,467</b> <b>(38.5%)</b>	<b>3,018,014</b> <b>(100.0%)</b>	<b>717,133</b> <b>(56.1%)</b>	<b>561,688</b> <b>(43.9%)</b>	<b>1,278,821</b> <b>(100.0%)</b>	<b>45.0%</b>	<b>64.8%</b>	<b>51.3%</b>

Note: Charkhi Dadri was officially notified as 22nd district of Haryana by the Government of Haryana state in 2016. Hence the data is not available.

Source: Prepared by JICA Survey Team based on Statistical Abstract of Haryana 2020-21 and 2009-2010, Department of Economic and Statistical Analysis, Haryana

## (2) Division of work in farming activities

Since statistics and results of previous surveys on gender-wise division of farming-related work in Haryana were not found, opinions on trends/features of this issue were obtained from concerned parties met by the JICA Survey Team as follows.

- While men are mostly engaged in heavy work (including digging, spraying, loading, etc.), many activities (sowing, weeding, harvesting, etc.) are done by women.<sup>42</sup>
- Women are mostly engaged in such farming work as sowing, transplanting, weeding, etc., while men are engaged with other heavy work including spraying, ploughing/digging etc.<sup>43</sup>
- It seems that about 80% of female farmers still depend on male for farming related activities (including decision-making) while about 20% of them decide and implement farming activities independently from men. Since women are engaged in animal husbandry including fodder arrangement, milking, etc., around 50-60% of farming related activities are conducted by female farmers which could be observed in 5 Districts (namely Rohtak, Kaithal, Jind, Bhiwani, and Jhajjar).<sup>44</sup>

These trends were observed at the meeting with Bawania Women FPO (Mahendragarh District)<sup>45</sup>. In most of member households, both men and women are engaged in farming such as cultivating mustard, millets, carrot, cucurbits, tomato, etc. Cases that men work outside and only women are engaged in farming are very limited. The below table shows compilation of answers from participants on “Who in the family are engaged in farming activities?”. It was answered by participants that purchase the agriculture inputs, land preparation, spraying, bringing produces to markets, and obtaining farming-related information are done solely by men. According to responses from participants, women are engaged in weeding solely and in deciding cultivating crops, sowing/transplanting, irrigation, fertilization, harvesting, and post-harvest processing together with men.

**Table 3.6.7 Who in the Family is Engaged in the Following Activities?**

Activities	Both	Women	Men
Deciding crops to be cultivated.	✓		
Purchase of agriculture inputs (seeds, pesticides, fertilizers, etc.).			✓
Land preparation			✓
Sowing (transplanting)	✓	✓	
Irrigation	✓		
Fertilization	✓		
Spraying			✓
Weeding		✓	
Harvesting	✓		
Post-harvest processing (cleaning, bundling, packaging, etc.)	✓		
Bring produces to markets			✓
Obtaining farming-related information (prices of inputs, market prices, etc.)			✓
Attend technical training relating to crop production.			✓
Attend technical training relating to post-harvest/processing.		✓	
Decision making	✓	✓*	✓*

Note: \*Decisions related to household issues are usually made by women, and those related to outside issues are made by men.

Source: Prepared by JICA Survey Team based on answers from Director and some members of Bawania Women FPO and CPC.

This JICA Survey conducted “value chain study of cauliflower, watermelon, green pea seed, chilli and mango” with questionnaire survey for sample farmers of these crops. The below table shows compilation of answers from sample farmers on their division of works.

42 Comments from CEO of Crown FPO (Kurukshetra).

43 Comments from Director of Research, Maharana Pratap Horticultural University Karnal.

44 Comments from staff of Shri Swami Rama Foundation Trust.

45 Meeting was held on 3 February 2023 with participation of the Director, some board members and general members (around 40 in total) of Bawania FPO, together with a Cluster Project Coordinator (CPC) supporting this FPO. Questionnaires were not distributed to respective participants, but discussion was held based on list of questions.

**Table 3.6.8 Division of Work in Family by Gender (Results of Value Chain Study)**

Activities	Califlower Sample: 80 men			Watermelon Sample: 60 men			Green pea seed Sample: 38 men & 2 women			Chilli Sample: 79 men & 1 woman			Mango Sample: 57 men & 3 women		
	Both (%)	Women (%)	Men (%)	Both (%)	Women (%)	Men (%)	Both (%)	Women (%)	Men (%)	Both (%)	Women (%)	Men (%)	Both (%)	Women (%)	Men (%)
Deciding crops to be cultivated.	24	0	76	43	0	53	0	0	100	21	0	79	0	0	100
Purchase of agriculture inputs.	3	0	98	3	0	90	0	0	100	0	0	100	0	0	88
Land preparation	1	0	51	-	-	-	0	0	8	8	0	2	-	-	-
Planting/sowing	13	0	28	20	0	25	0	0	78	34	0	19	0	0	88
Irrigation	9	0	59	23	0	43	0	0	78	8	0	65	0	0	30
Fertilization	1	0	80	2	0	62	0	0	75	3	0	80	0	0	28
Spraying	1	0	59	3	0	48	0	0	68	1	0	40	0	0	17
Weeding (Pruning for mango)	13	0	36	33	0	23	50	0	30	16	0	53	0	0	30
Harvesting	15	0	26	37	0	10	15	0	5	28	0	13	0	0	7
Post-harvest processing.	13	0	16	27	0	20	18	0	0	28	0	13	0	0	2
Bring produces to markets	0	0	95	0	0	90	0	0	100	0	0	100	0	0	7
Obtaining farming-related information.	1	0	99	0	0	100	0	0	100	0	0	100	0	0	7

Source: Value Chain Survey subcontracted by JICA Survey Team.

Note: Since outsider labours are also engaged in activities particularly land preparation, planting, harvesting, post-harvest processing, etc., total of percentages of "Both", "Women" and "Men" is not matched to 100%.

Answers from sample farmers except mango farmers under this value chain study also show similar trends. In all cases of sample mango farmers, men and/or outside labours undertake all activities related to mango cultivation. There is no case/activity that women are solely engaged in. While purchase the agriculture inputs, land preparation, spraying, bringing produces to markets, and obtaining farming-related information are done only by men in nearly all cases, women are engaged in deciding cultivating crops, planting, weeding, harvesting, and post-harvest processing together with men.

Compared with cereal crops, mechanization for vegetable cultivation is limited, and vegetable cultivation still requires a labour force<sup>46</sup>. In addition, according to results of the value chain study, 119 out of total 320 sample farmers have changed cropping pattern from grain crops to vegetables and realize workloads of both men and women have been increased since vegetable cultivation requires more knowledge and cares. It could be thought that shifting from cereals to vegetable cultivation may increase the workload particularly for women who are engaged in labour-intensive manual farming activities such as sowing, weeding, and harvesting.

### **(3) Women's Access to Agriculture/Horticulture related Information and Services**

#### **(a) Land holding situation**

The Hindu Succession Act, 1956, was amended in 2005 to give daughters equal rights as sons to inherit all types of property including those acquired through gift, will, or inheritance<sup>47</sup>. In actual, tendency that daughters give their inheritance rights to their brothers seems to continue.

Cases where women hold agricultural land, seem to be very limited. For example, 12.8% of women own operational land holding according to a previous survey<sup>48</sup>. Members of Bawania Women FPO answered that land holding are mostly owned by their husbands. The staff of Shri Swami Rama Foundation Trust commented that only about 5% of women in its target Districts seem to hold land ownership.

#### **(b) Farmers' and other related organizations/groups**

##### **1) SHGs**

As previously mentioned, more than 50,000 SHGs have been formed and credit linked in Haryana. The total number of members of SHGs credit linked could be estimated as around 750,000 which accounts for more than 60% of female population working as cultivators and agricultural laborers (1,178,571 in total in 2011 Census). Since there are also other credit-related schemes such as Kisan Credit Card Scheme, JLG scheme, etc. by government and donor agencies, it could be said that the accessibility of farmers including female ones to credit services is not so difficult.

Through SHG-related activities, member women could receive training such as on accounting and skills (including processing vegetables, nursery management, compost-making, mushroom cultivation, etc.) for increasing their incomes.

Despite current accessibility to SHGs, some female farmers still do not join SHGs. According to interviews from some women agricultural laborers working at farms of the CEO of some FPO, they have not registered in any SHGs near their residences since they are very busy with their full-day labor work.

##### **2) PG(FPO)s**

As previously mentioned, Central Sector Schemes for promoting PG(FPO)s have been implemented all over India including Haryana. From gender consideration viewpoints, criticisms were raised by some articles<sup>49</sup> for these initiatives as follows:

- The guidelines for 10,000 FPOs set the inclusion of at least one female board member as one of conditions for receiving equity grants. They do not mention the minimum number

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46 Comments from Director of Research, Maharana Pratap Horticultural University Karnal.

47 <https://www.nrilegalservices.com/property-rights-of-women-as-per-hindu-law/>  
<https://indiankanoon.org/doc/1291956/>

48 Kispotta, S., Kumar, G., & Vadyak, A. (2016), "Participation of female labor force agriculture sector: a study with reference to Chattisgarh, India", *International Journal of Research in Management and Commerce*, 6 (8), pp19-26.

49 Shilpa Vasavada, "The 10,000 FPO scheme ignores women farmers", *IDR* (February 25, 2021); Rahul Ranjan Sinha, Rupali Awade and Rajnikant Prasad, "The invisible women in India's farmer producer organizations", *POLICY CIRCLE* (March 8, 2022).

of women PG(FPO)s to be formed nor the minimum number of women shareholders in a mixed PG.

- The guidelines do not lay out a separate strategy for reaching out to women farmers.
- There is no gender segregated data on PGs available in the public domain.
- Women's participation in PG activities are very limited judging from the results of some surveys.<sup>50</sup>

In Haryana, 747 PGs have been so far registered by August 2023 either with these government initiatives or self-promoted. However, the number of women's PGs and gender-wise number of PG members were not available in Haryana<sup>51</sup>.

According to officers of SFACH, incentives are not set for facilitating women's participation in PG activities except for a minimum of one female board member as one of the conditions for receiving equity grants. Women centric PG whose members are all women could be under "special category" and it is not required to take permission from the District Level Monitoring Committee (DLMC) for its formation and its members could be from 2-3 different blocks.

According to the regional manager of a CBBO (Star Agri Warehousing and Collateral Management Ltd.) in charge of supporting 5 PGs in Kurukshetra District, efforts were made to persuade executive members of PGs to include women members because of advice from DOH/SFACH (but without setting specific targets). In actual, around 20 % of members of these 5 FPOs are women<sup>52</sup>. Activities specific to women members have not been arranged by this CBBO. Since regular meetings are held on village basis, general women members could attend such meetings.

Number of women's FPOs in Haryana was not given by DOH/SFACH. Instead, they showed one PG (Bawania Women FPO) as a good case of women's PG. During the meeting of JICA Survey Team with Bawania Women FPO on 3 February 2023, its members gave their opinions: i) there are no opposition from their husband, thus they do not feel difficulties in participation in PG activities; ii) they feel benefits from becoming members of PG as they are given priority to receive assistances and trainings; and iii) more members could work and their income might be increased after their processing facility is constructed.

### 3) Trainings

DOH together with related organizations has provided farmers with various trainings and services under different government schemes. The below table shows District and scheme-wise numbers of beneficiaries. Women beneficiaries (11,224) account for about 27% of total beneficiaries.

Technical trainings related to crop (vegetable, fruits, etc.) production are available for both male and female farmers in such as KVK, Horticulture Training Institute (HTI), Centres of Excellence, etc. However, only male farmers tend to participate in these crop cultivation related trainings. This trend was also heard from members of Bawania Women FPO and some female farmers attending the food processing training in Food Technology Lab. (Kurukshetra)<sup>53</sup>. Those women also explained that they do not particularly want to participate in those cultivation related trainings since they are busy for household chores and their husbands participate in those trainings. On the other hand, it was observed in JICA's mission in June 2023 that some female PG members were motivated to obtain skills and knowledge for improving their production and market channels and to participate in related trainings including those on handling heavy agricultural machinery which is regarded as men's work. Since male farmers seem to communicate with agricultural input suppliers and markets<sup>54</sup>, it could be said that most of farming related information (cultivation technique, prices of inputs, market prices, etc.) is obtained mainly by men.

50 Study implemented by Azim Premji University in 2019 estimated about 3 % of total FPCs in India were women's ones. Another study of MANDI on 40 FPOs in eastern Uttar Pradesh showed only 20% of total members were women and women's participation at the leadership level was limited (two out of three FPOs had no women board members).

51 At least, SFACH, one of implementing agencies for "10,000 FPOs Scheme" has not taken these gender segregated data.

52 Ratios of women members of other FPOs visited by JICA Survey Team are around 20% for Crown FPO and 10% for Kurukshetra Vegetable FPO.

53 Members of Bawania Women FPO explained that men usually participate in crop cultivation related trainings, while women participate in training on post-harvest/processing.

54 Answers from members of Bawania Women FPO.

On the other hand, female farmers tend to participate in trainings related to post-harvest, preserving and processing, which are provided by HTI, Food Technology Labs., etc. It was heard from members of Bawania Women FPO that venues and accessibility are more important for women than topics of trainings.

Distribution of information on those trainings, their applications and selection of target participants are done online or DHOs (District Horticulture Officer) who communicate with leaders of villages.

In case of trainings for members of PGs, while CBBOs provide guidance and trainings related to managing organizations, marketing, etc., CBBOs do not organize by themselves but coordinate with related government departments/organizations such as DOH to provide technical trainings and inputs related to crop (vegetable) production to PG members with utilizing existing schemes<sup>55</sup>.

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<sup>55</sup> According to hearing from Director and members of Kurukshetra Vegetable FPO, exposure tour on value-addition was organized by SFACH (before introduction of CBBO) and board members and some general members participated in the tour. Many general members participated in technical training on peas arranged by DOH. (Number of women participants for these activities was not obtained.)

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**Table 3.6.9 Number of Beneficiaries of All Schemes in Haryana (2020-21)**

#	District/Centers	Participant Number by Scheme										By Gender		Total
		MIDH	SCSP	IHD	GAP	Sericulture Schemes	PMKSY	AHRD	MPMV	CCDP	Demonstration /Food Processing	Women	Men	
1	Ambala	1,007	18	112	0	0	14	0	0	0	0	137	1,014	1,151
2	Bhiwani	3,448	3	455	0	0	2,517	0	0	0	0	5,776	647	6,423
3	Charkhi Dadri	1,020	2	184	70	0	0	0	0	0	0	78	1,198	1,276
4	Faridabad	0	15	276	0	0	8	0	0	0	0	5	294	299
5	Fatehabad	1,463	24	249	0	0	18	0	0	0	0	131	1,623	1,754
6	Gurugram	1,016	16	191	0	0	66	0	0	0	0	220	1,069	1,289
7	Hisar	1,086	27	770	0	0	0	0	0	0	0	171	1,712	1,883
8	Jhajjar	738	22	235	0	0	0	0	0	0	0	43	952	995
9	Jind	1,933	25	247	0	0	13	0	0	0	0	114	2,104	2,218
10	Kaithal	0	51	365	0	0	16	0	0	205	0	37	600	637
11	Karnal	1,581	31	166	0	0	14	0	0	0	0	149	1,643	1,792
12	Kurukshetra	1,219	23	238	0	0	10	0	0	0	0	116	1,374	1,490
13	Nuh	0	5	529	0	0	304	0	0	0	0	53	785	838
14	Mahendragarh	903	16	322	0	0	0	0	0	0	0	102	1,139	1,241
15	Palwal	0	43	298	0	0	0	0	0	0	0	33	308	341
16	Panchkula	1,129	22	871	0	0	0	0	0	0	0	139	1,883	2,022
17	Panipat	1,064	21	602	0	0	0	0	0	0	0	135	1,552	1,687
18	Rewari	0	18	731	0	0	373	0	0	0	0	136	986	1,122
19	Rohtak	1,557	29	272	0	0	19	0	0	0	0	141	1,736	1,877
20	Sirsa	2,492	7	546	0	0	0	0	0	0	0	461	2,584	3,045
21	Sonapat	653	21	167	0	0	3	0	0	0	0	63	781	844
22	Yamunanagar	1,245	28	334	0	0	0	0	0	0	0	148	1,459	1,607
23	Sericulture Branches	0	0	0	0	517	0	0	0	0	0	98	419	517
24	FT Kurukshetra	0	0	0	0	0	0	0	0	0	775	775	0	775
25	FT Sirsa	0	0	0	0	0	0	0	0	0	813	813	0	813
26	FT Jind	0	0	0	0	0	0	0	0	0	976	976	0	976
27	CEG, Bhuna (Fatehabad)	0	0	0	0	0	0	0	3	0	0	1	2	3
28	CEV, Gharaunda (Karnal)	0	0	325	0	0	0	98	0	0	0	46	377	423
29	PTC Shamgarh (Karnal)	0	0	0	0	0	0	0	0	0	0	0	0	0
30	HTI Uchani, Karnal	0	0	0	0	0	0	53	0	0	0	1	52	53
31	CSTF Ladwa (Kurukshetra)	0	0	0	0	0	0	0	0	0	0	0	0	0
32	IBDC Ramnagar (Kurukshetra)	0	0	1,276	0	0	0	0	0	0	0	59	1,217	1,276
33	CEF Mangiana (Sirsa)	0	0	259	0	0	0	305	0	0	0	22	542	564
34	IHDC Hodal, Palwal	0	0	364	0	0	0	0	0	0	0	26	338	364
35	IHDC Sunderah (M.Garh)	0	0	230	0	0	0	0	0	0	0	7	223	230
36	HGHSC, Samargopalpur (Rohtak)	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: <Schemes>MIDH: Mission for Integrated Development of Horticulture, SCSP: Scheduled Castes Sub Plan, IHD: Integrated Horticulture Development, GAP: Good Agricultural Practices, PMKSY: Pradhan Mantri Krishi Sinchayee Yojana, AHRD: Agricultural Human Resource Development, MPMV: Mera Pani Meri Virasat, CCDP: Crop Cluster Development Programme, <Centres>FT: Food Technology, Sericulture Branch: Panchkula, Ambala, Yamuna Nagar, CEG: Centre of Excellence for Guava, CEV: Centre of Excellence for Vegetable, PTC: Potato Technology Centre, HTI: Horticulture Training Institute, CSTF: Centre of Sub-Tropical Fruits, CEF: Centre of Excellence for Fruits, IBDC: Integrated Beekeeping Development Centre, IHDC: Integrated Horticulture Development Centre  
Source: DOH.

### **3.6.3 Challenges for Gender Mainstreaming**

Challenges for gender mainstreaming are identified as follows:

#### **(1) General situation of women in Haryana:**

Past gender-related indicators (sex ratios, literacy, health conditions, etc.) showed worse women's situation in Haryana. Their situation has been improved by many schemes/measures mainly initiated by WCD, however, it should be further improved and these initiatives for gender mainstreaming in general should be continued.

#### **(2) Women working in the agricultural sector:**

Although the actual number of women working in agricultural sector was decreased, its ratio against total working population is still high, thus measures for considering them should be taken. While women practicing farming independently are limited (which may be related to limited women land holders), most of them are engaged in farming in supplemental ways with such labour-intensive works as sowing, weeding, harvesting, etc. Shifting from cereals to horticultural (vegetable) cultivation may increase the workload particularly for women who are engaged in such labour-intensive manual farming.

#### **(3) Access to credit services:**

There are many programs/schemes providing micro-credit services such as through SHGs, thus accessibility of credit services for women seems not be so difficult. Linking female farmers who need credits to these programs/schemes is still required.

#### **(4) Access to training and information:**

Gender mainstreaming efforts have been taken for various schemes in agriculture, horticulture, and allied sectors with allocating certain portion of funds for women farmers. Under these schemes, various training on production and services are provided for farmers. Only male farmers tend to participate in crop-cultivation related training although they are available for both male and female farmers. On the other hand, female ones tend to participate in training related to post-harvest, preserving and processing. Measures to encourage/facilitate female farmers to participate in crop cultivation trainings should be considered. In addition, it seems that trainings related to gender sensitization and mainstreaming for farmers have not been conducted.

#### **(5) Participation in PG(FPO)s:**

The number of women's PGs and gender-wise number of PG members are not available in Haryana. At least, these data should be collected and compiled under the proposed Project. Incentives are not set for facilitating women's participation in PG activities except minimum one female board member as one of conditions for receiving equity grants. Efforts were made to persuade executive members of PGs to include women members because of advice from DOH/SFACH. In actual, women members seem to be still limited.

#### **(6) DOH:**

Neither units are set nor personnel are assigned in DOH for addressing gender mainstreaming issues. In addition, officers of DOH have not received trainings on gender sensitization and mainstreaming, thus they do not seem very gender conscious. Preparation of manuals on measures to be taken in proposed Project for gender mainstreaming and implementation of related trainings for DOH officers and persons of concerned organizations should be examined.

### **3.7 Nutrition Sensitization**

#### **3.7.1 Background**

##### **(1) Overall Nutrition Status in India and Haryana**

Though India has made great progress in the economic field with an impressive growth rate in the last several years, the nutrition scenario in the country remains grim, with a continuing high burden of undernutrition. The nutrition inequality gap has widened across different states and socio-economic



groups. Also, this progress in economics has generated a change in food habits, which causes new issues in nutrition. Main health issues and concerns of the Nation and State can be summarised as follows: 1) Increasing population of obesity and consequent life-style diseases, 2) One in every ten children seem not taking enough nutrient for their growth, 3) Every second woman of reproductive age in the country is anaemic; Two in every three children of age 5 years are anaemic. Table 3.6.1 shows the data of the National Family Health Survey (NFHS) highlights the above stated facts. The comparison of the three surveys reveals that the rate of overweight among adult men and women significantly increased from 2005-2006 to 2019-2020, and the rate is rapidly increasing in Haryana compared to India. In terms of children, the proportion of underweight children has decreased while other indicators to assess the nutritional status had shown deterioration. For example, it is only 11.3% of the children (between 6-23 years old) receive a balanced diet of minimum required frequency in India. Infant mortality rate and Under-five mortality rate has been slightly improved from 2015-2016, however both rates remain high, 35.2% and 41.9% respectively.

Anaemia is one of the frequently observed symptoms of malnutrition in India and in Haryana. It is commonly observed in children and women. As shown in the table below, the proportion of anaemic children is still as high as 70.4% in Haryana. Among adult women, 60.6% of non-pregnant women and 56.5% of pregnant women are anaemic while adult men whose anaemic accounted for 18.9%.

**Table 3.7.1 Nutritional Status of People in India and Haryana**

Indicators	India			Haryana		
	NFHS-3 (2005- 2006)	NFHS-4 (2015- 2016)	NFHS-5 (2019- 2020)	NFHS-3 (2005- 2006)	NFHS-4 (2015- 2016)	NFHS-5 (2019- 2020)
Children under 5 years who are stunted (height for age) in %	48	38.4	35.5	45.7	34.0	27.5
Children under 5 years who are wasted (weight for height) in %	19.8	21.0	19.3	19.1	21.2	11.5
Children under 5 years who are severely wasted (weight for height) %	6.4	7.5	7.7	5	9.0	4.4
Children under 5 years who are underweight (weight for age) in %	42.5	35.8	32.1	39.6	29.4	21.5
Women whose Body Mass Index below normal (BMI<18.5kg/m <sup>2</sup> ) %	35.5	22.9	18.7	31.4	15.8	15.1
Men whose Body Mass Index is below normal (BMI<18.5kg/m <sup>2</sup> ) %	34.2	20.2	16.2	30.9	11.3	14.5
Women who are overweight or obese (BMI≥25.0kg/m <sup>2</sup> ) in %	12.6	20.6	24.0	<b>17.4</b>	<b>21.0</b>	<b>33.1</b>
Men who are overweight or obese (BMI≥25.0kg/m <sup>2</sup> ) in %	9.3	18.6	22.9	<b>10.8</b>	<b>20.0</b>	<b>28.3</b>
Children age 6-59 months who are anaemic (<11.0g/dl) in %	69.4	58.6	67.1	<b>72.3</b>	<b>71.7</b>	<b>70.4</b>
Non-pregnant women age 15-49 years who are anaemic (<12.0g/dl) %	55.2	53.2	57.2	55.2	63.1	60.6
Pregnant women age 15-49 years who are anaemic (<11.0g/dl) in %	57.9	50.4	52.2	<b>69.7</b>	<b>55.0</b>	<b>56.5</b>
Men age 15-49 years who are anaemic (<13.0g/dl) in %	24.2	22.7	25.0	19.2	20.9	18.9
Infant mortality rate (IMR)	57	40.7	35.2	42	32.8	33.3
Under -five mortality rate(U5MR)	74	49.7	41.9	52	41.1	38.7
Total children age 6-23 months receiving an adequate diet (%)	NA	9.6	11.3	NA	7.5	11.8

Source: National Family Health Survey-4, 2015-16, and NFHS-5, Ministry of Health and Family Welfare, Government of India.

National Sample Survey Organization (NSSO) shows recommended dietary allowance (RDA) for adults and actual the daily per capita energy intake, protein intake, and fat intake at national and state levels. At the national level, daily per capita energy intake is lower than the RDA while that protein intake and fat intake is higher enough than the RDA. High daily per capita fat intake can be one of the reasons for the increase in people who are overweight.

**Table 3.7.2 Recommended Dietary Allowances and Daily Per Capita Energy, Protein, and Fat Intake for India and Haryana in 2011-2012**

Categories	RDA (ICMR norms) * kcal	Energy intake (Average) kcal	RDA (ICMR norms) * for Protein gm	Protein intake (Average) gm	RDA (ICMR norms) * for Fat in gm	Fat intake (Average) gm
India	2,420	2,219.5	49.8	60.5 gm	28.3	52.05
Rural area in India		2,233		60.7 gm		46.1
Urban area in India		2,206		60.3 gm		58.0
Haryana		2,442		70.7 gm		71.65
Rural area in Haryana		2,441		72.8 gm		68.6
Urban area in Haryana		2,443		68.6 gm		74.7

Note: RDA=Recommended Dietary Allowance/ ICMR=Indian Council of Medical Research<sup>56</sup>

Source: Nutritional Intake in India, 2011-2012, 68th round of NSSO Consumer Expenditure Survey published by Ministry of Statistics and Programme Implementation, Government of India (October 2014).

At the state level, Haryana has relatively many households in the high calorie intake ranges, even though their amount of cereal consumption, which makes the largest contribution to calorie intake, is almost the same as the national average. Also, it is explained that Haryana had very few households in the lowest energy intake class in both rural and urban areas. The protein intake per person per day in Haryana was 72.8gm in the rural sector and 68.6gm in the urban which is significantly higher than the average at the national level (rural: 60.3gm, urban: 60.7gm). One of the reasons for this seems to be that consumption of milk and milk products is relatively high in Haryana. The share of milk and milk products in protein intake was 27% in rural and 22% in urban, which is noticeably above the national average (rural: 10%, urban: 12%). The average fat intake in Haryana was 68.6gm in rural and 74.7gm in urban, which is quite higher than the national average (rural:46gm, urban:58gm) and this is the highest in India.

According to Comprehensive National Nutrition Survey (CNNS)-2016-18, both overnutrition and undernutrition can be more apparent within the same community, household, and individuals. Table 3.7.3 shows micronutrient (vitamin A, vitamin D, vitamin B12, iodine, zinc, folate) deficiency among children in India and Haryana. While the lack of Vitamin-B12 and Zinc in the adolescents and Folate remain grim at the national level, deficiency of Vitamin-A and Vitamin-D is also a serious issue in Haryana.

**Table 3.7.3 Micronutrient deficiency among children in India**

Age group of children	Vita-A		Vita-B12		Vita -D		Zinc		Folate (Vita- B9)	
	India	Haryana	India	Haryana	India	Haryana	India	Haryana	India	Haryana
Pre-schoolers (1-4 years)	17.6%	<b>26.1%</b>	13.8%	11.6%	14%	<b>27.6%</b>	19%	6.2	23.3%	14.6%
School age (5-9 years)	21.5%	<b>24.2%</b>	17.2%	8.6%	18.2%	<b>45.5</b>	17%	9.1	28.2%	23.5%
Adolescents (10-19 years)	15.6%	8.9%	30.9%	<b>34.3%</b>	23.9%	<b>53.8%</b>	31.7%	19.4	36.7%	33.5%

Note: Gender segregated data is not available.

Source: Comprehensive National Nutrition Survey (2016-18) 2019

Table 3.7.4 shows the anaemia and iron deficiency among children in India and Haryana. The status of anaemia has been improved yet the percentage of children under 4 and girl children between 10-19 remain as high as 40.5% and 39.6% respectively. Although anaemic and iron deficiency have been still common in every age in Haryana, they are more serious issues especially in children under 4. Almost one-half of children under 4 have symptoms of anaemia, and 58.9% of pre-schoolers have iron deficiency. One of the major causes of anaemia is a lack of iron consumption and absorption. This may be due to the low iron content of foods consumed, a lack in the amount/quantity of consumption of iron-

56 The recommended calorie intake level for Indians set by the National Institute of Nutrition, ICMR, is based on age, sex, body mass, and nature of work. The norm set for the reference Indian man of age 19-39 years and woman of age 18-29years with a normal body mass index and body weight 65 kg and 55kg respectively in Short Report of NUTRIENT REQUIREMENTS FOR INDIANS published by ICMR (2020). Here, the RDA is calculated using the average moderate weight of a man and woman (60 kg).

rich foods, or low absorption of iron due to some micronutrient deficiency that helps the absorption of iron, such as vitamin B6, B12, C, and B9. This is linked to the result in Table 3.7.3.

**Table 3.7.4 Anaemia and Iron deficiency among children in India and in Haryana**

Age group of children	Anaemic		Iron deficiency (Low serum ferritin)	
	India	Haryana	India	Haryana
Pre-schoolers 1-4 years*	40.5%	<b>48.3%</b>	31.9%	<b>58.9%</b>
School age 5-9 years*	23.5% (Female: 24.7%/ Male: 22.2%)	18.3%	17% (Female: 17.5%/ Male: 16.5%)	<b>35.6%</b>
Adolescents 10-19 years	28.4% (Female: 39.6%/ Male: 17.5%)	<b>29.9%</b>	21.5% (Female: 31.3%/ Male: 11.5%)	<b>28.7%</b>

Note: Gender segregate is not available.

Source: Comprehensive National Nutrition Survey (2016-18) 2019

## (2) Nutrition Status in Haryana (District wise)

A comparative analysis is done to analyse the overall nutrition data of the twenty-two districts in Haryana. The result is shown in the Table 3.7.5.

The proportion of overweight women is higher than average in relatively developed districts in Haryana such as Ambala, Jhajjar, Karnal, Kurukshetra, Panchkula, Panipat, Rohtak, Sonapat, and Yamuna Nagar. In contrast, the proportion of women with body mass index below normal is high in developing districts such as Bhiwani, Charkhi Dadri, Fatehabad, Hisar, Jind, Kaithal, Nuh, Palwal, Rohtak, and Sirsa. Although there is no data showing the consumption of micronutrient district wise, people in these districts might have faced micronutrient deficiency as well based on the explanation in Comprehensive National Nutrition Survey (CNNS)-2016-18.

Table 3.6.5 shows an increased percentage of malnutrition in various forms whereas highlighted figures reflect an alarming situation with respect to children and women health. While the prevalence of anaemia among women in reproductive age is whole in Haryana, that of children below 5 years appears severe (below the average) in specific area such as Karnal, Kurukshetra, Mahendragarh, Nuh, Palwal, Panipat, Rewari, Rohtak, and Sirsa.

**Table 3.7.5 Nutritional parameters and status of State Haryana**

Districts	Children under 5 year of age who are stunted (Height for age) %		Children under 5 year who are wasted (weight for height) in %		Children under 5 year of age who are severely wasted (weight for height) %		Children under 5 year of age who are under weight (weight for age) %		Women with body mass index below normal (BMI < 18.5 kg/m <sup>2</sup> )		Women who are overweight or obese (BMI ≥ 25.0 kg/m <sup>2</sup> ) in %		Children (6-59 months) who are anemic (< 11.0 g/dl)		Non-pregnant Women of age 15-49 years who are anemic (< 12.0 g/dl) %		Pregnant Women of age 15-49 years who are anemic (< 11.0 g/dl) %		Total children aged 6-23 months receiving adequate diet (%)	
	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5
<b>Haryana</b>	34.0	27.5	21.2	11.5	9.0	4.4	29.4	21.5	15.8	15.1	21.0	33.1	71.7	70.4	63.1	60.6	55.0	56.5	7.5	11.8
Ambala	19.8	24.1	37.9	10.9	18.4	4.0	32.9	13.7	11.1	14.8	12.7	41.6	75.1	64.2	69.8	46.5	54.7	(33.8)	12.5	17.4
Bhiwani	-	29.0	-	6.0	-	1.9	-	20.6	-	19.5	-	28.1	-	69.2	-	66.8	-	(54.1)	-	8.4
Charkhi Dadri	-	23.9	-	10.6	-	2.6	-	16.9	-	17.0	-	28.8	-	67.2	-	73.1	-	(62.4)	-	11.5
Faridabad	29.7	28.9	19.7	8.0	8.9	3.6	20.5	19.5	14.4	10.0	14.4	10.0	75.0	68.4	55.5	54.8	(31.0)	(30.9)	14.8	11.7
Fatehabad	28.5	24.6	20.7	16.0	8.0	5.3	30.0	26.6	22.2	19.8	15.1	29.8	70.5	59.3	65.3	62.5	(67.6)	(59.0)	10.8	11.2
Gurgaon	41.2	22.1	17.9	15.7	9.5	4.2	30.6	22.2	12.5	9.0	20.2	24.3	66.2	67.7	73.6	68.0	66.5	(55.9)	5.8	10.1
Hisar	25.6	27.8	23.5	16.4	9.3	5.1	23.5	21.4	14.9	18.5	17.8	30.2	66.4	70.5	60.1	64.0	49.8	(58.7)	3.2	2.6
Jhajjar	22.3	15.6	15.5	8.0	5.5	3.5	21.0	9.7	12.4	10.1	21.6	43.5	70.9	76.9	61.2	59.9	(59.8)	(65.7)	12.5	15.4
Jind	26.0	25.5	26.7	8.8	14.0	1.6	29.3	22.9	17.0	18.9	17.5	32.3	76.6	68.9	62.6	59.5	62.3	(62.7)	8.9	10.5
Kaithal	33.6	29.9	23.8	20.7	10.2	9.5	37.5	29.9	15.3	16.5	25.3	32.7	68.0	61.4	60.1	62.5	54.4	(43.2)	6.3	10.0
Karnal	41.0	29.2	19.8	9.8	7.1	4.8	32.5	20.5	12.9	14.9	26.3	36.5	75.5	78.3	67.1	62.1	66.3	(53.2)	7.1	19.2
Kurukshetra	31.9	24.9	24.1	12.8	11.9	5.0	27.1	22.5	9.2	11.8	19.6	37.3	63.4	73.7	55.9	57.5	32.9	(46.3)	11.0	28.7
Mahendragarh	23.5	25.2	19.2	8.4	6.8	2.1	26.1	15.4	19.2	14.3	14.4	29.5	73.7	72.3	64.3	61.2	(43.0)	(62.8)	19.3	8.7
Mewat	52.2	44.4	17.2	14.2	7.5	7.1	40.2	37.3	27.1	19.2	12.2	14.9	83.7	76.4	69.1	61.1	78.6	55.2	3.7	13.0
Palwal	34.0	31.0	21.4	9.9	10.2	4.2	27.5	21.0	16.9	15.8	19.0	27.4	75.2	71.6	60.4	57.2	58.6	(56.8)	7.4	21.2
Punchkula	21.5	21.8	31.8	12.0	13.6	5.0	26.2	19.3	6.8	14.1	22.9	39.9	66.4	53.1	56.5	57.4	38.7	-	6.2	10.3
Panipat	44.6	25.1	25.1	9.9	11.8	2.8	40.8	18.9	10.4	13.7	25.8	37.8	65.5	73.4	67.2	66.8	50.2	(69.0)	4.7	10.3
Rewari	27.8	25.9	18.3	9.3	7.0	4.2	23.0	20.5	21.4	11.7	20.1	28.3	77.8	71.3	65.6	61.9	(48.4)	(59.3)	4.6	6.1
Rohtak	36.6	28.9	13.6	12.5	4.5	2.9	25.2	22.1	16.1	15.9	21.6	35.9	76.3	76.2	57.8	64.8	58.7	(77.1)	5.6	6.0
Sirsa	34.2	25.0	22.5	12.6	7.2	5.1	30.1	23.4	20.6	20.8	23.0	29.3	72.4	70.1	59.7	62.1	52.8	-	0.0	(9.1)
Sonapat	40.2	23.6	21.6	9.2	9.7	5.1	30.4	12.7	14.1	13.2	31.3	39.3	58.6	68.7	66.5	53.0	(65.5)	(61.0)	4.6	5.1
Yamunanagar	30.0	27.7	26.8	12.1	11.6	4.3	31.8	23.1	16.2	14.0	19.0	38.0	58.0	72.9	57.1	56.3	55.8	(62.2)	12.4	12.4

Source: National Family Health Survey-4, 2015-16, and NFHS-5, . Ministry of Health and Family Welfare, Government of India.

### (3) Cause of Malnutrition

Causes of this malnutrition can be summarised as follows: 1) Change in diet among adults and 2) Undernourishment of children and women.

(a) Change in diet among adults

According to Comprehensive National Nutrition Survey (CNNS)-2016-18, it has been easier to access rich food items such as milk and its products, oils and fats, and miscellaneous food products (consisting of relatively unhealthy food such as fast food, processed food, beverages, etc.). This has implications for the emerging problem of obesity in India.

The growth of the food delivery sector is also one of the huge factors that has changed food habits. Though people can easily get access to the food cooked outside of their homes, most restaurants hardly give nutrition information. This may cause people to overeat certain nutrients such as sugar, oils, and fats. The COVID-19 pandemic helped grow this sector, and it is estimated to grow more in the future.

(b) Lack of knowledge

Comprehensive National Nutrition Survey (CNNS)-2016-18 pointed out that parents also may lack knowledge on appropriate foods and feeding practices for the child's age and have inadequate awareness and or means for proper caring and health-seeking behavior. This may be true for health and nutrition of adults themselves.

(c) Lack of access

Micronutrients seem related to the lack of access to foods rich in micronutrients (vegetables, fruits, dairy products)<sup>57</sup>. Since they are unaffordable for lower income families, this gap in the provision of key vitamins, iron, zinc, calcium, and iodine can have a serious negative impact on long-term development. Comprehensive National Nutrition Survey (CNNS)-2016-18 describes that the correlation between wealth level and Vitamin-A deficiency is relatively strong. Providing access to foods rich in micronutrients to the poor is a key challenge.

(d) Lack of data

Although it is not hard to obtain the data on the consumption status of energy, protein, and fat, there are few data as to nutrition data availability for micronutrients. Proceeding data collection and research related to micronutrients can also help attract people's interest in nutrition.

### (4) Intervention by Central Government

Given these situations, constitutional, legislative policy, plan and programmatic commitments have been conducted. There are various government interventions working towards improving the nutritional status of the Indian population. The nodal agency for nutrition in India is POSHAN Abhiyan (former National Nutrition Mission) established under the Ministry of Women and Child Development. The interventions implemented by POSHAN Abhiyan are given in the table below.

**Table 3.7.6 Interventions Concerning Nutrition undertaken by POSHAN Abhiyan**

Type of Intervention	Outline of the Intervention
Ration	Take home ration is preschool children, adolescent girls, pregnant and feeding mothers. Distribution of ration is done through Anganwadi (childcare centre under the women and child development department)
Poshan Tracker App	The poshan Tracker is a mobile based application rolled out by the ministry of women and child development department Government of India provides a view of the activities of Anganwadi centre (AWC), service deliveries of Anganwadi workers (AWWs) and complete beneficiary management of pregnant women, lactating mothers, and children.
Poshan Pakhwada	POSHAN pakhwada emphasises on identification and celebration of healthy child, and integration of modern and traditional practices for a healthy India within the thematic areas around POSHAN MITRA (Modern, IT-based, Traditional and Regional Activities). It is held every year in the month of March for a fortnight.
Village Health Sanitation and Nutrition Day)	On the last Saturday of every month, celebration held at AWC for Health check-up and vaccination of children and pregnant women.
Mid-day Meal Scheme	The scheme aims at enhanced enrolment, retention and attendance, retention, and attendance

<sup>57</sup> Food and Nutritional Security Analysis 2019 (FNSA 2019)

Type of Intervention	Outline of the Intervention
	beside improvement of nutritional levels among children. It was launched as a national program of nutritional support to primary Education. This is implemented as a part of Nutritional Food Security Mission and by the Educational Department. Primary and upper primary pupils are assisted in this scheme.
Targeted public Distribution System	National food security miss, the "Targeted Public Distribution System" (TPDS to below poverty line). Under this families get minimum ration like Rice and wheat, and some states provide sugar and pulses every month.

Source: ICDS, UNDER Poshan abhiyan

Although DOH in Haryana hold “Enhance horticulture production, augment farmers, income and strengthen nutritional security” as one of the objectives in Mission for Integrated Development of Horticulture (MIDH), there are almost no state scheme targeting nutrition improvement itself in DOH and DOA Haryana is also the same.

### 3.7.2 Activities and Challenges

#### (1) Horticulture Development and Nutrition

Nation’s economic development and nutritional profile are interlinked. Especially, food production, and processing and storage direct bearing on food access, diet and nutritional status of women and children. In a place where agriculture is a major source of livelihood, agriculture income affects the food expenditure, which is linked to food access and diet. One of the advantages that the farmer has is that they can also diversify the crops that they grow which can also be consumed at home to meet the nutritional requirement.

#### (2) Nutrition Improvement Activities

##### (a) Promoting Nutrient Rich Crops

In the project districts, vegetables and fruits which have micronutrient will be promoted for production, and increased intake or household consumption. This may lead to improving the nutrition status of people in Haryana and around Haryana as well. Also, one of the advantages that the farmer has is that they can also diversify the crops that they grow which can also be consumed at home to meet the nutritional requirement.

##### (b) Training about Nutrition to PGs

Developing and strengthening Producer Groups (PGs) is one of the main components of this project. Training regarding horticulture development to PGs has been provided by some institutions, which can be utilized for sharing the knowledge and techniques of nutrition improvement (Alternative nutritious and healthy foods, Recipes to keep the nutrition the ingredients have, and so on).

**Table 3.7.7 Training to PGs**

Institution	Contents of Training
Krishi Vigyan Kendra/ KVK	KVK is an institution that provides agriculture extension services across the state. Participants can get the technology and knowledge developed at the research stations
Food Technology Lab, Kurukshetra/ Jind / Sirsa	This Scheme was launched in the year 2007-08 primarily to demonstrate and train the local farmers and women entrepreneurs in the field of Post-Harvest Management and processing. Food Processing Technologists give participants the original recipe they produced. Nutrition and health are also considered (e.g., They use Jaggery which has more mineral than sugar in some recipe.).
Horticulture Training Institute/HTI	HTI provides the need-based training for farmers/staff of other states. These areas are production of horticultural crops, post-harvest Management & Processing Technology for Horticultural crops, and so on.
(HAMETI) *Target is not PGs	The Institute's goal is to assist the field staff of the State Department of Agriculture and related agencies in effectively managing Extension Services through bottom-up, farmer-participatory, and decentralized planning and control systems.

Source: Prepared by JICA Survey Team

##### (c) Kitchen Garden

One of the advantages to belong to PG(FPO)s is that members can get access to resources of agriculture, not only agricultural inputs but also kit of kitchen gardens. Kitchen garden and

medicinal garden kind of small initiatives along with small processing units help each family can process surplus seasonal vegetables and fruits to use year around, which leads to complement the nutrition value. DOH supports these activities through financial support but not have such activities or schemes for the sake of nutrition improvement.

## Chapter 4 Result of Subcontract Survey

### 4.1 Groundwater Depletion and Soil Degradation Survey

#### 4.1.1 Methodology

##### (1) Introduction

Agriculture and related industries account for a significant portion of India's GDP and employment, but Haryana state faces a high risk of groundwater depletion due to grain production centered on rice. To address this, the Haryana government launched the *Mera Pani Meri Virasat* Scheme promoting crop diversification to horticultural crops with low environmental impact.

Considering the current situation of Haryana state mentioned above, JICA decided to conduct a study on groundwater depletion and soil degradation, leading to the Haryana Sustainable Horticulture Promotion Project. The scheme offers incentives for farmers to replace paddy with maize, cotton, pearl millet (bajra), sugarcane, pulses, fodder crops, horticulture and summer onion in targeted blocks with high water tables and restricts paddy cultivation in certain areas.

##### (2) Scope of Work

The scope of work includes analyzing the current status in Haryana state such as groundwater, the change in land use and cropping patterns over the last 30 years, water source portfolio for agriculture, groundwater depletion and soil degradation status in each district, environmental issue such as water logging and salt accumulation, statistics showing the relationship between groundwater table decline and agriculture, costs of conversion to horticultural crop production and its effects on groundwater depletion, and evaluation of government-supported projects.

The survey was conducted through interviews with the following subjects.

No.	SL. No. Name of Institute
1	Haryana Water Resource Authority
2	Centre for Excellence for Vegetable (An Indo-Israel Project), Gharaunda, Karnal
3	District Horticulture Office, Karnal
4	District Horticulture Office, Yamuna Nagar
5	District Horticulture Office, Rohtak
6	District Horticulture Office, Mahendragarh
7	District Horticulture Office, Fatehabad
8	District Horticulture Office, Nuh
9	District Horticulture Office, Jind
10	Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar

The survey was conducted through interviews with 10 farmers in each following districts, Jind, Rohtak, Fatehabad, Yamunanagar, Mahendragarh, Nuh and Karnal.

##### (3) Need of Comprehensive Survey

Haryana state is experiencing a water shortage of both surface and groundwater resources, with over-exploitation of groundwater leading to fast depletion. To address this issue, artificial recharge and water conservation are crucial, and crop rotation and conversion of cereals to horticulture are necessary. Water depletion can be mitigated through self-regulation by the community or regulation by the government. In December 2020, the Haryana government established the Haryana Water Resources Authority to regulate groundwater in the State. There was a need of comprehensive survey to generate data base on groundwater depletion and soil degradation which could be used to plan the project on sustainable horticulture in the state of Haryana.



#### (4) Material and Method

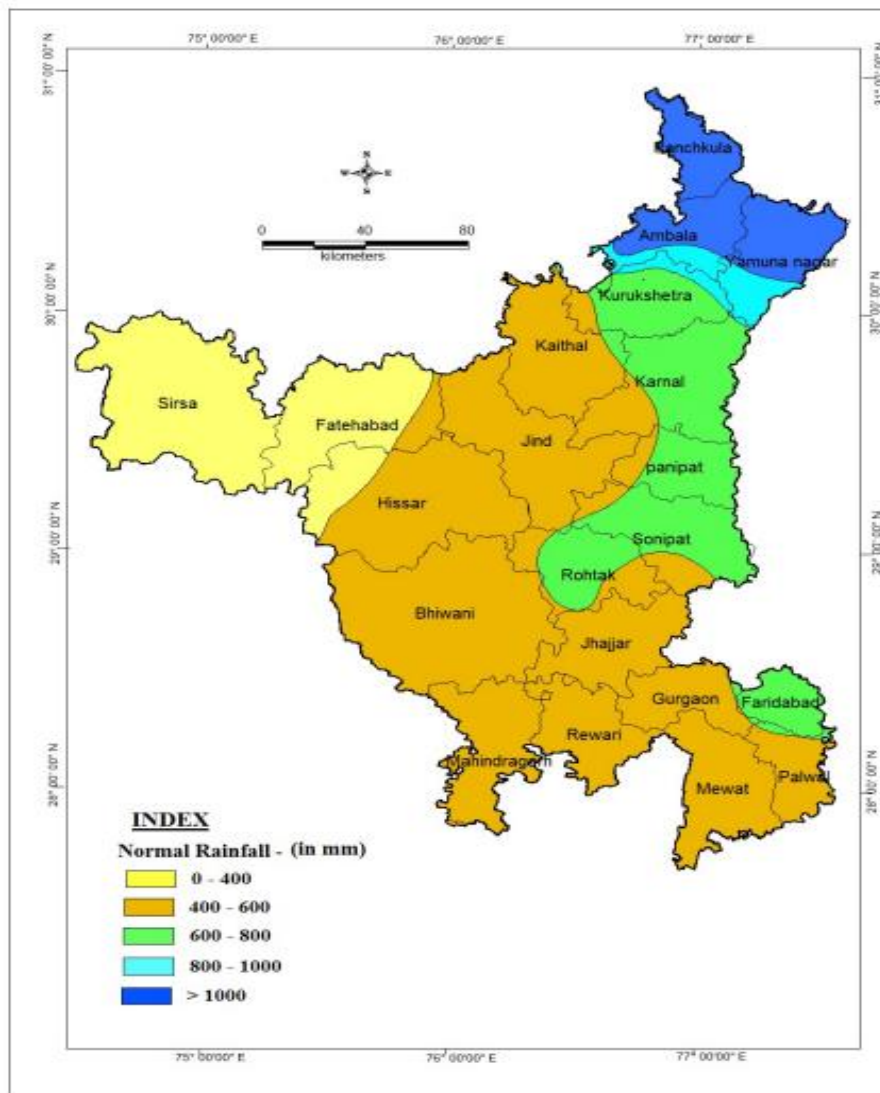
The survey was conducted by adopting the below described methods for the collection of data and their interpretation,

- Water Level, Rainfall, Crop Production and Soil Related data are taken from different government websites and their offices.
- Visited different government offices and universities and conducted meetings with some officials for the current and historical data.
- Preparation of GIS-based maps for showing all the data

#### 4.1.2 Result of the Subcontract Survey

##### (1) Climate and Rainfall

Haryana state has a subtropical, semi-arid to sub-humid, continental, and monsoon climate. The State experiences four seasons: cold, hot, southwest monsoon, and post-monsoon. The southwest monsoon season from June to September is the primary source of groundwater and contributes about 80% of the annual average rainfall, while the winter rain from December to March accounts for about 20%. There are significant spatial variations in rainfall across the State, with Panchkula receiving the highest average annual rainfall of 1,185 mm over the past 30 years (1992-2022) and Sirsa receiving the lowest with 321 mm. Rainfall Map of Haryana is given as Figure 4.1.1.



Source: Water Resource Information System (WRIS)

Figure 4.1.1 Normal Rainfall Map of Haryana Stat

Annual average rainfall of 30 years in the State is shown in Table 4.1.1.

**Table 4.1.1 Average Annual Rainfall of 30 Years (1992-22)**

SL. No.	Name of District	Avg. Rainfall of 30 Years(mm) (1992-2022)
1	Ambala	1,070
2	Bhiwani	432
3	Charkhi Dadri	627
4	Faridabad	528
5	Fatehabad	375
6	Gurugram	588
7	Hisar	412
8	Jhajjar	500
9	Jind	488
10	Kaithal	546
11	Karnal	652
12	Kurukshetra	729
13	Mahendragarh	496
14	Nuh	523
15	Palwal	483
16	Panchkula	1,232
17	Panipat	549
18	Rewari	571
19	Rohtak	516
20	Sirsa	321
21	Sonipat	567
22	Yamunanagar	1,185

Source: Water Resource Information System

### Geomorphology

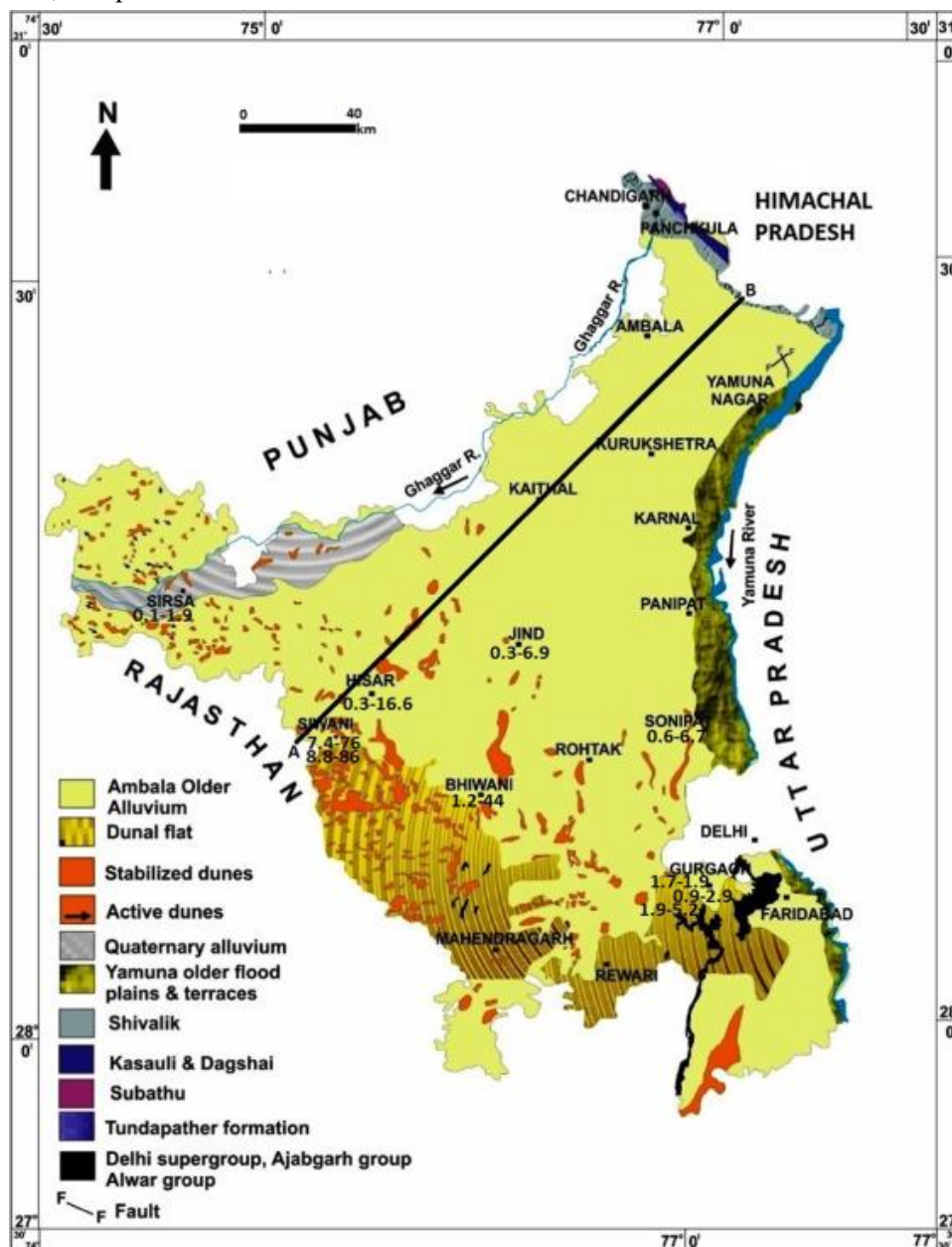
Haryana State has a flat topography with altitudes ranging from 190 to 480 m above mean sea level. The northern part of the state slopes from northeast to southwest, while the southern part has undulating topography due to the presence of the *Aravalli* hills and sand dunes. The State can be divided into three major geomorphological units based on topography, drainage, and lithological characteristics: Structural and Denudational Hills, Alluvial Plains, and Aeolian Plains. The Alluvial Plains can be further divided into three zones based on lithology, slope, and drainage characteristics: Piedmont, Central Alluvial Plains, and Marginal Alluvial Plains. The State exhibits several landforms such as lowlands, paleochannels, tals, and lakes. The southern parts of the south-western districts of NCR, viz., Rewari and Mewat, represent the aeolian Plains marked by the north-eastern extension of the Thar desert and comprises sand dunes and sand sheets. Geomorphological Map has been shown in Figure 4.1.2.

Haryana State's geology is dominated by Post-Siwalik Quaternary alluvium and aeolian sediments with occasional occurrences of lacustrine lenses. The area is divided into three geological groups: Pre-Cambrian, Tertiary, and Quaternary. The Quaternary group, which covers 98% of the State's area, consists of alluvium. The Tertiary group is represented by the outermost zone of the Siwalik system, composed mainly of sandstones, clay, and boulders, while the rocks of the Pre-Cambrian age which form part of the Aravalli hill ranges are exposed in the southern districts. The thickness of alluvium deposits decreases from North to South.

The Kandi belt in the Panchkula district forms the upper higher portions of the composite fan deposits and is 2 to 4 km wide, running more or less parallel to the Shivalik foothills. Sirowal belt and the adjoining Gangetic plain on the south of the Kandi belt are underlain by silt, fine to medium sand, and clays.

The area in the Gurgaon district is underlain by the rocks of the Delhi system and by Quaternary alluvium. In Hissar and Bhiwani districts, the area is underlain by unconsolidated sediments of

Quaternary age, comprising sand, silt, clay, and kankar. The alluvium deposits in Sonipat, Jind, Karnal, and Kurukshetra districts are generally lenticular in shape and comprise clay, silt, sand of various grades, kankar, gravel, and pebbles.



Source: Geological Survey of India 1973 Report

**Figure 4.1.2 Geomorphological Map of Haryana**

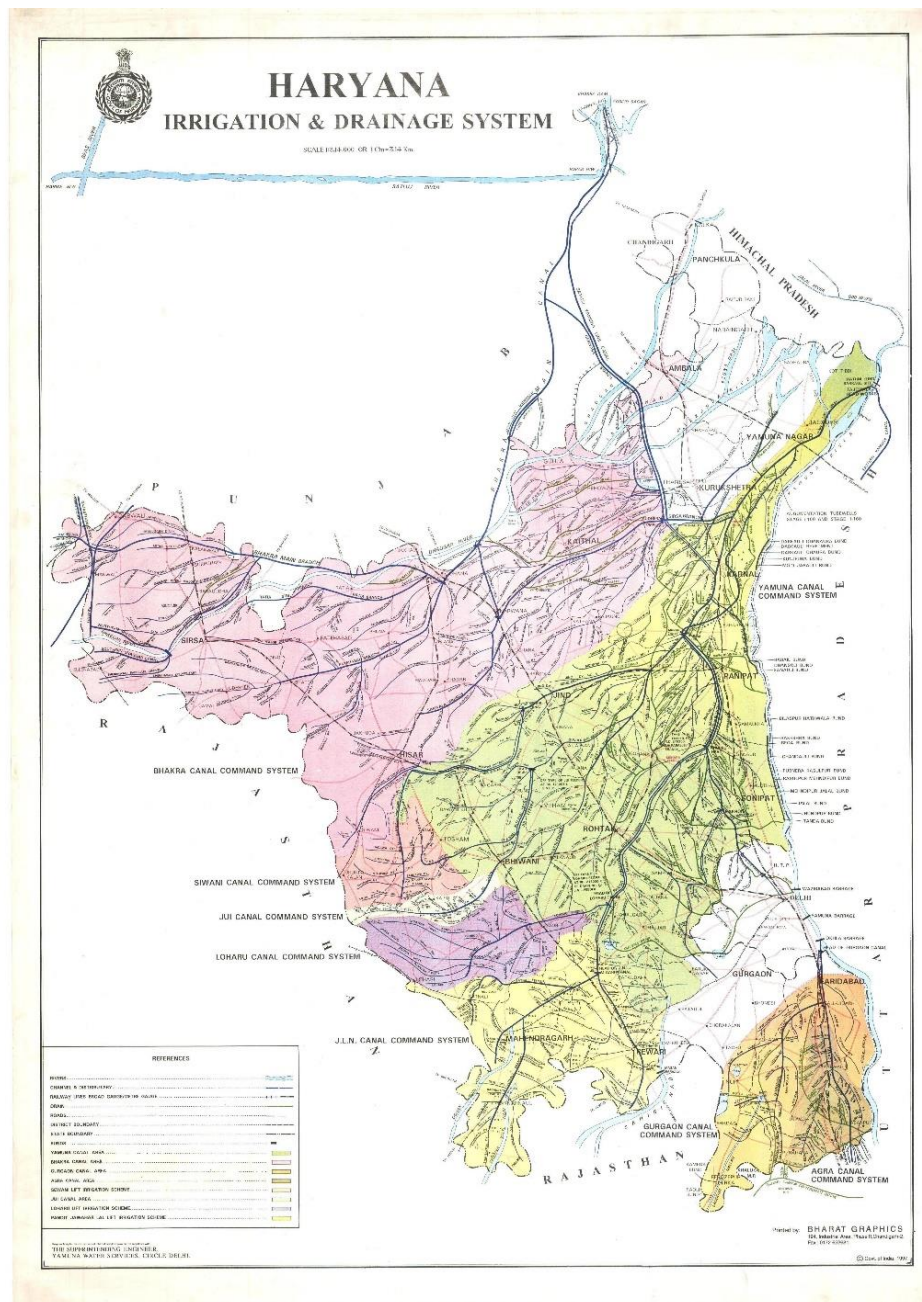
In Mahendragarh and part of Bhiwani districts, the geological succession includes recent to sub-recent alluvium and windblown sands, post-Delhi intrusive, Algonquian Delhi system, Ajabgarh Series, and Kushalgarh Limestone. Rohtak district is underlain by alluvium deposits of the Quaternary age, consisting of clay, silt, and various grades of sand, with windblown sand occurring as sand dunes in various parts of the district.

Alluvial deposits are of older and newer types and consist chiefly of clay, silt, and fine to medium sand. The thickness of alluvial sediments is more than 600 m, and along Yamuna Nagar-Karnal stretch, it is reported to be more than 3000 m. Piedmont deposits are confined to a narrow zone, about 2 to 4 km wide, between the Siwalik Hills and alluvial plains. Sand dunes are found in the districts of Bhiwani, Mahendragarh, Hissar, and Sirsa. Coarse sand, gravel, and boulders are found to occur in Piedmont areas and in the adjacent alluvial tracts.

## (2) Overall Groundwater and Surface Water

Haryana State has limited surface water resources, and the main perennial rivers of composite Punjab do not pass through it. The State mainly relies on groundwater for irrigation, and 85% of the area is suitable for groundwater development as shown in the Table 4.1.17. The State's varied hydrogeological characteristics have resulted in different groundwater potentials in different places.

The Ghaggar and its tributaries, the Chautang and Tangri, are Haryana's main seasonal rivers. The Markanda River originates from the lower Siwaliks Hills and joins the Sarasvati and later the Ghaggar. The Sahibi River originates in the Jaipur district in Rajasthan and reaches the outskirts of Delhi, flowing into the Najafgarh Lake that flows into the Yamuna through the Najafgarh drain. The State needs detailed and thorough groundwater investigation for optimum utilization of the resource. Drainage Map is shown in Figure 4.1.3.



Source: <https://hid.gov.in/Main-Canals-and-Drains-in-Haryana>, Irrigation and Water Resources Department, Haryana

Figure 4.1.3 Main Canals and Drains in Haryana

Haryana State has been divided into the following seven different basins based on geohydrological conditions, groundwater movement, and surface drainage patterns.

- 1) Yamuna basin
  - a) Upper
  - b) Lower
- 2) Ghaggar Basin
  - a) Upper
  - b) Lower
- 3) Inland Alluvial Basin
- 4) Krishnawati Basin
- 5) Sahibi Basin
- 6) Landoaha Nala Basin
- 7) Kanti Sub Basin (Loharu Satnali area)

In the Haryana State, present requirement of water for irrigation is much more than the available surface and sub surface resources as shown in the following Tables. The surface water available for utilization in the state is extremely limited. Only 85% of the area is suitable for the groundwater development through shallow and deep tubewells. The water gap has been calculated by summing the water gap of all the districts. It can be observed that Kaithal has the highest water gap, whereas Mahendragarh district has no gap as low water-requiring crops are grown in this district as the availability of water is not reliable.

**Table 4.1.2 District-wise Water Availability, Water Demand and Water Gap in 2021**

District	Total Surface Water Availability	Ground Water Recharge/ Availability	Additional GW Recharge	Total GW Recharge Availability	Total Water Availability form All Resources	Water Demand in 2021	Water Gap in 2021
	1	2	3	4	5	6	7 = 5-6
Ambala	116.80	480.27	42.91	523.18	639.98	1,198.06	-558.08
Bhiwani	655.13	418.07	185.70	603.77	1,258.9	1,834.74	-575.84
Charkhi Dadri	198.77	193.52	72.59	266.11	464.88	517.13	-52.25
Faridabad	34.51	162.73	28.80	191.53	226.04	532.21	-306.17
Fatehabad	828.34	594.76	139.26	734.02	1,562.36	2,747.65	-1,185.29
Gurugram	311.67	226.91	33.11	260.02	571.69	858.51	-286.82
Hisar	1,084.34	588.78	231.07	819.85	1,904.19	2,377.40	-473.21
Jhajjar	781.55	369.56	103.48	473.04	1,254.59	1,363.67	-109.08
Jind	698.05	856.64	145.53	1,002.17	1,700.22	2,713.06	-1,012.84
Kaithal	320.30	602.15	129.86	732.01	1,052.31	2,767.25	-1,714.94
Karnal	402.28	806.95	105.65	912.6	1,314.88	2,784.72	-1,469.84
Kurukshetra	35.17	389.19	54.99	444.18	479.35	1,892.56	-1,413.21
Mahendragarh	315.09	284.69	91.37	376.06	691.15	619.91	71.24
Nuh	206.45	196.82	48.15	244.97	451.42	852.41	-400.99
Palwal	188.42	387.36	33.33	420.69	609.11	798.84	-189.73
Panchkula	44.19	152.52	17.88	170.4	214.59	462.01	-247.42
Panipat	178.88	356.01	52.26	408.27	587.15	1,733.79	-1,146.64
Rewari	336.10	309.21	73.69	382.9	719.00	905.92	-186.92
Rohtak	496.99	324.34	87.53	411.87	908.86	1,340.57	-431.71
Sirsa	1,627.01	605.65	235.71	841.36	2,468.37	3,617.41	-1,149.04
Sonapat	421.66	646.79	104.59	751.38	1,173.04	1,734.90	-561.86
Yamuna Nagar	74.26	575.10	37.53	612.63	686.89	1,410.04	-723.15
Total	9,355.96	9,527.02	2,053.00	11,580.02	20,935.98	34,962.76	-14,026.78

Source) Integrated Water Resources Plan of Haryana 2023-2026, Haryana Water Resources Authority, 2023

Annual water demand for various sectors has been assessed as shown in the following Table. The major water demand is from Agriculture and horticulture sectors. Out of 22 Districts, the water demand of



Sirsa is maximum, followed by Karnal and Kaithal Districts, while the water demand of Panchkula is minimum.

**Table 4.1.3 District-wise Total Water Demand of Haryana in 2021**

(Unit: MCM)

District	Domestic (MCM)	Net Agri.			Net Hort	Livestock	Ind. and Infra	Power	Fisheries	Forest / Wildlife	Establish. / Insti..	Water Demand in 2021
		Sown	Unsown	Total								
Ambala	49.63	1,019.80	-	1,019.80	97.00	9.96	2.75	0.00	6.64	8.01	4.27	1198.06
Bhiwani	45.96	1,302.15	357.33	1,659.48	91.43	18.95	4.29	0.00	12.80	0.22	1.61	1834.74
Charkhi Dabri	19.61	446.75	29.51	476.26	7.07	9.54	3.74	0.00	0.86	0.05	-	517.13
Faridabad	112.28	284.63	21.00	305.63	26.58	7.59	65.03	1.42	6.35	0.04	7.29	532.21
Fatehabad	48.05	2,505.20	71.36	2,576.56	88.76	17.33	0.02	0.00	12.71	0.21	4.01	2747.65
Gurugram	176.03	285.00	93.49	378.49	35.77	8.89	243.87	0.00	2.98	4.85	7.63	858.51
Hisar	72.12	2,069.29	-	2,069.29	74.38	28.89	90.75	9.97	18.35	3.08	10.57	2377.4
Jhajjar	46.13	979.28	-	979.28	55.20	13.97	72.02	167.30	21.36	0.19	8.16	1363.61
Jind	46.10	2,480.42	65.31	2,545.73	61.61	25.60	1.05	0.00	17.90	13.54	1.53	2713.06
Kaithal	34.91	2,639.05	-	2,639.05	39.56	19.90	0.18	0.00	26.63	0.02	7.00	2767.25
Karnal	62.11	2,492.21	-	2,492.21	87.02	16.82	111.66	0.00	9.60	0.17	5.13	2784.72
Kurukshetra	31.64	1,744.43	-	1,744.43	92.60	11.70	1.98	0.00	6.78	0.11	3.32	1892.56
Mahendragarh	37.55	425.97	98.15	524.12	41.54	11.98	0.06	0.00	1.23	0.41	3.02	619.91
Nuh	40.19	469.25	160.34	629.59	96.84	10.46	0.85	0.00	64.10	6.09	4.29	852.41
Palwal	37.05	663.80	-	663.80	76.80	11.67	1.64	0.00	3.33	0.03	4.52	798.84
Panchkula	28.51	244.44	137.02	381.46	14.09	4.42	30.00	0.00	1.45	0.10	1.98	462.01
Panipat	40.40	1,116.58	-	1,116.58	216.09	8.32	322.75	4.62	7.98	12.90	4.15	1733.79
Rewari	43.73	652.97	137.06	790.03	26.09	10.21	7.81	0.00	10.11	10.26	7.68	905.92
Rohtak	51.92	1,190.05	-	1,190.05	59.40	14.16	0.37	0.00	18.5	0.21	5.96	1340.57
Sirsa	81.96	2,716.24	444.29	3,160.53	187.60	22.50	33.61	0.00	11.15	16.67	3.39	3517.41
Sonipat	55.62	1,556.67	-	1,556.67	50.90	13.88	35.55	0.00	16.21	0.90	5.17	1734.9
Yamuna Nagar	51.40	1,156.10	-	1,156.10	122.05	11.01	14.2	7.90	5.63	38.00	3.75	1410.04
Total	1,212.90	27,776.48	1,614.86	29,391.34	1,648.38	307.75	1,044.18	191.27	282.65	116.06	104.43	34298.96

Note) Ind. And Infra: Industrial and Infrastructure, Establish / Insti.: Establishment and Institutions

Source) Integrated Water Resources Plan of Haryana 2023-2026, Haryana Water Resources Authority, 2023

### (3) Wetlands and Major Waterbodies

Wetlands are ecosystems flooded by water, characterized by hydric soil and aquatic plants. Wetlands listed under the Ramsar Convention are called Ramsar Sites. Haryana State has two Ramsar Sites: Bhindawas Wildlife Sanctuary and Sultanpur National Park. Bhindawas is a man-made freshwater wetland and the largest in Haryana, with over 250 bird species, including globally threatened species. Sultanpur is a shallow lake fed by overflow from neighbouring canals and fields, with over 220 bird species, including globally threatened species like the sociable lapwing and Egyptian vulture. Both wetlands support the region's water table and act as natural flood buffers.

### (4) Groundwater Status

#### 1) Current Situation

Groundwater occurs in both confined and unconfined conditions in the alluvial formation, whereas it is mostly in unconfined conditions in Shivalik and Piedmont deposits, and semi-confined conditions in hard rocks.

The Central Ground Water Board has identified three aquifer groups, varying transmissivity, hydraulic conductivity, storativity, and yield characteristics as shown in the following table.

**Table 4.1.4 Aquifer Parameters for Different Aquifer Groups**

Aquifer Group	Depth Range (meter below ground level (m bgl))	Transmissivity (m <sup>2</sup> /day)	Hydraulic Conductivity (m/day)
I	40 to 167	800 - 5210	8.75 – 47.10
II	65 to 294	350 – 1050	3.95 – 10.70
III	197 to 383	345 - 830	3.50 – 10.70

Source: Report on Dynamic Ground Water Resources of Haryana State, Department of Irrigation & Water Resources, Haryana, July 2021

According to studies conducted by the Haryana State Minor Irrigation Tube Wells Corporation, the upper reaches of the Yamuna and Ghaggar basins covering Ambala, Karnal, and Kurukshetra districts have

more sand than clay and silt, and the aquifers in these areas contain fresh quality water and derive supplies from Yamuna and Ghaggar Basins.

In other districts of the State, below 60m depth, clay is the predominant component of alluvium, and the aquifers in these areas are mostly thin and pinch out at short distances, thus restricting the movement of groundwater. In the southern region of Karnal district, Kankar (nodules/ pebbles of CaCO<sub>3</sub> of secondary origin) is mixed with clay and occasionally present in the sand layers. Kankar layers are distinctly present at different depth ranges in Bhiwani, Faridabad, and Sirsa districts, and are mostly associated with saline groundwater regimes.

Geohydrological conditions and characteristics of the aquifers are crucial for groundwater management and sustainable utilization of this vital resource because these determine the transfer, storage and conductivity of water in the geological system.

It is reported that nine Indian states and union territories are ranked as having "extremely high" water stress<sup>1</sup>. Haryana is among the worst hit. Punjab, Rajasthan, Uttar Pradesh, Gujarat, Uttarakhand, Madhya Pradesh are the others. They all scored between four and five on scale of zero to five, with five being the worst.

As mentioned in the above reference, the Haryana is a water deficit state with respect to surface and ground water resources. The ground water level in the State particularly in the fresh ground water zone is depleting fast due to over exploitation of ground water and is a very serious problem, increasing demand and scarcity of ground water resource underlines the importance of artificial recharge and water conservation. Following points shows the current situation of Ground water condition in the State of Haryana:

## 2) Depth of Groundwater

Water level data of Haryana has been collated from Water Resource Information System Portal (Inda, WRIS). Year and district wise data on depth to water table has been given in the below table.

**Table 4.1.5 Depth to Groundwater Level Data of Haryana for the Last 30 Years**

(Unit: mbgl)

District	Year				Groundwater Depletion
	1992	2002	2012	2022	
Ambala	6.88	14.6	25.8	16.9	10.02
Bhiwani	9.7	15.5	12.1	19.2	9.5
Charkhi Dadri	9.7	15.5	12.1	19.2	9.5
Faridabad	4.05	18.1	25.4	32	27.95
Fatehabad	4.82	12.2	24.3	26.9	22.08
Gurugram	6.38	23	25.2	28.6	22.22
Hisar	6.6	9.67	11	12.4	5.8
Jhajjar	4.54	8.08	8.56	7.6	3.06
Jind	5.85	9.94	15.1	20.9	15.05
Kaithal	6.33	13.9	21.8	36.6	30.27
Karnal	7.25	12	20.4	28.6	21.35
Kurukshetra	10	20.8	34.3	38.7	28.7
Mahendragarh	8.2	24.4	30.4	45.7	37.5
Nuh	4.42	10	13.2	9.8	5.38
Palwal	6.25	8.22	9.78	17	10.75
Panchkula	7.42	19.5	23	11.1	3.68
Panipat	6.08	12.3	14.9	26.1	20.02
Rewari	10	18.7	23.8	35.4	25.4
Rohtak	3.7	6.7	4.9	9.7	6.0
Sirsa	9.25	13.5	18	27.7	18.45
Sonipat	4.9	7.59	12.1	19.7	14.8
Yamuna Nagar	8.73	12.6	14	19.3	10.57

Note) mbgl: meter below ground level

<sup>1</sup> Aqueduct 3.0 Country Rankings | World Resources Institute ([wri.org](http://wri.org)), World Resources Institute

Source) Water Resource Information System Portal (Inda, WRIS): <https://indiawris.gov.in/wris/#/groundWater>

In districts Kurukshetra, Karnal, Kaithal, Faridabad, Fatehabad, Gurugram, Panipat Rewari, Sirsa and Mahendragarh, there is huge depletion of ground water due to fresh groundwater zones and paddy irrigation. The districts of Kurukshetra, Karnal, Kaithal, Fatehabad, Sirsa and Panipat are mainly paddy growing area and also area under paddy gradually increased. However, districts like Faridabad, Gurugram, Mahendragarh, and Rewari are not paddy growing but water is extracted to grow crops like cotton and millets and water availability is limited due to low rainfall. Moreover, cotton is grown from end April to October and April, May, June are hot months (summer season) with almost no rainfall and hence more irrigations are required.

### 3) No. of Sources of Groundwater

Water resources are typically categorized as either surface water or groundwater. The ownership and control of water sources including surface water bodies (rivers, lakes, reservoirs) and groundwater are subject to specific laws and regulations.

**Surface Water Sources:** In Haryana, surface water resources such as rivers, lakes and reservoirs are primarily owned and controlled by the state government. The management and allocation of surface water are governed by laws and regulations at the state level. The Water Resources Department or a similar authority in Haryana is responsible for the administration, distribution and regulation of surface water resources.

**Groundwater Sources:** Groundwater ownership is regulated by the Haryana Water Resource Authority. As per this act, landowners generally have the right to use the groundwater beneath their land for reasonable purposes such as domestic use or irrigation. However, the state government has the authority to regulate and control groundwater extraction to prevent overexploitation and ensure sustainable use. The management and control of groundwater resources in Haryana are primarily governed by the state's groundwater laws and policies which may include the requirement of obtaining permits for groundwater extraction for Industrial, Mining and Infrastructure Projects.

The ownerships of different water abstraction structures for the Haryana State is given in the below Table.

**Table 4.1.6 Number of Different Tube Wells in the Haryana State**

(Unit: nos.)

Year	Diesel Sets (Nos.)	Electric Sets (Nos.)	Total (Nos.)
1966-67	-	-	25,311
1970-71	17,903	86,455	104,358
1980-81	109,353	222,674	332,027
1990-91	155,842	341,729	497,571
2000-01	255,302	334,171	589,473
2005-06	231,821	386,202	618,023
2010-11	231,146	492,311	723,457
2015-16	298,452	545,509	843,961
2017-18	297,616	550,134	847,750
2018-19	275,211	546,188	821,399
2019-20	264,472	526,401	790,873

Source: Statistical Abstract of Haryana 2019-20

Further District-wise nos. of tube-wells are shown in the below Table. In Haryana, there is approximately 7.91 lakh nos. of tube-wells out of which 2.64 lakh are diesel operated and 5.26 lakh are electric operated as shown below.



**Table 4.1.7 District-wise Number of Different Water Resources in the Haryana State**

District	Diesel Sets (Nos.)	Electric Sets (Nos.)	Total (Nos.)
Ambala	3,218	5,748	8,966
Bhiwani	11,860	27,573	39,433
CharkhiDadri	10,590	8,272	18,862
Faridabad	18	1,509	1,527
Fatehabad	6,897	33,813	40,710
Gurugram	3,809	18,592	22,401
Hisar	55,883	18,429	74,312
Jhajjar	16,261	11,837	28,098
Jind	29,784	44,526	74,310
Kaithal	5,506	47,897	53,403
Karnal	848	67,964	68,812
Kurukshetra	114	37485	37,599
Mahendragarh	0	27,261	27,261
Nuh	4,455	6,282	10,737
Palwal	14,632	13,037	27,669
Panchkula	687	3,312	3,999
Panipat	1,542	33,676	35,218
Rewari	2,521	27,092	29,613
Rohtak	27,656	5,334	32,990
Sirsa	9,973	59,893	69,866
Sonipat	33,478	33,441	66,919
Yamuna Nagar	4,561	21,088	25,649
Total	244,293	554,061	798,354

Note: As per one recent report the total number is 8.76 lakhs in 2023  
Source: Statistical Abstract of Haryana 2021-22

#### 4) Water Logging and Salt Accumulation

The twin problems of waterlogging and soil salinity are threatening the sustainability of agriculture production in large parts of North-West India (Punjab, Haryana and Rajasthan). The alarming rise in the water table is causing a threat to the highly productive agricultural lands. This menace is worsened because the groundwater in much of the endangered area is brackish or saline. The deep percolation losses from the field applications of irrigation water and seepage losses from the canal system have been distorting the groundwater balance in those areas of the state which have brackish or saline groundwater (about 65% of the area of Haryana). It is stated that Particularly, Rohtak, Jhajjar, Sirsa, Jind, Bhiwani, Sonapat, Fetehabad and Nuh have problem of salinity and brackish water.

According to the survey conducted by the ground water cell in June 2020, about 982740 acres area was affected with the problem of waterlogging and salinity in the State. Out of which, 1,74,470 acres area is affected severely (water table depth 0-1.5 meter) and in June, 2019, an estimated area of 4,37,940 hectare in the State it was affected with the problem of waterlogging and salinity, out of which about 35,809-hectare area is under critical condition (water table 0-1.5 m). Haryana is in the forefront of implementation of Sub Surface Drainage (SSD) system for reclamation of water-logged & saline lands. Most affected areas fall in the districts of Rohtak, Sonipat, Jhajjar and Bhiwani followed by Jind, Palwal, Mewat and Fatehabad. The area goes on fluctuating depending upon the rainfall.

Waterlogging and secondary soil salinization has emerged as a result of the excessive use of irrigation water in poorly drained areas thereby endangering the long-term viability of irrigated agriculture in Haryana. 8.9 % geographical area of the state is under waterlogging conditions (June 2020) where 7.31 % area has a water level between 1.5 and 3 mbgl, while 1.58% area is under critical conditions with a shallow water level between 0 and 1.5 mbgl. The district-wise waterlogging status of Haryana is given in the following Table.

**Table 4.1.8 District-wise Waterlogging Status in Haryana**

SN	District Name	Waterlogged Area (ha)			Geographical Area(km <sup>2</sup> )	% of logged area
		Depth to water level (0-1.5mbgl)	Depth to water level (1.5-3.0mbgl)	Total		
1	Ambala	1,102	5,315	6,417	1,574	4.1
2	Bhiwani	0	47,428	47,428	3,999	11.9
3	Charkhi Dadri	5,154	14,140	19,294	979	19.7
4	Faridabad	0	0	0	741	0
5	Fatehabad	1,935	11,700	13,635	2,538	5.4
6	Gurugram	0	1,102	1,102	1,258	0.9
7	Hisar	2,520	19,841	22,361	3,983	5.6
8	Jhajjar	14,186	60,584	74,770	1,834	40.8
9	Jind	7,965	17,087	25,052	2,702	9.3
10	Kaithal	0	0	0	2,317	0
11	Karnal	0	0	0	2,520	0
12	Kurukshetra	0	0	0	1,530	0
13	Mahendragarh	0	0	0	1,899	0
14	Nuh	0	0	0	1,507	0
15	Palwal	373	560	933	1,359	0.7
16	Panchkula	0	0	0	898	0
17	Panipat	0	0	0	1,268	0
18	Rewari	0	0	0	1,549	0
19	Rohtak	16,824	90,538	107,362	1,745	61.5
20	Sirsa	0	1,100	1,100	4,277	0.3
21	Sonipat	19,729	53,899	73,628	2,122	34.7
22	Yamunanagar	0	0	0	1,768	0
Total		69,788	323,294	393,082	42,793	8.9

Source: Table 3.18, Integrated Water Resource Plan Haryana (2023-2026), HWRA

## (5) Soil Degradation Status

### 1) Current Situation

Soil quality of various districts in the Haryana is clarified, based on seven indicators: Soil Salinity, Available Nitrogen, Electrical Conductivity (EC), Organic Carbon (OC), Phosphate P<sub>2</sub>O<sub>5</sub> (PO), and Potassium (K), Available Sulphur Content, and Available Zinc Content. The pH values of the soil in different districts indicate the burden of back-to-back cropping patterns on agricultural land. The report also discusses the ideal range of EC and the importance of OC for the nitrogen-carrying capacity of the soil. The report highlights that the availability of phosphate is low in most districts and the use of phosphate fertilizers can cause a deficiency of zinc and iron. The available nitrogen is generally low, available phosphorus is medium and availability of potassium is high in many districts due to mineral composition of the soil. The report presents maps of soil degradation in different districts.

The salinity levels in Haryana state can vary depending on several factors, including the quality of water sources, irrigation practices, and natural geological conditions. Salinity refers to the presence of dissolved salts, particularly common salts such as sodium chloride in water or soil.

### 2) Saline Area

Salinity refers to the presence of dissolved salts, particularly common salts such as sodium chloride in water or soil. The salinity levels in Haryana state vary depending on several factors including the quality of water sources, irrigation practices and natural geological conditions.

Haryana, being an inland state, does not have direct access to coastal areas where high salinity levels are commonly found. However, salinity issues can still arise due to various factors such as the presence of saline groundwater, waterlogging and the use of irrigation water with high salt content. The salinity status of the Haryana State has been given in Table 4.1.9 given below.

**Table 4.1.9 Salinity Status of Haryana**

SN	% Samples fit for drinking water	Name of the districts	Remarks
1.	>80	Ambala, Karnal, Kurukshetra, Panchkula, Yamuna Nagar	It has been classified on the basis of Salinity (EC, Cl, NO <sup>3</sup> & F)
2.	50-80	Faridabad, Gurugram, Kaithal, Palwal, Panipat, Sonipat	
3.	<50	Bhiwani, Fatehabad, Hisar, Jhajjar, Jind, Mahendragarh, Mewat, Rewari, Rohtak, Sirsa	

Source: Central Ground Water Board (CGWB)

The ground water quality in around 19% of the area of the State is not good for irrigation due to salinity based on Electric Conductivity (E.C.) parameter (E.C.>2000 Micro. Mhos/cm). District wise saline area (as of 2020) details of Haryana are shown in the following table.

**Table 4.1.10 District wise Saline Area in Haryana State**

SN	District Name	Saline Area in (Ha)*1	Net Area Irrigated (000ha)*2	% of Saline Area	Cultivable Area (000ha)*2
1	Ambala	0	142	0	149
2	Bhiwani	83,502	233	36	294
3	Charkhi Dadri	23,107	99	23	125
4	Faridabad	5,870	32	18	32
5	Fatehabad	14,070	218	6	221
6	Gurugram	1,544	61	3	118
7	Hisar	44,257	338	13	356
8	Jhajjar	61,250	129	47	183
9	Jind	55,424	243	23	256
10	Kaithal	335	209	0	197
11	Karnal	0	197	0	200
12	Kurukshetra	0	144	0	167
13	Mahendragarh	1,885	89	2	184
14	Nuh	56,930	95	60	112
15	Palwal	23,930	99	24	118
16	Panchkula	0	15	0	44
17	Panipat	0	93	0	122
18	Rewari	4,333	84	5	131
19	Rohtak	42,760	131	33	157
20	Sirsa	171,288	370	46	400
21	Sonipat	23,747	151	16	154
22	Yamunanagar	0	110	0	127
Total		614,232	3,282	19	3,847

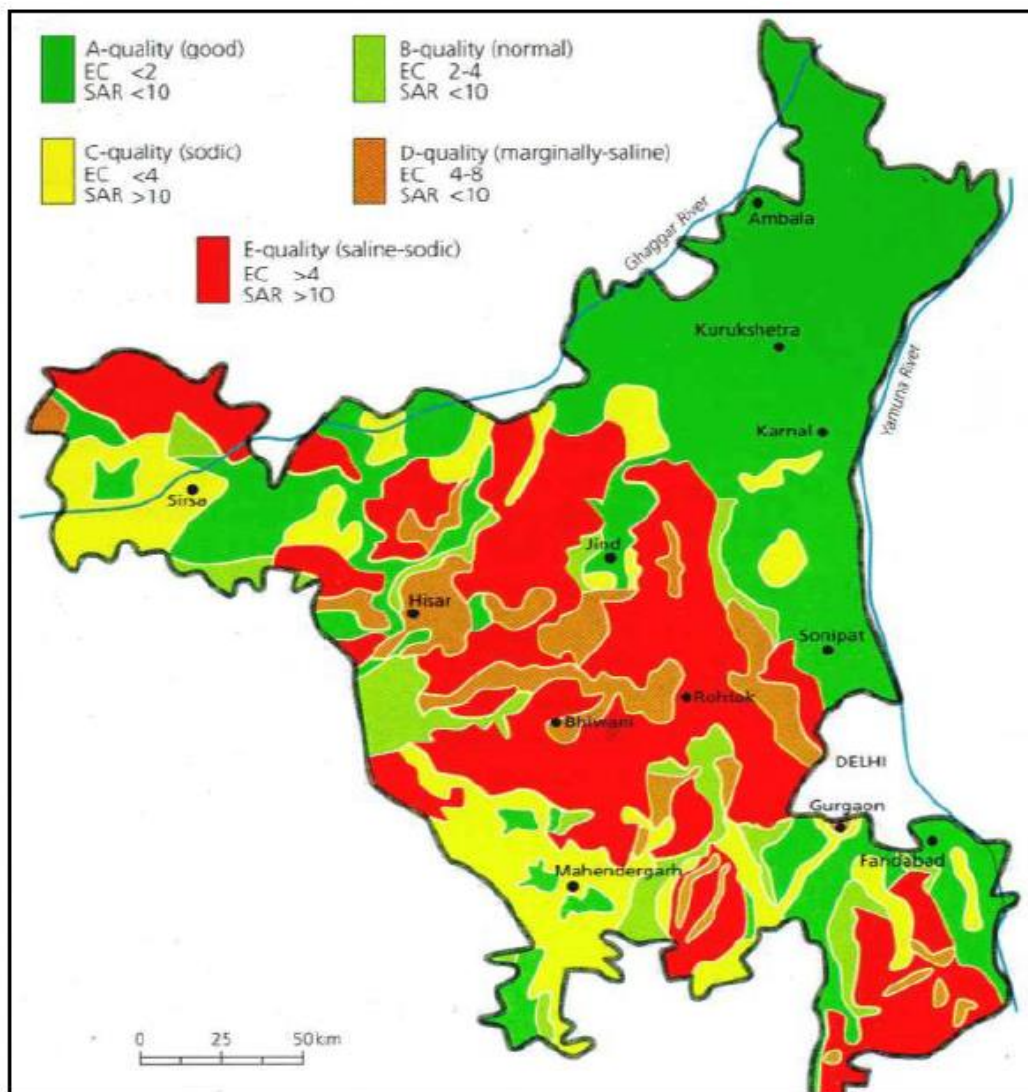
Source: \*1: Table 3.20 (as of 2020), Integrated Water Resources Plan of Haryana, 2023-26

\*2: Statistic Handbook of Haryana 2021-22, 2023

Irrigation induced waterlogging and soil salinization is one of the serious problems in irrigated agriculture in arid and semi-arid regions. At present, 2.96 mha areas in India are affected by soil salinity as shown in Table 4.1.10. About 50,000 ha<sup>2</sup> area in Haryana state is waterlogged saline area having shallow water table (depth < 1.5m) and soil salinity (EC<sub>e</sub>> 4 dS/m) as natural drainage system is not sufficient in affected areas for controlling the problem. The salinity map of Haryana has been given as per the following Figure.

This is a fact that Haryana is a very small state as compared to Uttar Pradesh and Gujrat. So, this area looks small as compared to large size states. Different authors have given different units, and we should keep the same in the text.

<sup>2</sup> In Table 4.1.9, saline area under 0 -1.5 mbgl is around 69,788ha, however, this 50,000ha is commonly quoted.



Source: Integrated Water resources Plan of Haryana, 2023-25 1 to 221 pages2

**Figure 4.1.4 Salinity Map**

Further the districts like Charkhi Dadri, Faridabad, Sirsa, Bhiwani, Jhajjar, Nuh, Jind, Hisar, Rohtak and Sonipat are highly affected by salinity. Six districts namely Ambala, Panchkula, Panipat, Yamunanagar, Karnal and Kurukshetra are not impacted by salinity.

### 4.1.3 Major Challenges and Necessary Intervention

#### (1) Major Challenges concerning Groundwater Depletion

##### 1) Depletion of Groundwater Level

Depletion of groundwater level in the last 30 years is shown in the following table.

**Table 4.1.11 Groundwater Depletion in Haryana State**

District	Area (km <sup>2</sup> )	Groundwater Level (mbgl)			Groundwater Depletion(m) in 30 Years				Area (%)
		1992	2022	declined	<10	<11 to <20	<21 to <30	>30	
Ambala	1,574	6.88	16.9	10.02		✓			3
Bhiwani	3,432	9.7	19.2	9.5	✓				8
Charkhi	1,370	9.7	19.2	9.5	✓				3
Faridabad	792	4.05	32	27.95			✓		2

District	Area (km <sup>2</sup> )	Groundwater Level (mbgl)			Groundwater Depletion(m) in 30 Years				Area (%)
		1992	2022	declined	<10	<11 to <20	<21 to <30	>30	
Fatehabad	2,538	4.82	26.9	22.08			✓		6
Gurugram	1,253	6.38	28.6	22.22			✓		3
Hisar	3,983	6.6	12.4	5.8	✓				9
Jhajjar	1,834	4.54	7.6	3.06	✓				4
Jind	2,702	5.85	20.9	15.05		✓			6
Kaithal	2,317	6.33	36.6	30.27				✓	5
Karnal	2,520	7.25	28.6	21.35			✓		6
Kurukshetra	1,530	10	38.7	28.7			✓		3
Mahendragar	1,859	8.2	45.7	37.5				✓	4
Nuh	1,874	4.42	9.8	5.38	✓				4
Palwal	1,359	6.25	17	10.75		✓			3
Panchkula	898	7.42	11.1	3.68	✓				2
Panipat	1,268	6.08	26.1	20.02			✓		3
Rewari	1,582	10	35.4	25.4			✓		3
Rohtak	1,745	3.7	9.7	6	✓				4
Sirsa	4,277	9.25	27.7	18.45		✓			10
Sonipat	2,122	4.9	19.7	14.8		✓			5
Yamuna	1,768	8.73	19.3	10.57	✓	✓			4
<b>Total</b>	<b>44,597</b>	<b>Area (%) out of the Sate Total</b>			<b>34</b>	<b>31</b>	<b>26</b>	<b>9</b>	<b>100</b>

Note: mbgl - meter below ground level

Source: Water Resource Information System Portal (Inda, WRIS)

The ground water depletion was much less in districts having waterlogging and saline water problem such as Biwami, Charkhi Dadri, Jhajjar, Rohtak, Panchkula and Hisar. Meanwhile, the depletion was much more in paddy-wheat growing areas of Fatehabad, Karnal, Kaithal, Panipat and Kurukshetra. Moreover, the depletion was also high in districts having no canal water supply and solely depended on tube-well irrigation.

**Table 4.1.12 Relationship between Groundwater Depletion and Total Irrigation Area Change**

District	Area (km <sup>2</sup> )	Groundwater Level (mbgl) <sup>*1</sup>			Total Area Irrigated (000 ha)			% of logged area <sup>*4</sup> (%)
		1992	2022	declined	2006 <sup>*2</sup>	2022 <sup>*3</sup>	difference	
Ambala	1,574	6.88	16.9	10.02	120	142	22	4.1
Bhiwani	3,432	9.7	19.2	9.5	280	233	-47	11.9
Charkhi Dadri	1,370	9.7	19.2	9.5	N/A	99	N/A	19.7
Faridabad	792	4.05	32	27.95	100	32	-68	0
Fatehabad	2,538	4.82	26.9	22.08	212	218	6	5.4
Gurugram	1,253	6.38	28.6	22.22	75	61	-14	0.9
Hisar	3,983	6.6	12.4	5.8	227	338	111	5.6
Jhajjar	1,834	4.54	7.6	3.06	105	129	24	40.8
Jind	2,702	5.85	20.9	15.05	221	243	22	9.3
Kaithal	2,317	6.33	36.6	30.27	200	209	9	0
Karnal	2,520	7.25	28.6	21.35	199	197	-2	0
Kurukshetra	1,530	10	38.7	28.7	151	144	-7	0
Mahendragarh	1,859	8.2	45.7	37.5	34	89	55	0
Nuh	1,874	4.42	9.8	5.38	N/A	95	N/A	0
Palwal	1,359	6.25	17	10.75	N/A	99	N/A	0.7
Panchkula	898	7.42	11.1	3.68	5	15	10	0
Panipat	1,268	6.08	26.1	20.02	91	93	2	0
Rewari	1,582	10	35.4	25.4	109	84	-25	0

District	Area (km <sup>2</sup> )	Groundwater Level (mbgl) <sup>*1</sup>			Total Area Irrigated (000 ha)			% of logged area <sup>*4</sup>
		1992	2022	declined	2006 <sup>*2</sup>	2022 <sup>*3</sup>	difference	(%)
Rohtak	1,745	3.7	9.7	6.0	132	131	-1	61.5
Sirsa	4,277	9.25	27.7	18.45	338	370	32	0.3
Sonipat	2,122	4.9	19.7	14.8	143	151	8	34.7
Yamuna Nagar	1,768	8.73	19.3	10.57	110	110	0	0

Note)mbgl: meter below ground level

Source) \*1: Table 4.1.11, \*2: STATISTICAL ABSTRACT HARYANA 2006-2007, P265 No.13.1, \*3: Table 4.1.10, \*4: Table 4.1.8

From the Table 4.1.12, it can be said that groundwater depletion is generally influenced by irrigation activity. Namely, it is intimated that increase in irrigated area tends to lead to a depletion in groundwater such as Fatehabad, Kaithal and Mahendragarh. Meanwhile, as depletion in the groundwater level become large such as Faridabad, Gurugram, Kurukshetra and Rewari, the irrigated area tends to decrease. Furthermore, it can be said that prefectures with relatively high waterlogging tend to smaller depletion in groundwater levels such as Bhiwani, Charkhi Dadri, Jhajjar and Rohtak.

## 2) Categorization of Blocks of Haryana

The Haryana Water Resource Authority (HWRA) has categorized blocks in Haryana, based on their groundwater conditions and the level of groundwater development. Blocks have been classified between Safe, Semi-Critical, Critical and Over-Exploited.

The categorization is primarily aimed at regulating and managing groundwater resources effectively. Such a categorization of blocks in the Haryana State is given below in Table 4.1.3.

In Haryana, 85 Blocks are over-exploited, 12 Blocks are critical, 14 Blocks are semi-critical and 30 Blocks are coming under the safe category.

**Table 4.1.13 Categorization on Groundwater Level of Blocks of Haryana**

S N	District	Over-exploited	Critical	Semi-critical	Safe
1.	Ambala	Barara, Naraingarh, Saha	Ambala-I	Ambala-II, Shahzadpur	-
2.	Bhiwani	Behal, Kairu, Loharu, Tosham	-	-	Bhiwani, Bawani Khera, Siwani
3.	Charkhi Dadri	Badhra, Jhoju	-	-	Baund, Ch. Dadri
4.	Faridabad	Ballabgarh, Faridabad, Tigaon, Faridabad Urban	-	-	-
5.	Fatehabad	Fatehabad, Ratia, Tohana, Jakhla, Nagpur	Bhuna, Bhattu Kalan	-	-
6.	Gurugram	Farukhnagar, Pataudi, Sohna, Gurugram, Gurugram Urban	-	-	-
7.	Hissar	Narnaund	Agroha,	Barwala,	Adampur, Hansi, Hansi-II, Hisar-I, Hisar-II, Uklana
8.	Jhajjar		-	-	Badli, Jhajjar, Matanhail, Salhawas, Beri, Bhadurgarh, Machhrauli
9.	Jind	Alewa, Uchana, Ujhana, Safidon, Jind	-	Pillukhera	Julana, Narwana
10.	Kaithal	Siwan, Gulha, Kaithal, Kalayat, Pundri, Rajaund, Dhand,	-	-	-
11.	Karnal	Assandh, Gharaunda, Karnal, Nilokheri Nissing at Chirao, Munak, Kunjpura	Indri	-	-

S N	District	Over-exploited	Critical	Semi-critical	Safe
12.	Kurukshetra	Ismailabad, Babain, Ladwa, Pehowa, Shahbad, Thanesar, Pipli	-	-	-
13.	M.garh	Ateli, Kanina, Mahendragarh, Simha, Nangal, Narnaul, Nangal, Chaudhary	Nizampur, Satnali	-	-
14.	Mewat	Tauru, Firozpur, Jhirkha	-	Punahna	Indri, Nagina, Nuh, Pingwan
15.	Palwal	Badoli, Prithala	Hasanpur	Hodal	Hathin, Palwal
16.	Panchkula	-	Raipur Rani	-	Pinjore, Barwala
17.	Panipat	Bapoli, Israna, Madlauda, Panipat, Samalkha, Sonali Khurd	-	-	-
18.	Rewari	Khol, Rewari, Nahar, Dharuhera, Jatusana, Bawal	Dahina	-	-
19.	Rohtak		-	-	Lakhan Majra, Meham, Kalanaur, Sampla, Rohtak
20.	Sirsa	Rania, Sirsa, Nathusari Chopta, Odhan, Dabwali, Ellenabad	-	Baraguda,	-
21.	Sonipat	Ganaur, Sonipat, Rai, Murthal, Mudlana	-	-	Gohana, Kathura, Kharkhoda
22.	Yamuna Nagar	Jagadhri, Mustafabad, Khizrabad, Radour, Bilashpur, Sadaura	-	Chachrauli, Radour	-
	State Total	85	12	14	30

Remark: The above classification is based on the GWRE-2022 Data, which has been classified on the basis of Ground Water Drain, Ground Water Recharge etc.

**Table 4.1.14 Basis of categorization of groundwater resources:**

Category of Block	Withdrawal of groundwater against recharge (%)
Over-Exploited	>100
Critical	90-100
Semi-Critical	70-90
Safe	<70

Source: Ground Water Cell, Govt. of Haryana & Haryana Water Resource Authority (HWRA)

### 3) Suitability of groundwater for irrigation

Such waters when used continuously for irrigation, they are likely to cause salinity hazards and lead to reduction in crop yields. They may also cause sodium hazards and lead to hardening of soils when used for irrigation without the addition of adequate quantity of gypsum. As shown in the following table, most of ground waters are suitable for irrigation for semi-salt tolerant crops on adequately drained soils.

**Table 4.1.15 District-wise Irrigation Suitability of Groundwater in Haryana State**

SL. No.	District Name	No. of Samples	Suitability Index		
			Safe	Marginal	Unsafe
1	Ambala	12	5	5	2
2	Bhiwani	34	29	2	3
3	Charkhi Dadri				
4	Faridabad	8	8	0	0
5	Fatehabad	12	9	1	2
6	Gurugram	24	21	1	2
7	Hisar	38	30	1	7
8	Jhajjar	15	12	0	3
9	Jind	21	10	1	10
10	Kaithal	24	8	6	10

SL. No.	District Name	No. of Samples	Suitability Index		
			Safe	Marginal	Unsafe
11	Karnal	32	18	5	9
12	Kurukshetra	20	10	4	6
13	Mahendragarh	9	8	0	1
14	Nuh	11	11	0	0
15	Palwal	23	13	3	7
16	Panchkula	23	17	3	3
17	Panipat	20	8	3	9
18	Rewari	12	10	0	2
19	Rohtak	12	8	0	4
20	Sirsa	37	25	4	8
21	Sonipat	39	29	2	8
22	Yamunanagar	21	16	4	1
Total		447	305	45	97

Note: Sample survey

Source: Integrated Water Resource Plan Haryana (2023-2026), HWRA

#### 4) Groundwater pollution (industrial effluent disposal without treatment)

Groundwater pollution is becoming a serious issue as large numbers of industries are disposing off their effluents without any treatment and groundwater contamination has caused large number of health problem. For example, these effluents are discharged from Faridabad industries in a drain which goes to Nuh area where people are suffering from health problems. Even villages polluted water is discharged in ponds making them unfit for livestock drinking. Now sewerage treatment plants are being installed by Public health Department in almost all major towns.

#### 5) Disposal of untreated sewerage and industrial effluent.

Haryana State has notified on 05.11.2019 (Reuse of Treated Wastewater, TWW) Policy to conserve /save each drop of water, keeping in view the fast-dwindling water resources. It has been envisaged that each and every drop of TWW will be utilized for various purposes in thermal plants, industries, construction, Horticulture and Irrigation purposes etc. TWW cell has also been set for implementation of the said Policy and projects for supplying TWW are being envisaged at the level of various stakeholders. The policy lays down the following objectives (revised):

- To attain a minimum coverage of 80% of the area with sewerage facilities and collection of sewage in all the towns of the State by 31.12.2020.
- To attain a level of 100% treatment of collected sewage as per present CPCB / HSPCB standards by 31.12.2020.
- To reuse at least 25% of TWW by every Municipality within the time frame set under the policy by 2022.
- To reuse 50% of TWW by 2025.
- To reuse 80% of TWW by 2030.

There are 172 Sewage Treatment Plants (STPs) / Common Effluent Treatment Plants (CETPs) having capacity of 1986.00 Million Liters Per Day (MLD) in 94 towns of the Haryana State. At present, 1336.65 MLD treated effluent is being generated from these STPs / CETPs. Out of this, 188.50 MLD TWW is being utilized for various purposes. Tentative Action Plan 2030 for Reuse of TWW is tabulated as under:



**Table 4.1.16 Tentative Action Plan 2030 for Reuse of Treated Waste Water**

Sr. No	Name of Department	Number of STPs / CETPs	Present Capacity of STPs / CETPs (MLD)	Present generation of TWW from STPs (MLD) up to March 2023	Estimated capacity of STPs / CETPs (in MLD)			Estimated Generation of TWW from these STPs (in MLD)			Tentative Action Plan			
					March 2024 (MLD)	March 2025 (MLD)	Dec. 2028 (MLD)	March 2024 (MLD)	March 2025 (MLD)	Dec. 2028 (in MLD)	Present use of TWW from these STPs (in MLD) up to March 2023	March 2024 (in MLD)	March 2025 (in MLD)	Dec. 2028 (in MLD)
1	GMDA	6	388.00 + 55.00 = 443.00	406.00	490.00	590.00	830.00	450.00	550.00	750	117.00	245.00	500.00	750.00
2	HSVP / T&CP	19	239.80	112.80	239.80	239.60	239.80	78.55	79.10	112.00	18.60	21.80	22.80	34.90
3	PHED	120	948.90	661.64	964.90	964.90	964.90	894.72	712.00	765.40	27	199.00	284.00	Feasibility being accessed)
4	I*WRD	-	-	-	-	-	-	-	-	-				
5	ULB	9	213.00	135.00	292.00	292.00	292.00	202.00	210.00	221.00	12.00	84.00	95.00	137.00
6	FMDA	2	75.00	10.00	75.00	75.00	75.00	25.00	65.00	75.00	Nil	Nil	20.00	75.00
7	I&C Deptt. / HSIIDC	18	184.60	103.94	184.60	184.60	2526.30	103.94	103.94	103.94	24.64	32.16	53.32	103.94
	<b>TOTAL</b>	<b>176</b>	<b>2104.30</b>	<b>1429.38</b>	<b>2230.30</b>	<b>2346.30</b>	<b>2586.30</b>	<b>1554.21</b>	<b>1720.04</b>	<b>2027.34</b>	<b>199.24 (13.94% of 1429.38)</b>	<b>581.96 (37.44% of 1554.21)</b>	<b>975.12 (56.69% of 1720.04)</b>	<b>1100.84 (54.30% of 2027.34)</b>

Source) Public Health and Engineering Department 2023 report.

Note)

STP: Sewage Treatment Plant,

TWW: Treated Waste Water

PHED: Public Health and Engineering Department

FMDA: Faridabad Metropolitan Development Authority

CETP: Common Effluent Treatment Plants,

GMDA: Gurgaon Metropolitan Development Authority

IWRD: Irrigation and Water Resources Department

I&C Dept. / HSIIDC: Haryana State Industrial and Infrastructural Development Corporation

MLD: Million Liters Per Day

HSVP / T&CP: Haryana Shehri Vikas Pradikaran

ULB: Urban Local Bodies

## 6) Net area under irrigation

The reliance on tube wells for the majority of the net irrigated area introduces complex challenges in water utilization and management for agriculture. While government canals and wells also contribute, as demonstrated in the table below, their contribution is limited compared to tube wells. Although the net irrigated area has steadily increased year by year, questions arise regarding the sustainability of this growth, as well as its potential to cause environmental issues such as groundwater depletion and soil salinization. The significant increase in the 2000s particularly highlights these challenges, urging us to take action towards better water resource management and improvements in irrigation systems.

**Table 4.1.17 Annual Net Farm Land Irrigated**

(Unit: 1,000ha)

Year	Source-wise Net Area Irrigated						Total Cultivable Area (000ha)	Net Area Irrigated (%)
	Government Canals	Tanks	Open Wells	Tube wells	Other sources	Total		
1966-67	991	4	289	—	9	1,293	3,423	38
1970-71	952	1	574	—	5	1,532	3,566	43
1980-81	1,161	—	26	941	6	2,134	3,602	59
1990-91	1,337	1	—	1,248	14	2,600	3,575	73
2000-01	1,476	1	—	1,467	14	2,958	3,526	84
2005-06	1,331	—	—	1,591	14	2,936	na	na
2010-11	1,236	—	—	1,650	1	2,887	3,518	82
2015-16	1,162	—	—	1,850	2	3,014	na	na
2016-17	1,181	—	—	1,996	—	3,177	na	na
2017-18	1,208	—	—	2,053	—	3,261	na	na
2018-19	1,215	—	—	2,067	—	3,282	3,601	91
2019-20	1,215	—	—	2,067	—	3,282	3,847	85

Source) Statistical Abstract of Haryana 2019-20

It may be noted from the data provided in the above table that the area under canal irrigation is more or less constant for the last more than 40 years, no area is now irrigated by tanks and open wells, but area irrigated by tubewells.

District-wisenet irrigated area varies with Hisar having the highest at 338,000ha, and Panchkula having the lowest at 15,000ha as shown in the following Table. Tube wells are the major source of irrigation in most districts.

**Table 4.1.18 District-wise Net Area Irrigated**

District	Net Area Irrigated (000 ha)			Total Cultivable Area (000ha)	Net Area Irrigated (%)
	Government Canals	Tube Wells	Total		
Ambala	3	139	142	149	95
Bhiwani	60	173	233	294	79
Charkhi Dadri	26	73	99	125	79
Faridabad	—	32	32	32	100
Fatehabad	64	154	218	221	99
Gurugram	—	61	61	118	52
Hisar	206	132	338	356	95
Jhajjar	53	76	129	183	70
Jind	178	65	243	256	95
Kaithal	76	133	209	197	106
Karnal	56	141	197	200	99
Kurukshetra	29	115	144	167	86
Mahendragarh	1	88	89	184	48

District	Net Area Irrigated (000 ha)			Total Cultivable Area (000ha)	Net Area Irrigated (%)
	Government Canals	Tube Wells	Total		
Nuh	14	81	95	112	85
Palwal	21	78	99	118	84
Panchkula	—	15	15	44	34
Panipat	54	39	93	122	76
Rewari	—	84	84	131	64
Rohtak	75	56	131	157	83
Sirsa	269	101	370	400	93
Sonipat	28	123	151	154	98
Yamuna Nagar	2	108	110	127	87
Total	1,215	2,067	3,282	3,847	85

Source: Statistic Handbook of Haryana 2021-22, 2023

As of now 12.15 lakh ha area is irrigated by canals and 20.67 lakh ha by tubewells. The districts like Faridabad, Gurugram, Panchkula and Rewari receive no canal water supply including very limited area in Amala, Mahendragarh and Yamuna Nagar districts where irrigation demands are met from only tube wells.

### 7) Sector-wise utilization of groundwater in different sectors

Major source of groundwater is fresh water in Haryana State (refer Table 4.1.18), and its utilization is crucial for the economy due to the scarcity of surface water resources. However, the groundwater consumption is much higher than the availability, which affects the State's sustainability of food security. 90% of the groundwater extracted is utilized for irrigation purposes as shown in Table 4.1.19. Excessive use of groundwater for paddy crop irrigation and sugarcane and limited scope of recharge has led to groundwater depletion. Since paddy crop yields are high, there is subsidy on electricity supply for irrigation, minimum support price, and assured procurement, the farmers tend to stick to paddy cultivation. Other alternatives in place of paddy under diversification programs have procurement problems.

Detailed studies are needed to ensure the optimum utilization of the water resource. The agricultural sector is the major consumer of groundwater, followed by industrial and domestic use as shown in the following table.

**Table 4.1.19 Sector-wise Current Annual Groundwater Extraction**

(Unit: MCM)

District	Current Annual Groundwater Extraction			
	Irrigation Use	Industrial Use	Domestic Use	Total Extraction
Ambala	394.28	75.75	66.49	536.52
Bhiwani	391.87	1.44	26.12	419.43
Charkhi Dadri	229.45	0.28	12.47	242.20
Faridabad	126.68	51.36	9.19	187.23
Fatehabad	890.95	1.36	16.26	908.56
Gurugram	220.73	171.17	22.32	414.23
Hisar	480.07	2.30	3.66	486.03
Jhajjar	153.89	0.86	3.14	157.89
Jind	831.75	4.62	33.59	869.95
Kaithal	1089.16	5.74	41.70	1136.59
Karnal	1143.75	21.80	62.31	1227.86
Kurukshetra	677.81	125.76	63.23	866.80
Mahendragarh	247.62	0.31	24.78	272.71
Mewat	125.26	0.20	16.96	142.42
Palwal	304.52	6.81	33.18	344.51
Panchkula	73.63	0.90	12.57	87.11
Panipat	534.06	6.36	24.41	564.83
Rewari	318.33	14.52	20.37	353.23
Rohtak	141.67	1.66	4.36	147.68
Sirsa	798.73	1.63	18.54	818.90

Sonipat	620.13	9.39	25.17	654.69
Yamuna Nagar	671.09	23.40	78.02	772.51
Total (Ham)	10,465.43	527.61	618.85	11,611.89

Source: GWRE, 2020

## 8) Power Tariff Structure for Agriculture and Irrigation

Currently, the electricity subsidies are not effectively reaching the intended beneficiaries, and the financial performance of electricity distribution companies is suffering as a result. In Haryana, agricultural consumers are allocated 75% of direct tariff subsidies, but the tariffs are too low to cover costs, leading to financial struggles for DISCOMs. To improve targeting, the report recommends strategies such as improving metering and implementing a two-part tariff structure. Groundwater tables in Haryana are stressed, and the lack of a relationship between electricity price and consumption incentivizes excessive groundwater extraction.

**Table 4.1.20 Cost Comparison between Electric Power Pump and Diesel Engine Pump for Paddy and Vegetable Cultivation**

Items	Major Crops				Remark
	Paddy	Potato	Onion	Tomato	
<b>(1) Electric Pump</b>					
1 Area (ha)	1	1	1	1	
2 Groundwater level (mbgl)	30	30	30	30	
3 Water requirement (mm)*1	1,800	500	650	600	
4 Water requirement (m <sup>3</sup> per ha)	18,000	5,000	6,500	6,000	
5 Irrigation method	Furrow	Furrow	Drip	Drip	
6 Capacity of pump (hp) *2	20	20	20	20	standard submersible pump
7 Discharge (m <sup>3</sup> /min)*2	1.02	1.02	1.02	1.02	
8 Operation hours (hr)	180	60	72	66	
9 Output power (kW/hr)*2	16 kW	16 kW	16 kW	16 kW	
10 Electric energy (kWh)	2,880	960	1,152	1,056	
11 Unit rate (Rs/kWh)*2	7	7	7	7	subsidized
12 Electric power charge (Rs.)	20,160	6,320	8,064	7,372	
13 Basic charge (Rs.)*2	400	300	300	300	
14 Maintenance cost (Rs.)*2	800	550	600	575	
Total (Rs.)	21,360	7,170	8,994	8,267	
<b>(2) Diesel Engine Pump</b>					
1 Area (ha)	1	1	1	1	
2 Groundwater level (mbgl)	10	10	10	10	
3 Water requirement (mm)*1	1,800	500	650	60	
4 Water requirement (m <sup>3</sup> per ha)	18,000	5,000	6,500	6,000	
5 Capacity of pump (hp) *2	8	8	8	8	standard type
6 Discharge (m <sup>3</sup> /min)*2	0.68	0.68	0.68	0.68	
7 Operation hours (hr)	240	80	96	88	
8 Fuel consumption (lit./hr)*2	1.0	1.0	1.0	1.0	
9 Fuel consumed (lit.)	288	96	115	106	
10 Unit rate of fuel (Rs./lit.)*2	95	95	95	95	
11 Power Charges (Rs.)	27,360	9,120	10,925	10,032	
12 Maintenance cost (Rs.)*2	1,600	1,000	1,100	1,050	
Total (Rs.)	28,960	10,120	12,025	11,082	

Source) \*1: CCS Haryana Agri. University Hissar

\*2: Interview to farmers

## (2) Major Challenges concerning Soil Degradation

### 1) Soil Salinity

Haryana, being an inland state, does not have direct access to coastal areas, where high salinity levels are commonly found. However, salinity issues can still arise due to various factors such as the presence of saline groundwater, waterlogging, and the use of irrigation water with high salt content.

According to data reported by GWC, I & WRD of June 2020, EC of >4,000  $\mu\text{S}/\text{cm}$  is reported in 6, 14,232 hectares (1,517,767 acres) area of Haryana. Districts like Sirsa, Bhiwani, Jhajjar, Nuh, Jind, Hisar and Rohtak are highly affected by salinity. Five districts, Ambala, Panchkula, Yamunanagar, Karnal and Kurukshetra are not impacted by salinity. District wise saline area details of Haryana are shown as Table 4.1.21.

Haryana is in the forefront of implementation of Sub Surface Drainage (SSD) system for reclamation of water-logged & saline lands. Most affected areas fall in the districts of Rohtak, Sonipat, Jhajjar and Bhiwani followed by Jind, Palwal, Mewat and Fatehabad. The area goes on fluctuating depending upon the rainfall. A project namely Haryana Operational Pilot Project (HOPP) was started in the year 1994 with technical support of Netherland Government. The Department of Agriculture, Haryana has implemented SSD projects in 11,240 hectares of waterlogged and saline soils in the State with technical support of the Central Soil Salinity Research Institute (CSSRI), Karnal. The problem of water-logging can be tackled through surface drainage, vertical drainage, bio-drainage and sub-surface drainage depending upon the nature and extent of the problem. However, where salinity and water-logging exists together, laying of sub-surface drainage system is the most effective technology. The affected area got reclaimed within 2-3 years through this technology. The average cost of system under this technology is about Rs. 80,000/- per hectare.

The problem of soil degradation due to the problem of salinity and sodicity (Alklineity) is common in the states of Punjab, Haryana and Uttar Pradesh and Gujrat where reclamation projects operated. An ambitious Sodic Soil Reclamation Project operated in the state of Uttar Pradesh with the World Bank assistance in two phases of five year each. In Punjab, the problem is more severe in Sangrur and Patiala districts where subsidized supplies of Gypsum were given to the farmers for application in sodic soils. Because of the seriousness of this problem, the Central Soil Salinity Research Institute was established at Karnal under Indian Council of Agriculture Research to develop technology of land reclamation. It has one of its centers in Lucknow (UP).

In India, 3.788 mha area is covered under sodic soils and 2.9569mha under saline soils. The state of Gujrat ha maximum area of 1.68 mha under saline soils and the state of Uttar Pradesh has maximum area of 1.347mha under sodic soils.

**Table 4.1.21 District wise saline area details of Haryana Extent of Salt-affected Soils in India**

(000 ha)

States	Sodic*1	Saline*1	Total*1	Cultivated Area*2	Percentage (%)
Punjab	151.7	0	151.7	4,233	3.6
Haryana	183.4	49.2	232.6	3,817	6.1
Uttarakand	0.0	0.0	0.0	1548	0.0
Himachal Pradesh	0.0	0.0	0.0	816	0.0
Uttar Pradesh	1347.0	22.0	1,369.0	18,775	7.3
Andhra Pradesh	196.6	77.6	274.2	8,997	3.1
Bihar	105.9	47.3	153.2	6,573	2.3
Gujarat	541.4	1,680.6	2,222.0	12,661	17.6
Jammu & Kashmir	17.5	0	17.5	1091	1.6
Karnataka	148.1	1.9	150.0	12,830	1.2
Kerala	0	20.0	20.0	2,235	0.9
Madhya Pradesh	139.7	0	139.7	17,121	0.8
Maharashtra	422.7	184.1	606.8	20,719	2.9
Orissa	0	147.1	147.1	6,675	2.2
Rajasthan	179.4	195.6	375.0	25,484	1.5
Tamil Nadu	354.8	13.2	368.0	8,109	4.5
West Bengal	0	441.3	441.3	5,615	7.9
Total	3,788.2	2,956.9	6,745.1	157,327	4.3

Source: \*1 Mandal et al. (2010). (Based on NRSA data of 1996 and reconciled during 2006 jointly by NRSA, CSSRI and NBSS & LUP, Nagpur), Mandal AK, Sharma RC, Singh G, Dagar JC (2010) Computerized database on salt affected soils in India. Technical Bulletin No.2/2010. Central Soil Salinity Research Institute, Karnal, p 28.

\*2 Agricultural Statistics at a Glance 2021, P.339-345, Table 4.5: Agricultural Land by type of Use.

## **2) Land Use and Cropping Pattern**

The report discusses the different categories of land use in the State of Haryana, India, including forested areas, non-agricultural land, barren and uncultivated land, permanent pastures and grazing lands, miscellaneous tree crops, cultivable waste land, and fallow land. The proportion of forested areas has sharply declined over the years, while non-agricultural land has increased due to urbanization and industrialization. Barren and uncultivable land has decreased slightly, while permanent pastures and grazing lands occupy a very small proportion of the total area. Cultivable wasteland has also decreased, while fallow land has remained almost absent in the State. Net sown area, which indicates the proportion of land devoted to crop production, has increased over the years but with not many fluctuations.

Meanwhile forest cover has sharply declined while the proportion of non-agricultural land has increased due to urbanization and industrialization. Barren and uncultivated land, grazing land, permanent pasture and cultivable land have all decreased over the study period. Miscellaneous tree crops and fallow land other than current fallow are almost non-existent. The net sown area has increased overall, but some districts near the National Capital Region have seen a decrease.

### **3) Cropping Pattern over a While (for the last 30 years):**

Cropping calendars for major crops in different Indian states and districts, as well as the production of major Rabi and Kharif crops in different districts for the years 2020-2021, 2019-2020, 2018-2019, and 2017-2018, were collected. The data is sourced from the Indian Council of Agricultural Research (Crop Science Division).

### **(3) Necessary Intervention**

#### **1) Waterlogging**

One third of the agriculture lands in Haryana are facing the problem of salinity and water logging. The water table has risen to variable depths in different regions of Haryana including Hisar, Sirsa, Rohtak, Jhajjar and some villages of district Charkhi Dadri. The affected area by water logging in Haryana is estimated to be 437,940 hectares, with Rohtak, Sonipat, Jhajjar and Bhiwani being the most affected districts. As per working group (Natural Resource Management) report of Haryana Kissan Ayog (2013), out of 44,021 lakh hectares of area in Haryana, 54,130 ha has water table in 0-15m depth and 379,762 ha in 1.5 to 3m depth to water table making total of 433,992 ha.

In order to solve this problem, Haryana has implemented a Sub Surface Drainage (SSD) system to tackle the problem of waterlogging and salinity in the State. A project called Haryana Operational Pilot Project (HOPP) was started in 1994, which has implemented SSD projects in 11,240 hectares of waterlogged and saline soils in the State. The technology of sub-surface drainage systems has been the most effective in tackling the problem of salinity and waterlogging. The affected area has been reclaimed within 2-3 years through this technology. The cost of implementing this system is about Rs. 80,000/- per hectare.

#### **2) Impact of the use of insecticides and pesticides on soil and groundwater contamination, etc.**

Average of 0.29kg/ha in 2016-17<sup>3</sup>. Haryana used 4,050 ton of pesticides (second highest) in 2020-21<sup>4</sup>. The introduction of high yielding varieties of rice and wheat after green revolution, the use of fertilizers and weedicides and pesticides increased many folds in Punjab and Haryana ultimately leading to high production but at the cost of groundwater depletion and soil degradation.

It is stated that a monitoring of multiresidues i.e. organochlorines (OC), synthetic pyrethroids (SP) and organophosphates (OP) in soil from different cropping pattern generally adopted in Haryana and Hisar, while ground water from tube wells is also monitored to assess the contamination level.

Presence of residues of SP and OP insecticides may be attributed to the change in usage pattern of pesticides in agriculture sector of Haryana. In the past one and half decade, the use of OC insecticides has been cut down drastically because of their persistence in the environment. Mostly the shift has occurred in favour of OP, SP and carbamate insecticides because of their wide spectrum of activity and comparatively less persistence.

The agriculture sector is important to the Indian economy, providing food and raw materials for industry. Pesticides are widely used in agriculture to increase production. Pesticides can enter the soil through

direct or indirect application and can be retained by soil materials or transported through soil, atmosphere, surface water, or groundwater. Several types of pesticides, including OC, OP, carbamate, and SP insecticides, have been found in soil and water samples from fields with crops like paddy-wheat, cotton-wheat, and sugarcane. This contamination is a concern, and regular monitoring of pesticide residues in soil and water is needed.

### **3) Statistics Showing the Causal Relationship Between Groundwater Table Decline and Agriculture**

Groundwater depletion and soil degradation are serious environmental issues that require immediate attention. Haryana's agricultural development has benefited significantly from groundwater irrigation. However, it has resulted in massive overexploitation of groundwater resources. This is true despite the fact that the state's groundwater availability increased by 35% from 1995 to 2020. The state's alluvial plains particularly in the northeastern region, has abundant groundwater resources. The Aravalli region in the south and southwest, however, has experienced inadequate groundwater supplies. It's interesting to note that in the two decades from the middle of the 1990s, the gross draught of water has increased more quickly in western Haryana's low tube wells intensity area. In the heavily tube wells irrigated area of the northeastern plain, the intensity of groundwater draw is already very high. Widespread overexploitation of groundwater in the state exists because water draw exceeds annual recharge in around 86 % of its land area. In a significant portion of the state, groundwater resources have been depleted as a result of ongoing overexploitation. The state's water table has decreased in about 53% of its area. On the other side, the state's water table has risen in nearly a quarter of the state, particularly in the belt from the Rohtak-Bahadurgarh-Gohana area to Hisar and Sirsa leading to the twin environmental issues of water logging and soil salinity. Poor horizontal and vertical drainage, extensive canal irrigation and the farmers' inability to use conjunctive irrigation resulted in the increase in the water table in this belt.

The ground water depletion was much less in districts having waterlogging and saline water problem such as Jhajjar, Rohtak and Hisar. However, the depletion was much more in paddy-wheat growing areas of Fatehabad, Karnal, Kaithal, Panipat and Kurukshetra. Moreover, the depletion was also high in districts having no canal water supply and solely depended on tube-well irrigation like Gurugram as shown in Table 4.1.18.

### **4) Cost Related to the Conversion of Cultivation Method:**

The State Government of Haryana is subsidizing the construction of secondary reservoirs for drip irrigation in horticultural crops. However, this needs to be evaluated in terms of costs, environmental implications, and management needs. The decline in water tables in certain regions is leading to serious salinity problems, and resource-poor small farmers cannot afford their own tube wells, which is affecting their irrigation. There is a demand for sinking deep tube wells and for more canal water or excess rainwater diversion for irrigation and water recharge options. At the extension level, farmers need to be incentivized to adopt agronomic measures and cropping patterns that enrich the soil with organic matter. Suitable rewards can be given to farmers for carbon sequestration and reducing GHG emissions.

### **5) Effects of Water Use Reduction by Shifting from Cereal Cultivation to Horticultural Crop Production**

India is a major food crop producer, with a focus on rice, wheat, pulses, and cotton. Haryana is a predominantly agricultural economy with a focus on wheat, rice, bajra, mustard, sugarcane, and cotton. The Green Revolution has led to a decline in the production of pulses in Haryana, raising concerns about nutritional security. The cropping pattern in Haryana has shifted towards cereals due to increased irrigation facilities and assured marketing at minimum support price. There is a need for district-level agricultural planning and policies to achieve balanced agricultural growth in Haryana. Since horticulture crops both fruit and vegetables have relatively less irrigation requirements as compared to paddy and wheat, so the area under horticulture should be increased by replacing paddy-wheat rotation.

## 6) Countermeasures toward Groundwater Depletion

Groundwater irrigation has significantly benefited agricultural development in Haryana, but it has resulted in massive overexploitation of groundwater resources. Water draw exceeds annual recharge in around 86 % of its land area, leading to the depletion of groundwater resources and a drop in the water table in about 53% of its area. Wheat and paddy, two crops that require a lot of water, are grown together in the northeastern and eastern plains which have resulted in extensive groundwater extraction for irrigation and the subsequent depletion of groundwater resources. Additionally, widespread tubewells irrigation in the dry area to exploit shallow aquifers may be to blame for the sharp decline in the water table in the *Aravalli* region in the southwest and south of Haryana. The causes contributing to the groundwater crisis in the area include ecological degradation and harm to the aquifer from widespread mining and the extraction of building materials.

Some of the measures that can be taken to mitigate groundwater depletion include:

- Rainwater harvesting - This is a process of collecting and storing rainwater for future use. It can help reduce the demand for groundwater.
- Water conservation - This involves reducing water usage by fixing leaks, using low-flow fixtures etc.
- Recharge wells - These are wells used to recharge groundwater by injecting water into the ground.
- Direct Seeded Rice (DSR) is a viable option to reduce water requirement of paddy. DSR is a process of establishing a rice crop from seeds sowing rather than by nursery raised transplanting of seedlings.
- Drip irrigation is the most efficient water and nutrient delivery system for growing crops. It delivers water and nutrients directly to the plant's roots zone, in the right amounts, at the right time, so each plant gets exactly what it needs, when it needs it, to grow optimally.
- Laser levelling, changing sowing dates of paddy, and incentivize diversification by promoting *Mera Pani Meri Virasat* program is also advocated in this study.

Some of the measures that can be taken to mitigate soil degradation include:

- Crop rotation - This involves planting different crops in a field each year to help maintain soil fertility.
- Conservation tillage - This involves reducing extent of tillage used on a field to maintain soil structure.
- Cover crops - These are crops that are planted in between main crops to help maintain soil fertility.
- Organic Farming: The organic farming uses fewer pesticides, reduces soil erosion, decreases nitrate leaching into groundwater and surface water, and recycles animal wastes back into the farm.
- Green Manuring: It helps to maintain the organic matter status of soil, serves as source of food and energy for microbes to multiply rapidly, not only decompose the GM but also result in release of plant nutrients in available forms for use by the crops.

## 7) On-going Relevant Schemes / Programmes

Groundwater depletion and soil degradation are serious environmental issues that require immediate attention. The government, policy makers, researchers, farmers and stakeholders are required to seek alternatives to high input requiring crops to more profitable and low input requiring crops. However, it is important to note that these issues require long-term solutions and cannot be solved overnight. On-going schemes / programmes are described as follows:

**Table 4.1.22 On-going schemes / programmes**

Scheme / Programme	Particulars
Mera Pani Meri Virasat	Stared in 2020 under the Department of Agriculture and Farmers Welfare. Being promoted to ensure effective crop diversification. Farmers paid @ Rs 7000 per acre for area diversified.
Crop Cluster Development Program	This is a program of Horticulture Department where crop cluster around



Scheme / Programme	Particulars
through SFAC	dominating crops are created to support production and marketing to increase net income of farmers
Bhavantar Bharpayee Yogna	Started in 2018 under Department of Horticulture Haryana a continuous scheme. To ensure minimum support price to diversified vegetable and fruit crops so that farmers do not go in loss due to marketing problems
National Project on Management of Soil Health and Fertility	Started in 2021 under the Department of Agriculture and Farmers Welfare Haryana. Promoting soil test based application of plant nutrients
Ponds and Waste Water Management Program	Started in 2018 under Haryana Pond and Waste Water Management Authority. To use this wastewater for irrigation and reduce dependence on groundwater,
Pardhan Mantri Krishi Sinchai Yogna,	Taken under National Mission on cost sharing mode in 2015. Now under Micro-Irrigation and Command Area Development Authority Haryana. Promotion of different schemes like rainwater harvesting, micro irrigation and laser levelling.
ATAL Bhujal Under Kal Shakti Mission	Started in 2019 under Irrigation and water Resources Department Haryana. This is project in mission mode on regulation of over use of water by industry and agriculture. No tubewells are allowed in critical blocks
Haryana Operational Pilot Project (HOPP)	Was started in the year 1994 with technical support of Netherland Government. The Department of Agriculture, Haryana has implemented SSD projects in 11,240 hectares of waterlogged and saline soils in the State with technical support of the Central Soil Salinity Research Institute (CSSRI), Karnal. The problem of waterlogging can be tackled through surface drainage, vertical drainage, bio-drainage and sub-surface drainage depending upon the nature and extent of the problem. However, where salinity and waterlogging exist together, laying of sub-surface drainage system is the most effective technology. The affected area got reclaimed within 2-3 years through this technology. The average cost of system under this technology is about Rs. 80,000/- per hectare.

Source: JICA survey team

## 4.2 Value Chain Survey on Horticulture Crops

### 4.2.1 Methodology

#### (1) Methodology

The methodology adopted for this study focused on certain parameters and a variety of indicators which included collection and analysis of primary and existing secondary data. Collection of primary data was done through interviewing the stakeholders involved in the value chains of mango, cauliflower, green chillies, watermelon and green pea seed production. Significant importance was given for collecting reliable and adequately detailed information about the pre and post-harvest practices and marketing methods being followed by the farmers. This helped in evaluating the gaps and potential of the interventions. For this study the following steps were primarily adopted:

- Collection and review of secondary data from district level database, reports, documents, government policies, plans and programmes
- Development of questionnaires and checklists for primary data collection
- Mobilization of the study team
- Internet surfing of websites of departments and research institutes
- Interactions and interviewing farmers and other stakeholders involved in supply chain

#### (2) Field survey in the selected areas to arrive at a conclusive analysis of the emerging scenario

- Analysis of secondary and primary data using appropriate tools

Though the study was proposed to be conducted in all 22 districts of the State, but was not possible to cover all the districts because of farmers' unavailability due to lack of area under given candidate crops

in each district. Therefore, only those districts were selected for the study where more than six percent of area was under the given crops.

**Table 4.2.1 Crop wise selection of districts for VC Study**

S.No	Shortlisted Crops	District(s)	No. of Farmers/Growers interviewed
1	Mango	Yamunanagar, Ambala, Panchkula	60
2	Watermelon	Sonipat, Jhajjar, Karnal	60
3	Chillies	Panipat, Jind, Palwal, Yamunanagar	80
4	Cauliflower	Yamunanagar, Panipat, Fatehabad, Ambala	80
5	Green peas seed production	Rewari, Mahendergarh	40*

Source: JICA Survey Team

Development of Research Tools (questionnaires, checklist and field planning) was done on the basis of secondary research. Research tools developed were used to conduct interviews with the stakeholders. To get accurate primary information/data per the survey's requirements, personal interviews; key informant interviews (KII), and focused group discussions (FGD) with the stakeholders were also conducted.

**Table 4.2.2 Actors interviewed at different levels of Value Chain for primary information**

Sr. No.	Actors of VC(s)	Functions	Stakeholders Interviewed (per district)
1	Input providers	Provide inputs required for production	<ul style="list-style-type: none"> <li>– Suppliers of farm inputs (1-2),</li> <li>– Seed companies (1-2)</li> <li>– Pesticides and fertilizer companies (1-2)</li> <li>– NGOs providing input knowledge</li> <li>– Companies providing small inputs to reduce drudgery (1)</li> <li>– Pre-harvest Contractor</li> <li>– Extension Officials (1-2)</li> </ul>
2	Producer	Production of crops using inputs like seeds, fertilizers	<ul style="list-style-type: none"> <li>– Representative producers/farmers per crop per district were interviewed (20)</li> <li>– PG(FPO) (1-2) for each target crop in each district as per availability; personal interview of farmers, focus group discussion of farmers, KII of `Gs/ SHG/Cooperatives executive members as per availability were done.</li> <li>– Women groups (1-2)</li> </ul>
3	Aggregators/ Distributers / Store operators /wholesalers level	– Distribution of produce after aggregating from different areas, creating a bulk load. Involved in primary activities like grading and sorting of produce	<ul style="list-style-type: none"> <li>– 2-3 companies from each stage of aggregation,</li> <li>– Storage companies, (1)</li> <li>– wholesaler companies (1-2)</li> <li>– PGs aggregating produce</li> </ul>
4	Processors	– Processing of produce that has local demand and does not require high end technology, more dependent on manual labour	<ul style="list-style-type: none"> <li>– 2-3 companies, each from major retailers (Big Bazar, Reliance, Fresh etc.),</li> <li>– Food industries (i.e. manufacturers, restaurant owners, hoteliers etc) (1-2)</li> <li>– PG members (1-2)</li> <li>– Processing companies (1)</li> </ul>
5	Marketing	– Marketing	<ul style="list-style-type: none"> <li>– High end markets (Aazdpur mandi Delhi, Chandigarh mandi)</li> <li>– Local markets (Mandies at district level i.e. Yamunanagar, Ambala, Sonipat, Jhajjar, Karnal, Panipat, Jind, Palwal and Fatehabad, Rewari and Mahendergarh) vendors</li> </ul>

Sr. No.	Actors of VC(s)	Functions	Stakeholders Interviewed (per district)
			<ul style="list-style-type: none"> <li>- Packaging material companies(1),</li> <li>- Retail stores (2-3) each district</li> <li>- Seed stores (3-4) (for green pea seed production VC)</li> <li>- Organic market stakeholders etc</li> </ul>
6	Supporting actors	- Providing assistance at different levels of VC	<ul style="list-style-type: none"> <li>- Financial institutions,</li> <li>- Govt. officials (Hort. Department) (2-3)</li> <li>- Agricultural product exporters (1)</li> <li>- Agritech companies, (1-2)</li> <li>- Crop Insurance companies</li> </ul>

Source: JICA Survey Team

Extensive desk study was undertaken to review and compile historical data and learning from similar exercises carried out earlier. It was helpful in understanding the existing supply chain of proposed crops and different type of stakeholders involved in the value chains. It was helpful in understanding the existing government policies and programmes under different agriculture institutions/organizations encouraging commercial agriculture in the State. Below mentioned websites of different organisations/institutes were searched for secondary data/information.

**Table 4.2.3 Different websites surfed for secondary information**

S.No.	Website	Type of Information Collected
1	<b>NHB</b> (National Horticulture Board) website and <b>AGMARKNET</b> website	Price (daily, weekly, monthly and annual prices); area and production statistics etc.
2	<b>APEDA</b>	Exports, trade, financial assistance schemes etc
3	<b>DOH</b> (Department of Horticulture) website	Area and production of crops; ongoing schemes in Haryana, etc
4	VC reports published by <b>NHRDF</b> (National Horticultural Research and Development Foundation) and <b>HSAMB</b> (Haryana State Agriculture Marketing Board) website	Farmer welfare schemes, food processing, acts, rules and byelaws etc
5	<b>MOFPI</b> (Ministry of Food Processing Industries) website, <b>MACP</b> (Maharashtra Agricultural Competitiveness Project) website	Identifying potential, competitive and consuming markets for the respective crops
6	Other material available online	

Source: JICA Survey Team

The data collected from the primary survey were analyzed using pivot table in excel. Primary data analysis was done to generate the required information as per Terms of Reference for the study. The below mentioned list of actors at different levels of the Value Chain were targeted for detailed discussions during the field survey and data collection.

### Selection of target crops

Target crops for the VC survey were selected from the following perspectives, and consent was obtained from DOH.

- It should be selected during the target crops for cluster development, a policy of DOH (a certain number of PGs and farmers deal with the target crop).
- It should not be a VC, which has been conducted by EY (15 crops have already been surveyed).
- It should have potential to increase productivity and production through technology transfer and equipment introduction.
- Highly cost-effective in terms of value-added improvement and cost reduction
- If there is no difference among the above, the order is based on the order of production volume (Easy to lead to economic benefits)

**Table 4.2.4 Crop Selection Criteria for VC Survey**

	Crop name	target crops for cluster development	EY's VC report	Productivity and output improvement potential	Cost-effectiveness	Within Haryana Production Rank
1	Potato	✓	✓	✓	✓	1
2	Tomato	✓	✓	✓	✓	2
3	Onion	✓	✓	✓	✓	3
4	Cauliflower	✓	X	✓	✓	4
5	Radish	✓	X	△	✓	5
6	Leafy vegetables	✓	X	✓	△	6
7	Kinnow	✓	✓	✓	✓	7
8	Carrot	✓	✓	△	△	8
9	Cabbage	✓	X	△	△	10
10	Brinjal	✓	X	✓	△	11
11	Guava	✓	✓	△	✓	14
12	Peas	✓	X	✓	✓	16
13	Chillies	✓	X	✓	✓	17
14	Mango	✓	X	✓	✓	18
15	Watermelon	✓	X	✓	✓	19
16	Garlic	✓	✓	✓	△	23
17	Musk melon	✓	X	✓	△	24
18	Capsicum	✓	✓	✓	✓	26
19	Ginger		✓	✓	✓	37
20	Peach		✓	✓	△	38
21	Strawberry	✓	✓	✓	✓	39
22	Litchi	✓		✓	✓	40
23	Aonla	✓		✓	✓	48
24	Cucurbits	✓		✓	△	n.a.
25	Okra	✓	✓	✓	✓	n.a.
26	Flower	✓		✓	✓	n.a.
27	Lemon	✓		✓	✓	n.a.
28	Sapota	✓		✓	△	n.a.
29	Baby corn	✓		△	✓	n.a.
30	Sweet corn	✓		△	✓	n.a.
31	Exotic vegetables	✓		✓	✓	n.a.
32	Ziziphus mauritiana	✓		✓	✓	n.a.
33	Honey		✓	✓	✓	n.a.
34	Mushroom		✓	✓	✓	n.a.
35	Green peas (seed)		(✓ fresh)	✓	△	n.a.

Source: JICA Survey Team

About the potential to improve productivity and production, crops with high potential to improve productivity and output through the transfer of technology and introduction of equipment such as mulch and vertical farming were given high marks. In terms of cost-effectiveness, the evaluation was higher for processing crops that could add value through pack houses and for seasonal crops that could add value through refrigerated warehouses. Furthermore, the value-added effect of clustered vegetables on production was used as a reference indicator in the case that no differences were found for other items, because it is considered to lead to the economic development of the region to assess the value-added effect for those with high production. For details of each crop, please refer to Table 3.3.9 Potential of clustered vegetables.

In addition, DOH requested that green pea seeds be included as a target crop for the VC survey. It was explained that there is already a VC report on green peas as a vegetable conducted by E&Y, but not yet on seed production. In the southern region of Haryana, the states adjacent to Rajasthan, Mahendragarh, Rewari, Jhajjar, Charkhi Dadri, and Bhiwani, seed production is expected to grow, and the DOH is planning to convert 8,000 ha of land to cultivation for green pea seed production. Therefore, the DOH needed to conduct a VC survey of green pea seeds.

Therefore, we propose that spices not be included as a target crop for the VC survey and that green pea seeds be one of the target crops for the VC survey.

In discussions with the DOH, the survey team also requested that E&Y make proposals for value addition in the 15 VC surveys conducted by E&Y, as the E&Y report lacks consideration of value addition in terms of possible technical interventions, crop-market matching proposals, etc. The survey team would like to make such proposals. The survey team will review the E&Y VC report and consider this issue. Refer to attachment 2.

The crops selected for Value Chain Survey are mango, cauliflower, watermelon, chilies and green peas seed production.

From the list of 35 odd crops the first four crops were selected based on the fixed criteria and having sufficient production volumes in the State. The fifth Crop was chosen solely based on the recommendations of the Department of Horticulture, Haryana.

The selection of crops for the Value Chain (VC) Survey was based on the following criteria. Firstly, crops excluded from previous studies/surveys done by E&Y need to be considered for the VC survey. Secondly, it should be a target crop for clusters. Thirdly, it should have productivity and output improvement potential (i.e., yields with high potential to increase productivity and production through the transfer of technology and equipment, such as mulch and vertical farming, etc.) and finally, cost-effectiveness (i.e., crops that can be processed and add value using facilities of pack houses and highly seasonal crops adding value through the use of cold storage and other means). Green peas seed production was shortlisted because DOH (Department of Horticulture) plans to convert around 8,000 ha of land for green peas seed production in Southern regions of the State (viz. Mahendragarh, Rewari, Jhajjar, Charkhi Dadri, and Bhiwani) bordering Rajasthan. The DOH, Haryana, has a target of covering 8,000 ha for green peas seed production for the next three years. As a result, green pea seed production was included in the VC Survey list.

#### **4.2.2 Result of the Subcontract Survey**

##### **(1) Present Status**

Production areas, varieties, yields and harvesting time, crop budget, market and post-harvest losses for the target crops are shown in Table 4.2.5, Table 4.2.6, and Table 4.2.7.

**Table 4.2.5 Production areas, varieties, yields and harvesting time of select crops in Haryana**

Crop	Area(s)	Varieties	Irrigation	Yields	Duration/Harvest time of Crop
Mango	Yamuna Nagar (Kaleser, Chhachhrauli, Khizrabad, Tajewala, Bhilpura, Sherpur and Bilaspur), Ambala (Naraingarh & Barara and Panchkula (Raipur Rani, Barwala and Pinjore).	Dashahari (75%), Langda (10%), Chausa (10%), Desi (4%) and other varieties (1%) like Ramkela, Malika, Amrapali, kesar etc.	Flood through tube well. Farmers reported drip is not successful in orchard because it increases the cost of orchard management during cultural operations	Most of the respondents have old orchards (more than 30 years). Therefore, the average yield reported by them is ranging from 60qtl to 80qtl per acre. (1.5 to 2 qtl/tree). The number of trees per acre is 40 to 50.	Flowering season- End of February to March Harvesting – June-July
Watermelon	Sonipat, Karnal and Jhajjar, mostly near the Yamuna River.	033535, Ali 072, Madhuri 64, Ramdhari 64, Raja Madhu, Kanchan, Century, Sufia 766, Hira 03535, Hira 766, Max, Rehan, Khushbu 64 &10, Janat, and Arohi,.	Farmers use both flood and drip type of irrigation. On the edge of river mostly flood type of irrigation is used. Farmers have their own tube well and with the help of plastic pipe, they irrigate it.	Average yield reported by farmers are ranging from 150 to 200 qtl per acre. Few farmers cultivate watermelon on the edge of Yamuna River in sandy soil and yield reported by these farmers varies from 100 to 120 qtl/acres.	January to June. Harvesting is mostly done in month of May to June.
Chili	Panipat, Jind, Palwal & Yamuna Nagar	Golden (AK47), VNR 6013, 1360, 1701, Soldier, Arman, Pepsi, Armer, 71 and Samaridhi	Farmers use flood and drip both type of irrigation.	Average yield reported by farmers are ranging from 80 to 150qtl per acre. Number of pickings done by farmers are range from 5 to 6.	90 to 120 days. Harvesting is mostly done in month of April to June.
Cauliflower	Yamuna Nagar, Panipat, Fatehabad and Ambala	Neha-70, Golden, Garima, Lucky, Nilima, Syngenta, Ramdhai-Girja, Golden, 15/22, Korta, snow queen, slow pearl and Karti.	Farmers use flood type of irrigation.	Average yield reported by farmers are ranging from 80 to 100 qtl per acre.	90 to 120 days. Harvesting is mostly done from December to March.

Source: JICA Study Team based on the result of VC subcontract survey

**Table 4.2.6 Different costs incurred by farmers (per acre) to produce the select crops and market them**

Crop	Cost of nursery preparation	Cost of FYM	Labour charges*	Fertilizer cost	Cost of pesticide and insecticide	Cost of irrigation	Harvesting & aggregation	Packaging material
<b>Mango</b>	Farmers generally buy seedlings from adjoining states viz Uttar Pradesh or Himachal Pradesh. The price of one grafted plant of one-year ranges from 150 to 700/plant	INR 4000	INR 15000	Two basal doses of fertilizer July August- Dye, Zink, Sulphur and FYM- INR 100/tree (average 40 tree in one acre = INR 4000 December - INR 100*40 = INR 4000	Five sprays = (5*5000/spray) = INR 50,000	Irrigation (electricity bill)- INR 500 to INR 700	2 male and 2 female labour harvest 4 trees in one day; cost of one day: INR 1500 /day. 10 days required for 1 acre. Hence, total harvesting cost: 1500*10=15000.	Crate is INR 150 to 200 one-time investment & sometime provided by commission agents. Cardboard boxes of 10 kg whose rate is INR 25/box
<b>Watermelon</b>	INR 18000 (Seedlings required =7200/acre and germination rate 85%). (Cost of one plant-2.90). Total 6000 plant required for transplantation of watermelon in one acre)	INR 4000-5000	INR 44000	INR 14800	INR 15000	INR 600	INR 24000	INR 1500
<b>Chili</b>	INR 12000	INR 2000	INR 5000	INR 6500	INR 24,000 (total number of spray-6 and cost of per spray-INR 4000)	INR 5000	more than INR 30,000 (6 INR /kg)	INR 2000
<b>Cauliflower</b>	If purchase seedling: total 30,000 seedling are required for one acre and rate of one seedling is 0.6 to 0.7 INR /seedling=30,000X0.7= INR 21000	INR 3000	INR 8000	INR 3000	INR 3000 to 5000 (no of spray 3-4)	INR 500	INR 6000 (mostly by self)	1300

Source: JICA Study Team based on the result of VC subcontract survey

**Table 4.2.7 Sale/Marketing of crops by farmers and losses incurred in the process.**

Crop	Transportation Rs/qtl	Marketing	Losses
<b>Mango</b>	INR 125 (local market)	Majority of the contracts are from Uttar Pradesh, and they sell the harvested mango in the local mandi. As per the contractor, they do sort grading and in one acre of orchard, they get 60% A-grade of produce, 25% B-grade of produce, 10% of C-grade of produce and 5% D-grade of produce.	Average loss reported during harvesting, aggregation, packaging and transportation is 10%.
<b>Watermelon</b>	150 to 200	Major mandi reported by farmers are local district mandi, Chandigarh and Delhi. Sources of information on market price are generally commission agents and on the basis of current price, farmers decide where to sell their produce. Size of watermelon in the range of 3 to 5 kg has high demand in market. In most of the cases, farmers do not use any packaging material. Average price reported by farmers is 8-12 Rs. /kg of local watermelon. Currently, watermelon is coming from other states. Local watermelon will arrive in the month of May and June.	Average loss reported during harvesting, aggregation, packaging and transportation is 10-15% but mostly quality loss.
<b>Chili</b>	INR 6000-10,000 (depending upon market distance)	Major mandi reported by farmers are local district mandi, and Delhi. In Haryana, presently chili is coming from Delhi through traders. Local chili will arrive in mandi after May. Sources of information on market price are generally commission agent and on the basis of current price, farmers decide where to sell their produce. Average price reported by farmers is 30-32 Rs. /kg of local chili. In case of bumper production/high arrival in mandi, its price goes as low as 20 Rs. /kg. Current wholesale price (at mandi level) of chili which is coming from Delhi is 45 to 50 Rs/kg.	Average loss reported during harvesting, aggregation, packaging and transportation is 10%.
<b>Cauliflower</b>	INR 150 to 200	Major mandi reported by farmers are local district mandi. Arrival of cauliflower in the mandi started in the month of December and goes up to March. Farmers generally get good price in the month of 26 <sup>th</sup> January and after that its price reduces up to 2 Rs/kg. Sources of information on market price are generally commission agent and on the basis of current price, farmers decide where to sell their produce. Average price reported by farmers is ranging from 18 Rs/kg to 3 Rs. /kg. In case of bumper production/high arrival in mandi (Month of February and March), its price goes as low as 2 Rs. /kg.	Average loss reported during harvesting, aggregation, packaging and transportation is 10-15% (moisture and physical loss)

Source: JICA Study Team based on the result of VC subcontract survey



## (2) Price representation at producer, distributor and retail level

Information on prices at various levels was collected during interactions with various stakeholders in the value chain. The following describes the changes in prices at different levels of the value chain in the target crops.

### MANGO

Three varieties of mango are mainly being cultivated in Haryana viz. Deahari, Chausa and Langda. Grade wise price difference for each of these three varieties is presented.

**Table 4.2.8 Chausa mango price difference**

Mango Variety	Grade wise price (Rs./kg)			
	A Grade (60%)	B Grade (25%)	C Grade (10%)	D Grade (5%)
Chausa	70	50	30	15
Deshari	40	30	20	5
Langda	50	40	30	10

Source: JICA Study Team based on the result of VC subcontract survey

Chausa variety of mango when studied in detail showed that at farmers level the minimum and maximum price is same i.e., INR 6/kg and increases more than 6 times at contractor level and the minimum price is INR 40/kg whereas the maximum price is INR 70/kg. This variation is mainly due to the farmers auctioning their orchards to the contractors at the time of flowering of mango trees. At wholesale level the minimum price increases to INR 53/kg and maximum price at this level is INR 89/kg at retail level the minimum price is INR 68.6/kg whereas the maximum price is INR 108/kg.

**Table 4.2.9 Chausa mango price fluctuation**

Mango variety – Chausa				
Stakeholders	Components of expenses		Min Price (Rs. /kg)	Max Price (Rs. /kg)
Farmers			6	6
Contractor			40	70
Wholesalers/Vendor/Mashakhori	Commission agents (7%)	7%	2.8	4.9
	Losses (%) (2-3%)	3%	1.2	2.1
	Other expenses like labour, rent etc. (Rs.)	5	5	5
	Margin (min. 10%)	10%	4	7
	Wholesale Price		53	89
Retail Price	Transportation & other expenses (3-5 Rs/kg)	5	5	5
	Losses (3-5%)	5%	2.7	3.5
	Margin (min. 15 to 20%)	15%	8.0	10.5
	Retail Price		68.6	108.0

Source: JICA Study Team based on the result of VC subcontract survey

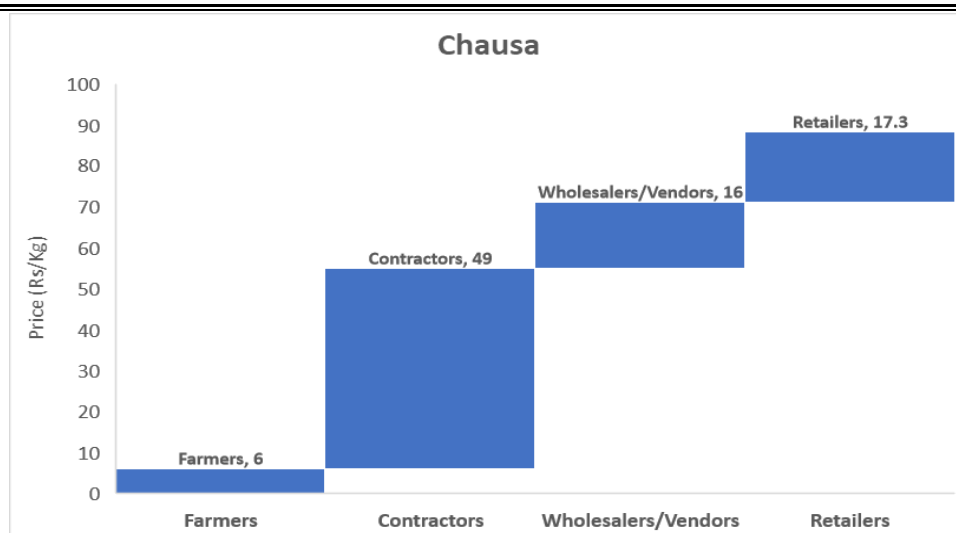
**Table 4.2.10 Price range of Chausa mango**

Chausa				
Price Range (Rs/kg)	Farmers	Contractors	Wholesalers/Vendors/Mashakhori	Retailers
Minimum	6.0	40.0	53.0	68.6
Maximum	6.0	70.0	89.0	108.0
Average	6.0	55.0	71.0	88.3
<b>Price Change (Rs/kg)</b>	<b>6.0</b>	<b>49.0</b>	<b>16.0</b>	<b>17.3</b>

Source: JICA Study Team based on the result of VC subcontract survey

The graph below shows the variation in average price for Chausa mango variety. The farmer only gets INR 6/kg and the maximum margins are claimed by the contractors.

The chart represents the variation in the prices at different levels and how much margins each actor of the value chain makes from the final sale.



Source: JICA Study Team based on the result of VC subcontract survey

**Figure 4.2.1 Chausa mango price chart**

The second variety of mango is Dasherri, details about the stakeholder and price variation at different levels are shown.

**Table 4.2.11 Dasherri Mango price fluctuation**

Dasherri				
Stakeholders	Components of expenses		Min Price (Rs. /kg)	Max Price (Rs. /kg)
Farmers			6	6
Contractor			20	40
Wholesalers/Vendor /Mashakhor	Commission agents (7%)	7%	1.4	2.8
	Losses (%) (2-3%)	3%	0.6	1.2
	Other expenses like labour, rent etc. (Rs.)	5	5	5
	Margin (min. 10%)	10%	2	4
	Wholesale Price		29	53
Retail Price	Transportation & other expenses (3-5 Rs/kg)	5	5	5
	Losses (3-5%)	5%	1.5	2.0
	Margin (min. 15 to 20%)	15%	4.4	6.0
	Retail Price		39.8	66.0

Source: JICA Study Team based on the result of VC subcontract survey

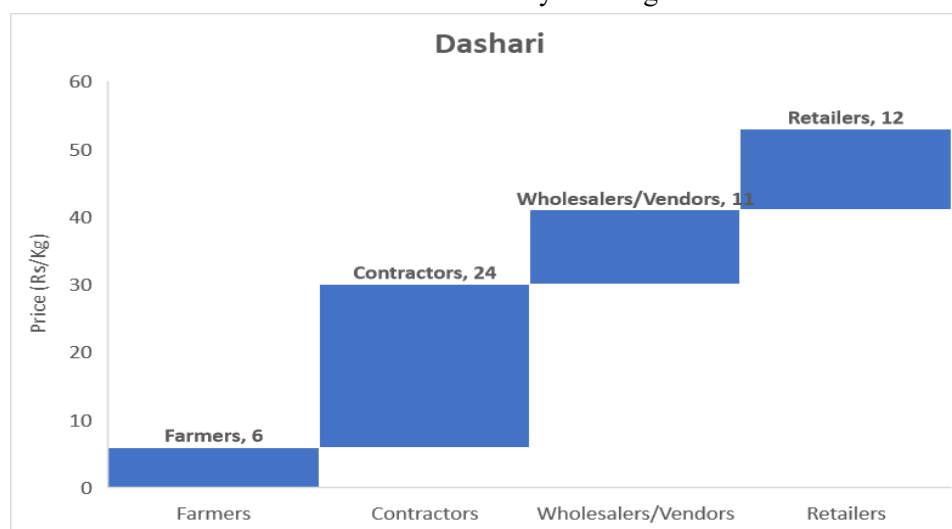
Dasherri variety of mango when studied in detail showed that at farmers level the minimum and maximum price is same i.e., INR 6/kg and increases to INR 20/kg and maximum to INR 40/kg at contractor level. This variation is mainly due to farmers auctioning their orchards to the contractors at the time of flowering of mango trees. At the wholesale level, the minimum price increases to INR 29/kg and maximum price at this level is INR 53/kg at retail level the minimum price is INR 40/kg whereas the maximum price is INR 66/kg.

**Table 4.2.12 Dasherri Mango price range**

Dasherri				
Price Range (Rs/kg)	Farmers	Contractors	Wholesalers/Vendors/Mashakhor	Retailers
Minimum Price	6	20	29	40
Maximum Price	6	40	53	66
Average Price	6	30	41	53
<b>Price Change (Rs/kg)</b>	<b>6</b>	<b>24</b>	<b>11</b>	<b>12</b>

Source: JICA Study Team based on the result of VC subcontract survey

The chart represents the variation in prices at different levels and how much margins each actor of the value chain makes from the final sales of Dasherri variety of mango.



Source: JICA Study Team based on the result of VC subcontract survey

**Figure 4.2.2 Dasherri Mango price chart**

The third variety of mango is Langda, details about the stakeholder and price variation at different levels are shown.

**Table 4.2.13 Mango price fluctuation**

Langda				
Stakeholders	Components of expenses		Min Price (Rs. /kg)	Max Price (Rs. /kg)
Farmers			6	6
Contractor			30	50
Wholesalers/Vendor/Mashakhor	Commission agents (7%)	7%	2.1	3.5
	Losses (%) (2-3%)	3%	0.9	1.5
	Other expenses like labour, rent etc. (Rs.)	5	5	5
	Margin (min. 10%)	10%	3	5
	Wholesale Price		41	65
Retail Price	Transportation & other expenses (3-5 Rs/kg)	5	5	5
	Losses (3-5%)	5%	2.1	2.5
	Margin (min. 15 to 20%)	15%	6.2	9.8
	Retail Price		54.2	82.3

Source: JICA Study Team based on the result of VC subcontract survey

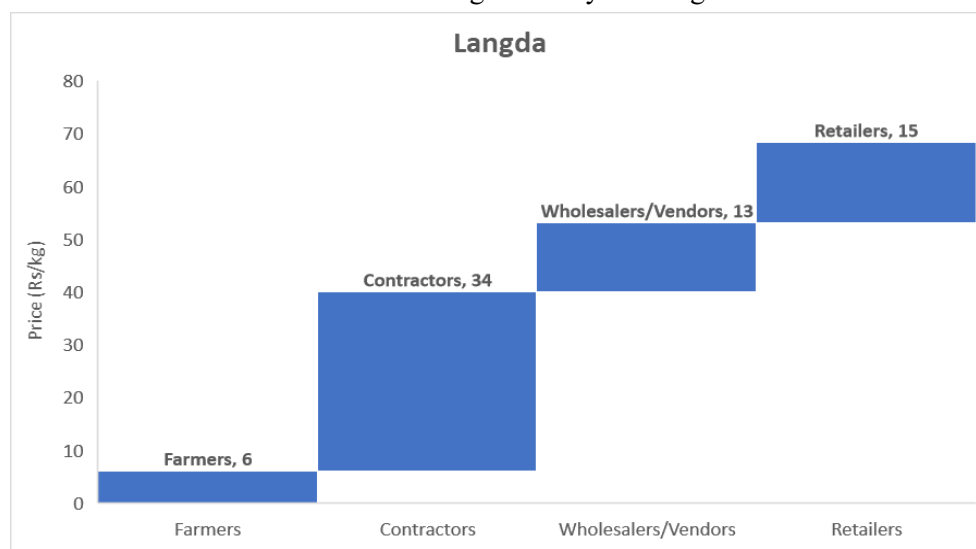
Langda variety of mango when studied in detail showed that at farmers level the minimum and maximum price is same i.e., INR 6/kg and increases to INR 30/kg and maximum to INR 50/kg at contractor level. This variation is mainly due to farmers auctioning their orchards to the contractors at the time of flowering of mango trees. At the wholesale level, the minimum price increases to INR 41/kg and maximum price at this level is INR 65/kg at retail level the minimum price is INR 54/kg whereas the maximum price is INR 82/kg.

**Table 4.2.14 Mango price range**

Langda				
Price Range (Rs. /kg)	Farmers	Contractors	Wholesalers/Vendors/Mashakhor	Retailers
<b>Minimum Price</b>	<b>6</b>	<b>30</b>	<b>41</b>	<b>54</b>
<b>Maximum Price</b>	<b>6</b>	<b>50</b>	<b>65</b>	<b>82</b>
<b>Average Price (Rs/kg)</b>	<b>6</b>	<b>40</b>	<b>53</b>	<b>68</b>
<b>Price Change (Rs. /kg)</b>	<b>6</b>	<b>34</b>	<b>13</b>	<b>15</b>

Source: JICA Study Team based on the result of VC subcontract survey

The chart represents the variation in prices at different levels and how much margins each actor of the value chain makes from the final sales of Langda variety of mango.



Source: JICA Study Team based on the result of VC subcontract survey

**Figure 4.2.3 Mango price chart**

## WATERMELON

Watermelon value chain when studied in detail showed that at farmers level the minimum price is INR 10/kg and maximum price is INR 15/kg and increases to INR 17/kg and the maximum to INR 23/kg at the wholesale level. At retail level the minimum price increases to INR 25.3/kg and the maximum price at this level is INR 32/kg.

**Table 4.2.15 Watermelon price fluctuations**

Stakeholders	Components of expenses		Min Price (Rs/kg)	Max Price (Rs./kg)
Farmers			10	15
Wholesalers/Vendor/Mashakhor	Commission agents (7%)	7%	0.7	1.05
	Losses (%) (2%)	2%	0.2	0.3
	Other expenses like labour, rent etc. (Rs.)	5	5	5
	Margin (min. 10%)	10%	1	1.5
	Wholesale Price		16.9	22.85
Retail Price	Transportation & other expenses (3-5 Rs/kg)	5	5	5
	Losses (5%)	5%	0.8	1.1
	Margin (min. 15 to 20%)	15%	2.5	3.4
	Retail Price		25.3	32.4

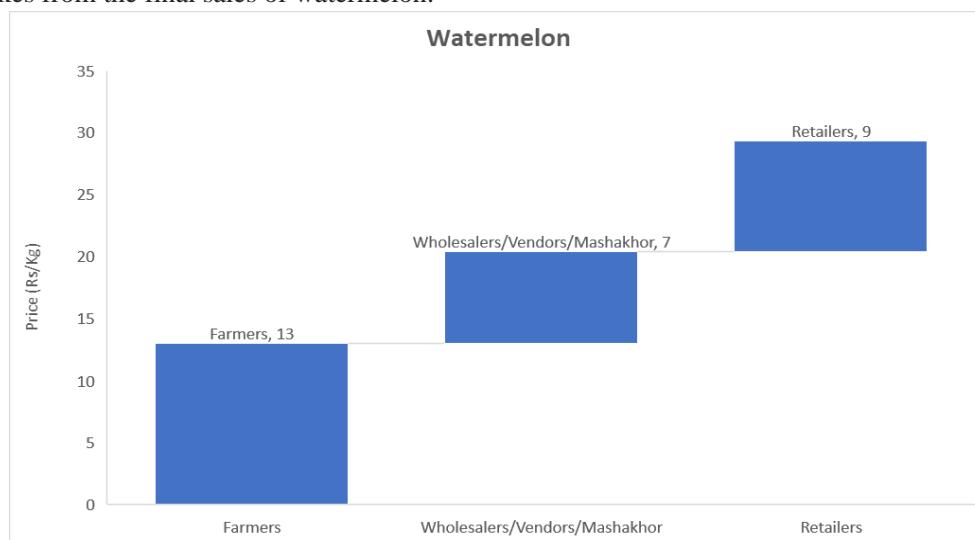
Source: JICA Study Team based on the result of VC subcontract survey

**Table 4.2.16 The price range of watermelon**

WATERMELON			
Price Range (Rs. /kg)	Farmers	Wholesalers/Vendors/Mashakhor	Retailers
Minimum Price	10	17	25
Maximum Price	15	23	32
<b>Average Price (Rs. /kg)</b>	<b>13</b>	<b>20</b>	<b>29</b>
<b>Price Change (Rs/kg)</b>	<b>13</b>	<b>7</b>	<b>9</b>

Source: JICA Study Team based on the result of VC subcontract survey

The chart represents the variation in prices at different levels and how much margins each actor of the value chain makes from the final sales of watermelon.



Source: JICA Study Team based on the result of VC subcontract survey

**Figure 4.2.4 Watermelon price chart**

## CHILI

Chili value chain showed that at farmers level the minimum price is INR 32/kg for local chili and INR 50/kg for supplied chili (supplied to other States). At the wholesale level, the price of local chili increases to INR 43/kg and supplied chili increases to INR 64.5/kg. At retail level the local chili price increases to INR 57/kg and supplied chili price at this level is INR 82/kg.

**Table 4.2.17 Chili price fluctuations**

Stakeholders	Components of expenses		Average Price of Local Chili (Rs. /kg)	Average Price of current supplied Chili (Rs. /kg)
Farmers			32	50
Wholesalers/Vendor/Mashakhor	Commission agents (7%)	7%	2.24	3.5
	Losses (%) (2%)	2%	0.64	1
	Other expenses like labour, rent etc. (Rs.)	5	5	5
	Margin (min. 10%)	10%	3.2	5
	Wholesale Price		43.08	64.5
Retail Price (Shopkeeper, reddybala and roadside seller)	Transportation & other expenses (3-5 Rs/kg)	5	5	5
	Losses (5%)	5%	2.2	3.2
	Margin (min. 15 to 30%)	15%	6.5	9.7
	Retail Price		56.7	82.4

Source: JICA Study Team based on the result of VC subcontract survey

Currently, chili price at retail level varies from Rs. 80 to 90 per kg but wholesale price is 45-50 Rs/kg).

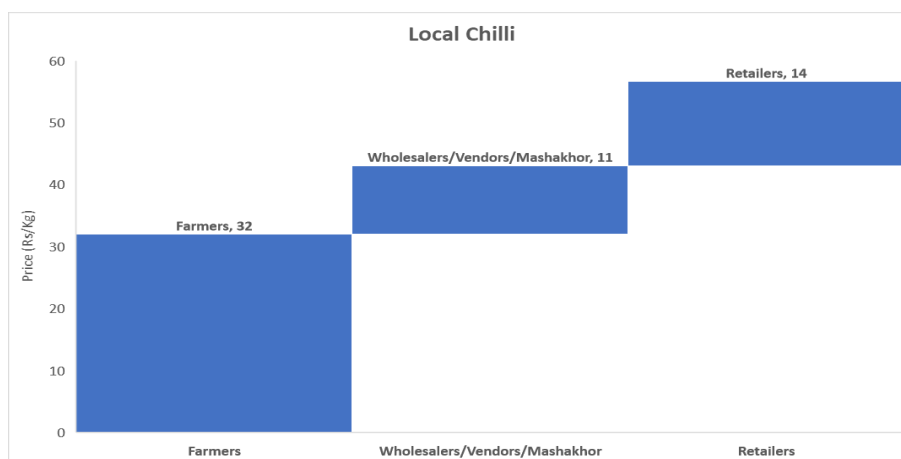
The table shows supply of local chili and price range at farmers level, wholesalers' level and retailer's level.

**Table 4.2.18 The price range of Local chili**

Local Chili			
Price Range (Rs/kg)	Farmers	Wholesalers/Vendors/Mashakhor	Retailers
Average Price of local chili (Rs/kg)	32	43	57
<b>Price Change (Rs/kg)</b>	<b>32</b>	<b>11</b>	<b>14</b>

Source: JICA Study Team based on the result of VC subcontract survey

The chart represents the variation in the prices at different levels and how much margins each actor of the value chain makes from the final sales of local Chili.



Source: JICA Study Team based on the result of VC subcontract survey

**Figure 4.2.5 The Chili price chart**

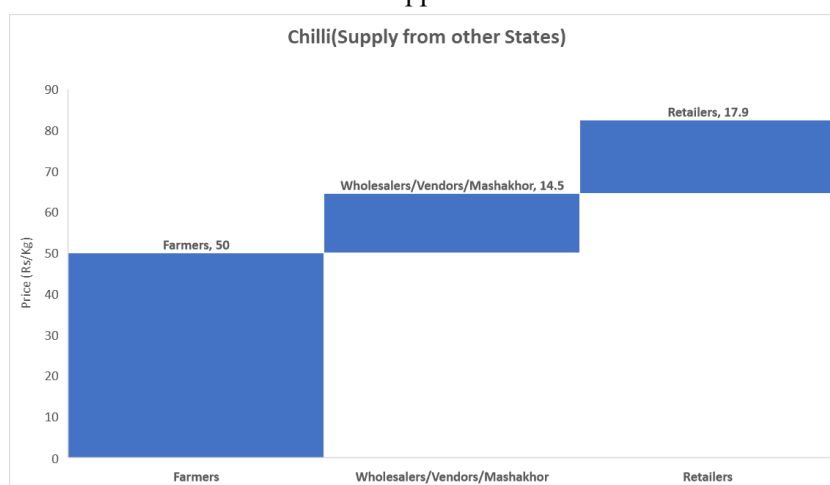
The table shows supply of chili to other States and price range at farmers level, wholesaler's level, and retailer's level.

**Table 4.2.19 The price range of Chili**

Chili supply from other states currently			
Price Range (Rs/kg)	Farmers	Wholesalers/Vendors/Mashakhor	Retailers
Average Price of local chili (Rs/kg)	50.00	64.50	82.40
<b>Price Change (Rs/kg)</b>	<b>50.00</b>	<b>14.50</b>	<b>17.90</b>

Source: JICA Study Team based on the result of VC subcontract survey

The chart represents the variation in prices at different levels and how much margins each actor of the value chain makes from the final sales of Chili supplied to other States.



Source: JICA Study Team based on the result of VC subcontract survey

**Figure 4.2.6 The Chili Price chart**

## CAILIFLOWER

Cauliflower value chain showed that at the farmers level, the average price for cauliflower is INR 18/kg (before 26th January) and the average price after 26th January is INR 3/kg. At the wholesale level, the price of Cauliflower (before 26th January) increases to INR 29.6/kg and average price after 26th January is INR 9.11/kg. At the retail level, the price of Cauliflower (before 26th January) increases to INR 45/kg and average price after 26th January is INR 17.3/kg.

**Table 4.2.20 Cauliflower price fluctuations**

Stakeholders	Components of expenses		Average Price of (Before 26th Jan) (Rs. /kg)	Average Price after 26 <sup>th</sup> Jan (Rs. /kg)
Farmers			18	3
Wholesalers/ Vendor/ Mashakhor	Commission agents (7%)	7%	1.26	0.21
	Losses (10%)	10%	1.8	0.3
	Other expenses like labour, rent etc. (Rs.)	5	5	5
	Margin (min. 20%)	20%	3.6	0.6
	Wholesale Price		29.66	9.11
Retail Price	Transportation & other expenses (3-5 Rs/kg)	5	5	5
	Losses (15%)	15%	4.4	1.4
	Margin (min. 20 to 30%)	20%	5.9	1.8
	Retail Price		45.0	17.3

Source: JICA Study Team based on the result of VC subcontract survey

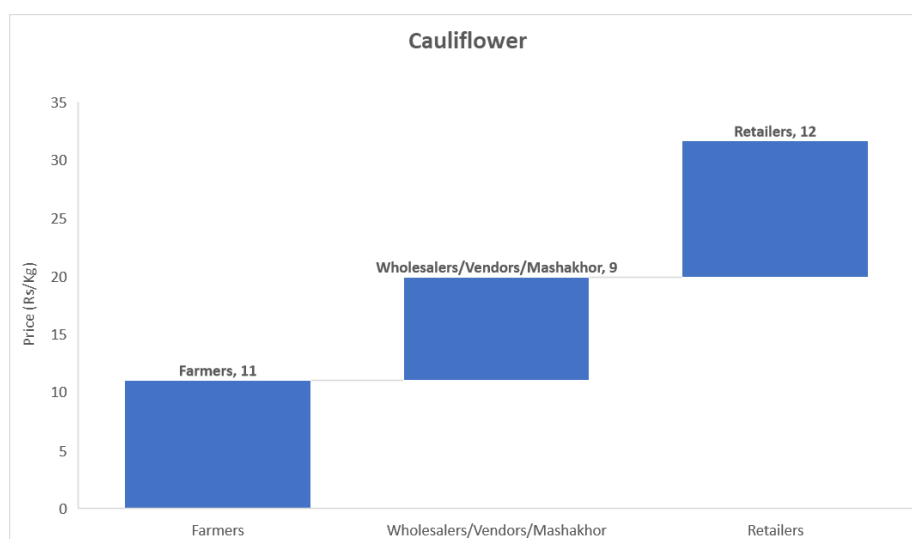
The table shows the price range for maximum and minimum prices at farmers level, wholesaler's level, and retailer's level.

**Table 4.2.21 The price range of Cauliflower**

Cauliflower			
Price Range (Rs/kg)	Farmers	Wholesalers/Vendors / Mashakhor	Retailers
Minimum Price	3	9	17
Maximum Price	18	30	45
Average Price (Rs/kg)	11	19	31
Price Change (Rs/kg)	11	9	12

Source: JICA Study Team based on the result of VC subcontract survey

The chart represents the variation in prices at different levels and how much margins each actor of the value chain makes from the final sales of Cauliflower.



Source: JICA Study Team based on the result of VC subcontract survey

**Figure 4.2.7 The Cauliflower Price chart**

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### 4.2.3 Major Challenges and Necessary Intervention

The value chain study of horticultural crops in Haryana focused on seed production of mango, watermelon, chillies, cauliflower, green and green peas seed production and provided important insights into the challenges and opportunities in these sectors. This chapter discusses these challenges and suggests necessary interventions.

#### (1) Identified Major Challenges

The key issues identified are described below for each node of the value chain.

#### **Pre-harvest challenges**

**Technology gaps:** The survey reveals a lack of modern agricultural practices among farmers. For example, traditional irrigation methods still predominate in mango production (Table 4.2.5), which affects yield and efficiency.

**Input quality and access:** Farmers face challenges in accessing quality inputs such as seeds and fertilizers, which affects crop quality and yield.

**Climate Change Impact:** Farmers report decreased yields due to climate changes, like increased heat and erratic rainfall patterns.

**Lack of Market Intelligence:** Farmers plant crops based on previous year prices, leading to market gluts and reduced prices.

#### **Harvest and Post-Harvest Challenges**

**Inefficient Harvesting Methods:** Manual harvesting, evident in crops like mango and chili (Table 4.2.5), leads to lower efficiency and higher labor costs.

**Significant Post-Harvest Losses:** The survey notes a 10-15% loss in crops like cauliflower during harvesting, aggregation, packaging, and transportation (Table 4.2.7), indicating a need for better post-harvest management.

**Inefficient Monitoring and Advisory:** There is a lack of continuous agronomist support for crop monitoring and marketing advice.

**Gender Wage Gap in Labor:** Female laborers are paid significantly less than their male counterparts.

#### **Marketing and Distribution Challenges**

**Price Discrepancies:** There is a significant variation in price from the farmer level to the retail level. For example, the Chausa mango variety is sold at INR 6/kg at the farmer level but reaches up to INR 108/kg at retail (Table 4.2.10).

**Access to Markets:** Small-scale farmers have limited access to broader markets, often resulting in the sale of produce at lower prices locally.

**Dependency on Commission Agents:** Most farmers sell their produce through agents in APMCs, incurring high commission fees.

**High-Interest Rates on Credit:** Farmers rely on commission agents for credit at high-interest rates, highlighting the need for better credit facilities.

**Input Purchase Practices:** Farmers mainly buy inputs from local retailers due to trust and credit issues.

#### (2) Necessary Interventions

#### **Specific Technological Interventions**

For these challenges, the necessary interventions are proposed separately for Specific Technological Interventions, Targeted Infrastructural Improvements and Policy and Regulatory Interventions.

**Introduction of Advanced Agricultural Techniques:** Implementing modern irrigation and high-yield seeds could dramatically increase productivity, as demonstrated in the survey's focus on traditional methods.

**Enhanced Post-Harvest Technology:** Adoption of better storage and handling techniques can significantly reduce the post-harvest losses documented in the survey.

**Climate Resilient Farming:** Educate farmers about climate adaptation and introduce climate-resilient seeds.



### **Targeted Infrastructural Improvements**

**Upgrading Processing Facilities:** Modernizing processing plants to handle products more efficiently and hygienically can improve product quality, aligning with the survey's indication of manual processing dependency.

**Improved Logistics:** Investing in refrigerated transport and efficient logistics can maintain produce quality, addressing the documented losses during shipping.

**Market Intelligence Cell:** Establish a central market intelligence cell for better demand and supply forecasting.

**Strengthened Agronomist Support:** Provide continuous support from agronomists to assist in crop monitoring and marketing.

### **Policy and Regulatory Interventions**

**Supportive Policies for Small Farmers:** Implement policies that provide better access to technology, credit, and markets, addressing the challenges faced by small-scale farmers as highlighted in the survey. Strengthen Farmer Producer Organizations (PGs) for better input access and collective bargaining.

**Standardization and Quality Control:** Enforce quality standards to ensure consistency and safety, a need underscored by the survey's findings on varied product quality.

**Revise Training Content:** Update the training programs to include modern, climate-resilient agricultural practices.

**Gender Wage Parity:** Implement initiatives to promote the reduction of the gender pay gap in agricultural labour.

The challenges identified in this study are supported by the survey findings and highlight the need for interventions, particularly in processing and packhouse. Addressing these issues will lead to significant improvements in the efficiency, profitability and sustainability of the project.

## **4.3 Pilot Project**

### **4.3.1 The purpose of the pilot project**

#### **(1) Introduction**

A purpose of executing pilot project is to obtain suggestions on approaches through participation of private companies for yen-loan project; improving horticulture business impact and added value with digital transformation and private company's services and products.

Pilot projects are conducted collaborated with three companies: Agribazaar, ITE, and EPSON, along with the Producer Group. In these pilot projects, Key Performance Index (KPI) are set and compiled the results. The overview of each company, the summary of their services/products, and the established KPIs are as follows.

#### **(2) Agribazaar**

##### **Company Overview**

Agribazaar (Star Agribazaar Technology Private Limited) is an Indian pioneering digital platform that connects farmers, traders, and stakeholders in the agricultural industry. Leveraging technology, it aims to simplify and enhance the trading experience, ensuring transparency, efficiency, and profitability for all parties involved.

**Table 4.3.1 Company Overview - Agribazaar**

Information	
Webpage	<a href="https://www.agribazaar.com/">https://www.agribazaar.com/</a>
Founded year	2016
Number of Employee	165 (As of May 2023)

Information			
Parent Company	StarAgri Warehousing and Collateral Management Limited <sup>3</sup>		
Address	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">                     Mumbai Headquarter: 801,Sumer Plaza, Marol maroshi road, Marol, Andheri East, Mumbai – 400059                 </td> <td style="width: 50%;">                     Noida Office : 3rd Floor, B-7, Udhyog Marg, Block B, Sec-1, Gautam Buddha Nagar, Noida Uttar Pradesh, 201301                 </td> </tr> </table>	Mumbai Headquarter: 801,Sumer Plaza, Marol maroshi road, Marol, Andheri East, Mumbai – 400059	Noida Office : 3rd Floor, B-7, Udhyog Marg, Block B, Sec-1, Gautam Buddha Nagar, Noida Uttar Pradesh, 201301
Mumbai Headquarter: 801,Sumer Plaza, Marol maroshi road, Marol, Andheri East, Mumbai – 400059	Noida Office : 3rd Floor, B-7, Udhyog Marg, Block B, Sec-1, Gautam Buddha Nagar, Noida Uttar Pradesh, 201301		

## Product Overview

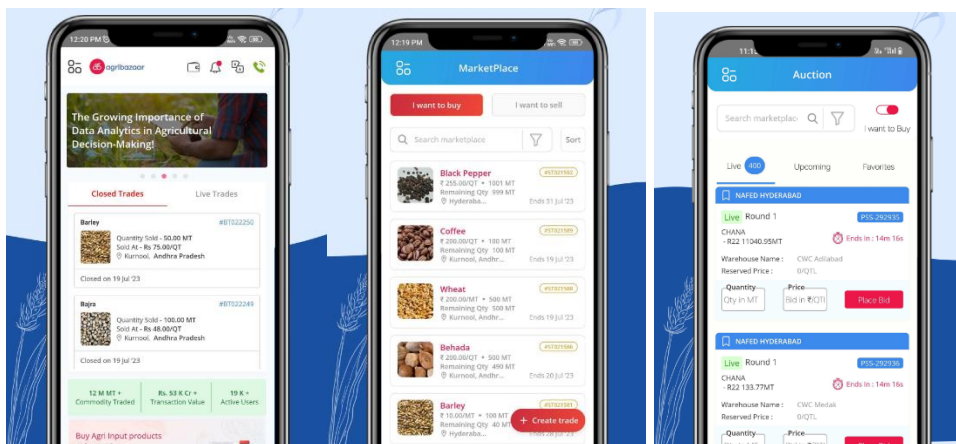
Agribazaar’s “Input & Output marketplace” is demonstrated as the pilot project. Input & Output marketplace serves as a comprehensive digital ecosystem tailored for the agricultural sector, which is a holistic digital solution, aiming to revolutionize traditional agricultural practices. By seamlessly integrating technology, it endeavors to empower farmers, enhance productivity and foster a transparent trading environment for all stakeholders involved.

### Procedure to Use Agribazaar's Input & Output Marketplace:

- i) Registration:
  - Visit the Agribazaar platform.
  - Register as a farmer, trader, or other relevant stakeholder.
  - Provide necessary details like name, contact information, and location.
- ii) Profile Verification:
  - Submit required documents for verification (e.g., land ownership documents for farmers).
  - Wait for the Agribazaar team to verify your profile.
- iii) Browse Listings:
  - Navigate to the marketplace section.
  - Browse available listings for agricultural inputs (e.g., seeds, fertilizers) or outputs (e.g., crops ready for sale).
- iv) Listing Products:
  - If you're selling, create a new listing.
  - Provide details about the product, such as type, quantity, price, and quality specifications.
- v) Engage in Transactions:
  - Buyers can place bids or directly purchase listed products.
  - Sellers can accept offers or negotiate terms.
- vi) Secure Payment System:
  - Use Agribazaar's secure payment gateway for transactions.
  - Ensure both parties honour the agreed terms.
- vii) Logistics Support:
  - Agribazaar may offer support in transportation and storage, depending on the services available at the time.
- viii) issuedback and Ratings:
  - After the transaction, both buyers and sellers can leave feedback and ratings.
  - This helps in building trust and credibility on the platform.
- ix) Continuous Monitoring:
  - Monitor the marketplace for price trends, demand fluctuations, and other relevant insights.
- x) Customer Support:

<sup>3</sup> StarAgri is an India based agricultural marketing company providing warehousing, procurement and Collateral Management of Agri-Commodities.

- Reach out to Agribazaar's customer support for any queries, disputes, or assistance.



Source: Agribazaar

Figure 4.3.1 Input & Output marketplace

### KPIs for Pilot Project

In implementing the pilot project with the Input & Output marketplace, below two KPIs are set.

- Reduction of Commission to Middlemen in Sales Channels.  
**Objective:** This KPI aims to minimize the costs associated with intermediaries in the sales process. By reducing reliance on middlemen, it seeks to enhance profitability for both producers and consumers, ensuring a more direct and cost-effective transaction pathway.
- Exploration of New Sales Channels.  
**Objective:** This KPI focuses on diversifying and expanding the available sales channels. The intent is to reach broader markets, cater to diverse customer segments, and ensure that products find their way to the most lucrative and suitable markets.

### (3) ITE

#### Company Overview

ITE (Innovation Thru Energy Co., Ltd.) stands as a pioneering force in Japanese cold chain logistics, offering the comprehensive solution that operates independently of electricity, gas, or diesel. With a clientele spanning over 200 customers, they cater to diverse sectors ranging from fruits and vegetables to medical, dairy, and other perishable goods. ITE's operational ethos is deeply rooted in the continuous improvement philosophy of 'Kaizen'. While they have an established presence in Japan, ITE is currently venturing into India's agricultural sector, marking a promising expansion of their innovative services.

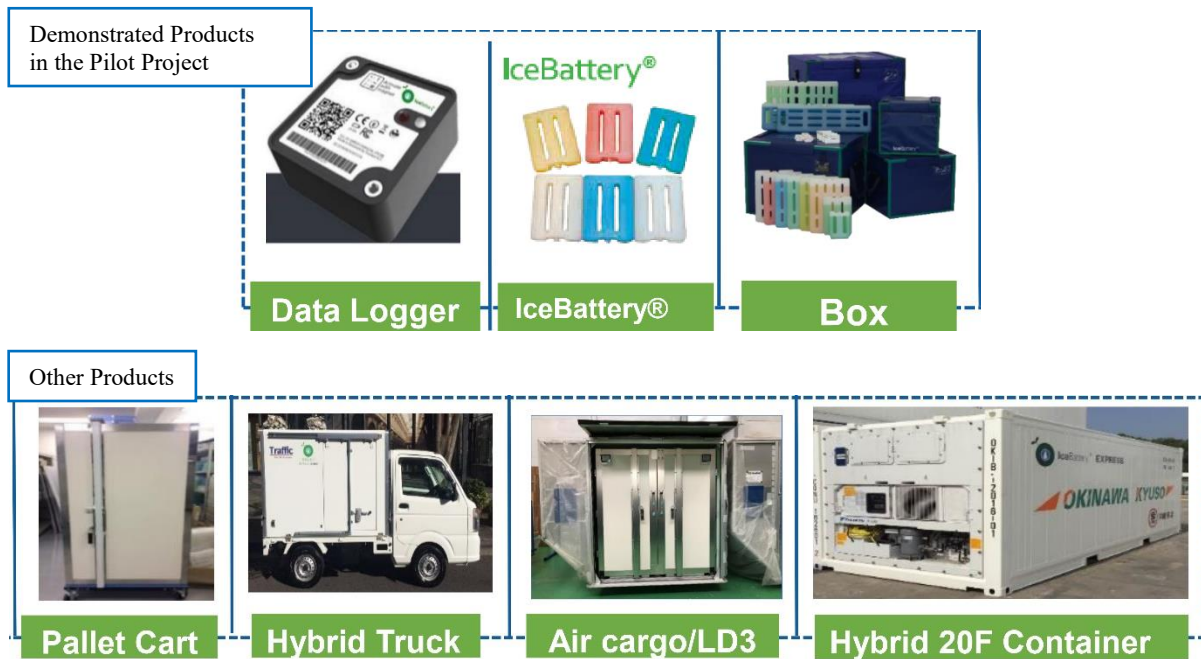
Table 4.3.2 Company Overview - ITE

Information		
Webpage	<a href="https://icebattery.jp/">https://icebattery.jp/</a>	
Founded year	2007	
Address	Tokyo Headquarter: Shin Marunouchi Building 10F Marunouchi 1-5-1 Chiyoda-ku Tokyo Japan	New Delhi Office : 610,6thF DLF Prime Tower,F-79&80, Okhla Industrial Area Phase-1, New Delhi-India

#### Product Overview

In this pilot project, IceBattery, Insulation Box and the Data Logger are used. IceBattery is product brand name, and it is a chemical liquid. IceBattery needs to be frozen 12-14 hours prior to the usage, and it maintains constant temperature for long hours (3-5 days) without active power. This product can be used for both cold storage and cold transportation. Compared to air-conditioned storage or reefer truck, IceBattery can maintain the humidity, which maintain the freshness and shelf life of the crops. In addition, IceBattery does not require active power once it is frozen, which leads energy saving.

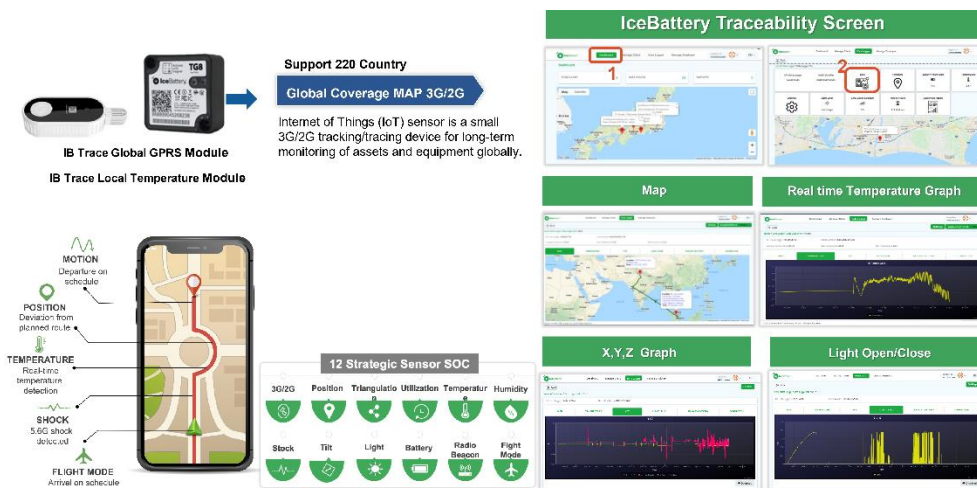
In this pilot project, it is planned to put crops together with IceBattery and Data Logger then deliver to the market / consumers. ITE has other products such as Hybrid Truck or 20 feet Container, but to start from small scale, Insulation Box is utilized under this pilot project.



Source: ITE

Figure 4.3.2 ITE's Products

As Figure 4.3.3 shows, Data Logger can track the location, temperature and humidity when delivering the product. Temperature and humidity inside the insulation box were monitored in the pilot project.



Source: ITE

Figure 4.3.3 Function of Data Logger

### KPIs for Pilot Project

In implementing the pilot project with the IceBattery, below two KPIs are set.

- iii) Retention of Moisture Evaporation when Compared to Ambient Temperature Transportation. **Objective:** This KPI aims to monitor and maintain the amount of moisture retained during transportation, especially when compared to transportation at ambient temperatures. Ensuring minimal moisture loss will help in preserving the quality and freshness of products, leading to better customer satisfaction.
- iv) Difference in Wholesale Price when Compared to Ambient Temperature Transportation.

**Objective:** This KPI aims to assess the price variation, specifically the wholesale price, when products are transported under controlled temperatures as opposed to ambient temperatures. Tracking this difference helps businesses understand the cost implications of different transportation methods and make informed decisions to ensure profitability without compromising product quality.

#### (4) EPSON

##### (a) Company Overview

EPSON (Seiko Epson Corporation) is a Japanese electronics company headquartered in Nagano. Founded in the 1959, it has since become a global leader in the world of imaging and innovation. While it's best known for its wide range of printers, both for personal and industrial use, Epson also produces a variety of other products including scanners, projectors, and wearables. The company prides itself on its commitment to sustainability, innovation, and delivering high-quality products that enhance the capabilities and productivity of its customers across various sectors.

On March 25, 2022, JICA and EPSON entered into a comprehensive partnership agreement aimed at addressing challenges in developing countries and contributing to the achievement of the SDGs. Leveraging JICA's extensive network in developing regions and Epson's expertise in printing and projection technologies, JICA and Epson are collaborating to accelerate the resolution of societal challenges in developing countries.

**Table 4.3.3 Company Overview – EPSON**

Information		
Webpage	<a href="http://www.epson.jp/">http://www.epson.jp/</a>	
Founded year	1959	
Number of Employee	12,918 (2023)	
Address	Nagano (Japan) Headquarter: 3-3-5 Owa, Suwa-shi, Nagano, 392-8502	Delhi Regional Office: M-12-M16A, Mezznine Floor, 89, Hemkunt Chambers, Nehru Place, New Delhi, 110019

##### Product Overview

In the pilot project, EPSON's Portable Projector (Figure 4.3.4) was used. This projector has a light output suitable for outdoor use on battery power and comes equipped with a speaker. With these functions, it can be utilized both outdoors and indoors. Agricultural guidance on topics such as crop selection was organized for the Producer Group, and this projector was employed as teaching material to conduct the training.



Source: EPSON

**Figure 4.3.4 EPSON's Portable Projector**

##### KPIs for Pilot Project

In implementing the pilot project with the projector, below KPI is set.



- i) Potential for Remote Training Using a Projector (Based on Feedback from Participants).  
**Objective:** This KPI is designed to verify whether the current training conducted at the Center of Excellence can be simplified and broadened using video materials. Ensuring the effectiveness of such a method would help in enhancing the overall training experience, leading to improved outcomes.

### 4.3.2 Result of the Pilot Project

#### (1) Agribazaar - Online Market Place

##### Details of the Pilot Project

A transaction was achieved through Agribazaar’s “Input & Output marketplace” as indicated Table 4.3.4.

**Table 4.3.4 Transaction Detail on Input & Output marketplace**

Date	May 8, 2023
District	Panipat
Seller	Baba Samer Dass Farmer Producer Company
Buyer	Middleman in Panipat
Crop	Mask Melon
Transaction amount	1,000kg
Unit Sales Price	INR 25/kg
APMC Mandi wholesale Price at the same time	INR 18-26/kg



Source: Survey Team

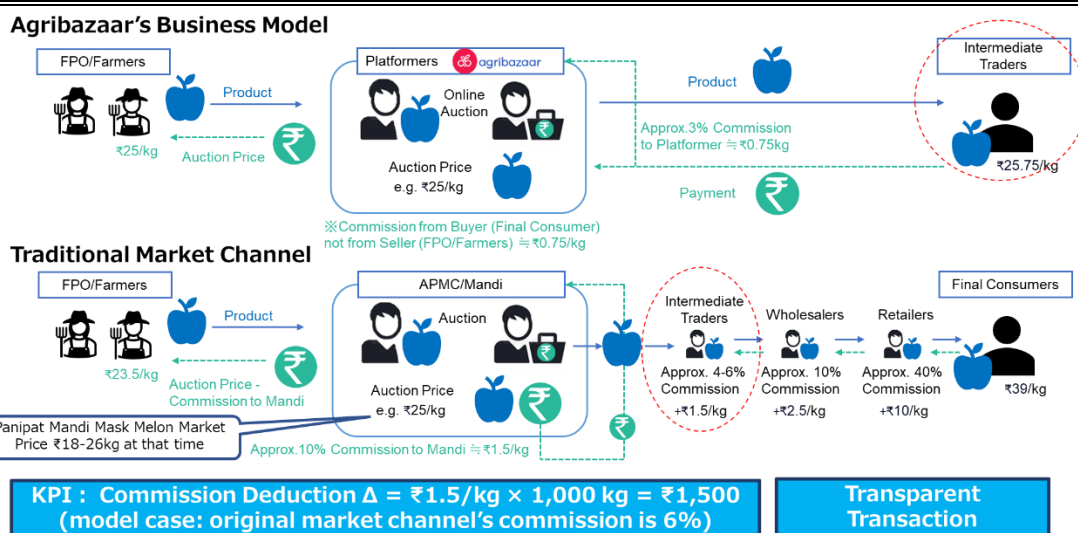
**Figure 4.3.5 Baba Samer Dass Farmer Producer Company (FPC) and their crop**

#### Results of KPIs

As indicating on Figure 4.3.6, Agribazaar does not charge commission to sellers and charge commission to buyers (approximately 3%) and all sales amounts directly go to seller. In this transaction,  $INR\ 25/kg \times 1,000kg = 25,000\ INR$  became seller’s sales. If the seller transacted in Panipat APMC mandi at that time, the wholesale price ranges from INR 18 /kg to 26/kg, so INR 25/kg was relatively high sales price.

In comparison, traditional APMC mandi system, approximately 6% of the commission will be deducted from the sales, so seller gets 23,500 INR. Hence, with using online marketplace, deduction of commission is indicated.

Also, Baba Samer Dass FPC did not have the transaction with this buyer before, thus this online marketplace has a potential to expand new sales channels.



Source: Survey Team

**Figure 4.3.6 Comparison of Commission between Input & Output marketplace and APMC Mandi**

The results of the above pilot project are summarized as the following KPIs outcomes.

- i) Reduction of Commission to Middlemen in Sales Channels.  
Result: It is indicated that approximately 4-6% commission compared to APMC mandi can be reduced by online marketplace.
- ii) Exploration of New Sales Channels.  
Result: It is indicated that there is a possibility to expand sales channel by using online marketplace, because online system can be accessed from many registered buyers. If more buyers are registered, more potential to expand the sales channels for sellers.

## (2) ITE – Cold Transportation

### (a) Details of the Pilot Project

Two transportations of lettuce were arranged with IceBattery as indicated on Table 4.3.5 and Table 4.3.6. The seller, Amar Agro is progressive iceberg lettuce farmers who has dealt with international fast foods restaurants such as McDonald's, Subway, KFC and Burger King. Amar Agro has a partnership with Vista Processed Foods Pvt Ltd who washes, cut and packs the lettuce and deliver to the McDonald's.



Source: Survey Team

**Figure 4.3.7 Amar Agro's Lettuce Farm**



Source: Survey Team

**Figure 4.3.8 Processed Lettuce by Vista**

As the first trial, it is compared between traditional vacuum type air-conditioned refer truck and IceBattery to compare the freshness.

**Table 4.3.5 Cold transportation with IceBattery to Vista Food**

Date	August 26, 2023
Seller /Start Point	Amar Agro / Kullu, Himachal Pradesh
Buyer / End Point	Vista Processed Foods Pvt Ltd / Fatehgarh Sahib District, Punjab
Transportation distance	250km
Transportation duration	10 hours
Amount of Crop	25kg (100L insulation box)
Required temperature	4°C (McDonald's requirement)

As the second trial, it is compared between IceBattery and ambient transportation and deliver to Mandi to compare the price difference.

**Table 4.3.6 Cold transportation with IceBattery to Azadpur Mandi**

Date	August 27, 2023
Seller /Start Point	Amar Agro / Kullu, Himachal Pradesh
Buyer / End Point	Wholesaler at Azadpur Mandi / Azadpur, Delhi
Transportation distance	450km
Transportation duration	15 hours
Amount of Crop	IceBattery: 26.3kg (100L insulation box) Ambient: 9.0kg



Source: Survey Team

**Figure 4.3.9 Setting of IceBattery in Insulation Boxes**



Source: Survey Team

**Figure 4.3.10 Lettuce in Insulation Box**



Source: Survey Team

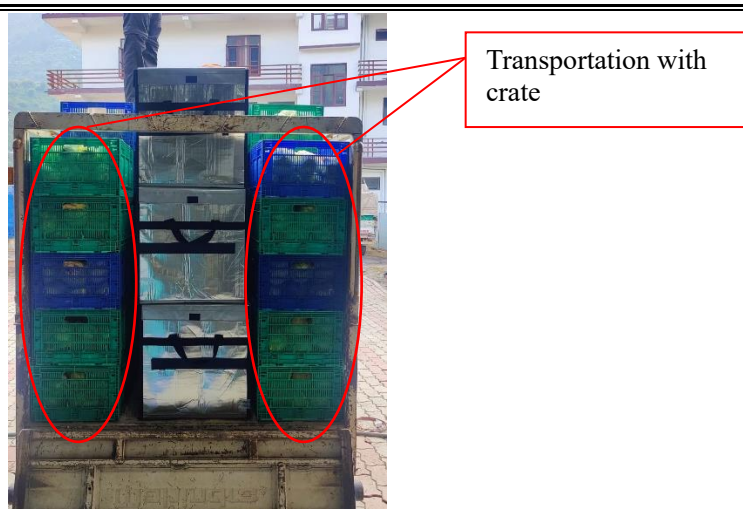
**Figure 4.3.11 Lettuce in a Cardboard Box (Ambient Temperature)**

### Results of KPIs

From the first trial to Vista Processed food, due to limited number of Data Logger, it could not monitor the moisture. However, Vista Processed food mentioned positive feedback as following.

- Freshness of lettuce was maintained very well with icebattery
- Compared to the crate transportation (Figure 4.3.12), insulation box can reduce the shaking damage of the product
- Vista Processed food want to demonstrate more with the insulation box. They have some demands for small quantity transportation, such as one shop of McDonald's or small buyers.





Source: Survey Team

**Figure 4.3.12 Comparison with crate transportation**



Feedback from Vista Processed Foods suggests that the IceBattery not only helps in retaining freshness but also minimizes shaking damage due to the insulation box. Additionally, there's demand for smaller quantities in cold transportation.

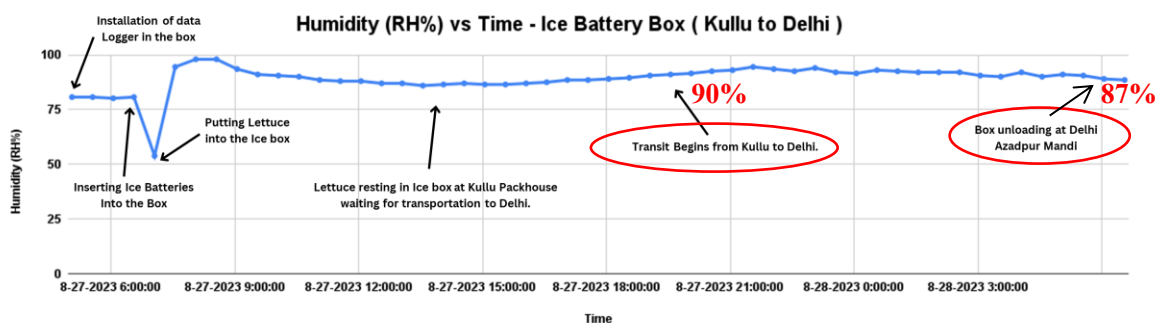
As indicating on Table 4.3.7, Cold transportation using IceBattery starts with a weight of 26.3kg and, by the end, records a slight decrease to 26.2kg. This results in a minimal weight loss of just 0.1kg, equating to a loss ratio of 0.38%. When these products reach Mandi, they command a higher wholesale price of 60 INR/kg, labeled as Grade A quality. Figure 4.3.13 shows the Humidity Changes inside the Insulation box extracted from Data Logger, which started from 90% and ended 87%. This indicates that Insulation Box retains the humidity inside for entire 15 hours transportation. The buyer who deals with high-end consumers such as hotels, restaurants, online retailers satisfied the freshness of the lettuce.

On the other hand, ambient transportation begins with a starting weight of 9.0kg. By its conclusion, there's a more noticeable drop to 8.35kg. This translates to a weight loss of 0.65kg, with a much steeper loss ratio of 7.22%. In Mandi, these goods fetch a lower wholesale price of 50 INR/kg, reflecting their Grade B status.

In summary, the cold transportation with IceBattery not only preserves weight and reduces loss but also ensures a higher market value upon selling.

**Table 4.3.7 Measurement of Moisture Evaporation and Wholesale Price Difference**

Condition	Cold transportation with IceBattery	Ambient transportation
Photo		
Start weight (A)	26.3kg	9.0kg
End weight (B)	26.2kg	8.35kg
Loss weight (C)	0.1kg	0.65kg
Loss ratio (C/A)	0.38%	7.22%
Wholesale price at Mandi	60 INR/kg (Grade A)	50 INR/kg (Grade B)



Source: Survey Team

**Figure 4.3.13 Humidity Changes with IceBattery during the transportation.**

The results of the above pilot project are summarized as the following KPIs outcomes.

- i) Retention of Moisture Evaporation when Compared to Ambient Temperature Transportation.  
Result: IceBattery maintained moisture of crops. In 15 hours, transportation, just 0.38% of moisture evaporation with IceBattery, on the other hand, 7.22% evaporation with ambient condition.
- ii) Difference in Wholesale Price when Compared to Ambient Temperature Transportation.  
Result: IceBattery maintained freshness and increased the sales prices. The difference was 10 INR/kg. This price difference is likely to change due to seasonal variations and fluctuations in supply and demand.

### (3) EPSON - Agriculture Training with Projector

#### (a) Details of the Pilot Project

The training is arranged at Khewra FPC. As the training materials, business plan, grading of crops and good practices of another producer group (Grow Smart FPCL) are shared. After the projecting the training materials, survey team and FPC members discussed the future usage of the projector.



Source: Survey Team

**Figure 4.3.14 Training Material – Business Plan**



Source: Survey Team

**Figure 4.3.15 Training Material – Grading of Crops**



Source: Survey Team

**Figure 4.3.16 Training Material  
– Good Practice of another PG**



Source: Survey Team

**Figure 4.3.17 Discussion**

### Results of KPIs

The following feedback was received from the participants.

- There was a common understanding that there are many situations in the technical training field where visual aids would be useful. The use of video materials increases efficiency and reduces the time required for education.
- With the projector, the frequency of training courses and the number of trainees will increase due to the use of **Video materials** at **PG activity sites**.
- The video materials are easy to understand, so I think knowledge and skills will improve.
- At present, training is mainly provided by contracted companies. However, members can easily receive training on topics of interest to them if PGs organize it at the **PG base** and if video is the way to view it. (I am interested in processing and marketing as training content).
- We also identified a need to create **their own educational video materials as PG** using AI and other technologies.
- Brightness should be improved
- Temperature and dust conditions should be considered on-site
- Battery backup should be improved

The results of the above pilot project are summarized as the following KPI outcomes.

- i) Potential for Remote Training Using a Projector (Based on Feedback from Participants).  
Result: Based on the feedback, there is a clear demand for the use of projectors in technical training sessions. The integration of video materials not only enhances efficiency and comprehension but also opens up opportunities for more tailored and interest-specific training, especially if organized by PG at their site.

### 4.3.3 Private Partnership Seminar

On 1 September 2023 (Friday) 11:00-12:30 IST (14:30-16:00 JST), online and offline hybrid seminar was held. 100 participants from district office of DOH, producer groups are joined online. As offline, at DOH office, DOH management and staff joined. As Table 4.3.8 shows introduction of private companies and results of pilot project are shared.

**Table 4.3.8 Agenda for 4.3.3 Private Partnership Seminar**

Indian Time (IST)	Japanese Time (JST)	Agenda
10:30	14:00	Gathering Start
11:00	14:30	Seminar Start
11:00 - 11:10	14:30 - 14:40	Introduction - About JICA Project and the Purpose of Pilot project
11:10 - 11:20	14:40 - 14:50	Business Introduction - Agribazaar
11:20 - 11:30	14:50 - 15:00	Business Introduction - ITE

11:30 - 11:40	15:00 - 15:10	Business Introduction - SAgri
11:40 - 11:50	15:10 - 15:20	Business Introduction - EPSON
11:50 - 12:00	15:20 - 15:30	Pilot Project - Agribazaar, ITE and EPSON
12:00 - 12:10	15:30 - 15:40	Other PG Needs for Private Enterprise
12:10 - 12:30	15:40 - 16:00	Q&A, Discussion

Unfortunately, no answers are collected for the questionnaire from participants, Director General of DOH gave a positive feedback of the pilot project and DOH will consider to do pilot projects in yen-loan phase as well.

#### **4.3.4 Major Challenges and Necessary Intervention**

Through executing pilot projects, some challenges were found, and the intervention are suggested following.

##### **(1) Agribazaar - Online Market Place**

###### Challenge 1: Resistance to New Technology for Farmers

Many farmers have a conservative approach towards adopting new technologies, often due to unfamiliarity, trust issues, or the habit of sticking to traditional methods.

###### Intervention for Challenge 1: Awareness Event

Implement extensive awareness campaigns, and firsthand demonstrations. Highlight the benefits and ease of using Agribazaar, making it more appealing for farmers to transition from traditional methods.

###### Challenge 2: Limited Transactions in Horticultural Produce

Agribazaar has numerous transactions for grains but lacks significant activity in horticultural crops. As a result, sellers of these crops aren't guaranteed to find buyers.

###### Intervention for Challenge 2: Focused Marketing & Incentives

Roll out marketing campaigns specifically targeting stakeholders in the horticulture sector. Offering incentives or promotional rates for horticultural products can also encourage more traders to participate.

###### Challenge 3: Lack of Awareness of the Service

Many in the agricultural community might not be aware of Agribazaar or its benefits.

###### Intervention for Challenge 3: Grassroots Campaigns & Digital Strategy

Organize grassroots-level workshops and partner with local agricultural bodies to raise awareness. Additionally, employ a robust digital marketing strategy to promote the platform and its advantages.

##### **(2) ITE – Cold Transportation**

###### Challenge 1: Proximity to Major Consumption Area

Haryana state is located close to the major consumption hub of Delhi. Given this proximity, goods can be transported at ambient temperatures and still reach the market in a relatively fresh state, thereby reducing the incentive for cold transportation.

###### Intervention for Challenge 1: Educate on Longer Shelf-Life

Promote the extended shelf-life benefits of cold transportation, which could lead to reduced wastage and potentially higher profits, even if Delhi is nearby. Emphasizing the superior quality of produce that has been cold-transported could appeal to discerning consumers and create a market differentiation.

###### Challenge 2: Cold Transportation Cost vs. Wholesale Price

The added expense of cold transportation is a deterrent, especially when juxtaposed against the low wholesale prices the produce fetches.

###### Intervention for Challenge 2: Subsidies or Financial Incentives

Offering financial incentives, subsidies, or discounted rates for early adopters of cold transportation might encourage more farmers and suppliers to use the service, at least until they see its benefits firsthand.

Intervention (General): Contract Farming with High-End Users with online marketplace

Engage in contract farming with high-end users who are more likely to appreciate and pay a premium for the freshness and extended shelf life that cold transportation offers. Also, partnerships with Agri-tech Platforms, farmer can connect directly to consumers. These platforms can promote the benefits of cold-transported goods, creating a premium category for consumers who are willing to pay extra for freshness and quality.

**(3) EPSON - Agriculture Training with Projector**

Challenge 1: Assurance of Educational Content Quality

There might be concerns about the quality, relevance, and accuracy of the educational content being presented using the projector.

Intervention for Challenge 1: Collaboration with Agricultural Experts (Center of Excellence)

Partner with agricultural universities, experts, and researchers to curate and vet the content. Ensure that the material is up-to-date, scientifically accurate, and beneficial for the target audience.

Challenge 2: Differentiation from Video Streaming and Other Media

With the proliferation of digital media, video streaming, and online tutorials, there might be questions about the unique advantages of using a projector for agricultural training.

Intervention for Challenge 2: Interactive Learning & Community Building

Highlight the communal and interactive aspects of learning with a projector. Emphasize the advantages of group discussions, real-time Q&A sessions, and community building that such sessions can foster, which can't be replicated by solitary video streaming.

## Chapter 5 Lesson Learnt from Similar Project

### 5.1 Lessons Learnt from The Small Farmers Agri-Business Consortium (SFAC)

#### 5.1.1 Introduction

The Small Farmers Agri-Business Consortium (SFAC) is a Government of India initiative established to support small and marginal farmers by promoting agribusiness ventures. SFAC works with the state governments, farmer organizations, and private sector entities to create market linkages for farmers and encourage entrepreneurship in the agriculture sector.

#### 5.1.2 Background

“Small Farmers Agri-Business Consortium Haryana” (SFACH) was registered under Society Registration Act- 1860 on 17.07.2008 and its registration has been got revised on 10.11.2016, as per provision under section 9(4) of the Haryana Registration and Regulation of Societies Act, 2012.

#### 5.1.3 SFACH at Glance

SFACH is a Society focused on increasing the incomes of small and marginal farmers through aggregation and development of agri-business. SFACH has pioneered the formation and growth of Farmers’ Producers Organizations and progressing towards establishing an eco-system for PGs to make them sustainable and viable in the long run. It has been taking steps for Agro/ Food Processing, marketing, and distribution sector. SFACH supports to forms of Farmers’ groups and properly looking after their management is one of the best practices which provide various inputs of training and capacity building and linking these bodies to input suppliers, technology providers and market players.

##### i) Members of SFACH

SFACH is the incorporated society involving Horticulture Department & allied departments namely: -Department of Agriculture Haryana, Panchkula Department of Animal Husbandry & Dairy Development Haryana, Panchkula Fishery Department Haryana, Panchkula HAFED<sup>1</sup>, Haryana, Panchkula, NABARD HSAMB, Mandi Bhawan, Panchkula

##### ii) General Body

The designation address, and occupations of the members of the General Body to whom the management of the Society is entrusted as required under section 29(1) of the Haryana Registration & Regulation of Societies Act, 2012 as applicable to the Haryana State, are as follows:

**Table 5.1.1 The body of SFACH**

Sr. No.	Name	Address	Status
1.	Additional Chief Secretary / Principal Secretary, Agriculture	Room No.406, 4th Floor New Civil Secretariat, Sector-17, Chandigarh	Ex-Officio, President
2.	CA, HSAMB	Mandi Bhawan, Sector-6, Panchkula	Ex-Officio Member
3.	Managing Director (MD), HAFED	HAFED, Sector-5, Panchkula	Ex-Officio Member
4.	Director General Agriculture/ Director Agriculture	Krishi Bhawan, Sector-21, Panchkula	Ex-Officio Member
5.	MD, Dairy Dev. Coop. Fed. Ltd.	Bays No. 21-22, Sector-2, SahkaritaBhawan,Panchkula	Ex-Officio Member
6.	MD, HAIC	Bays No.15-20, Sector-4, Panchkula	Ex-Officio Member
7.	DG Animal Husbandry & Dairy Development	PashudhanBhawan, Bays 9-12, Sector-2, Panchkula	Ex-Officio Member

<sup>1</sup> HAFED is the largest apex cooperative federation of Haryana State in India. It came into existence on November 1st, 1966 with the formation of Haryana as a separate State. Since then, it is playing a leading role in serving the farmers of the State as well as customers in India and overseas by providing hygienic and safe quality consumer products (<http://hafed.gov.in/about-us>).



Sr. No.	Name	Address	Status
8.	Director General Horticulture/Director Horticulture	Udhyan Bhawan, Sector-21,Panchkula	Ex-Officio Member & MD SFACH & Member Secretary
9.	Director Fisheries	SCO No.6/16, Panchkula	Ex-Officio Member
<b>Representative of Financial Institutions and Banks</b>			
1.	Registrar Cooperative Society	Sahkartia Bhawan Sector-2, Panchkula	Nominated Member
2.	MD, HSCARD Bank Ltd	HSCARD, Sector -2, Panchkula	Nominated Member
3.	CGM, NABARD	NABARD Building, Sec -34 Chandigarh	Nominated Member
4.	General Manager	PNB Zonal Office, Sec -17 B, Chandigarh	Nominated Member
5.	Regional Director NCDC	SCO No,82-83, Sec -17 C, Chandigarh	Nominated Member
<b>NGO's and Farmers Producer Organisation</b>			
1.	Kanwal Singh Chauhan, President	Sonipat Mushroom FPO Ltd	Nominated Member
2.	Randhir Singh, President	Pehowa Veg. FPO Ltd	Nominated Member
3.	Jagmohan Singh, President	Optimal Agro FPO Ltd	Nominated Member
4.	Inderjeet Singh, President	Assured Agri Income Producer Co. Ltd.	Nominated Member

Source: Department of Horticulture.

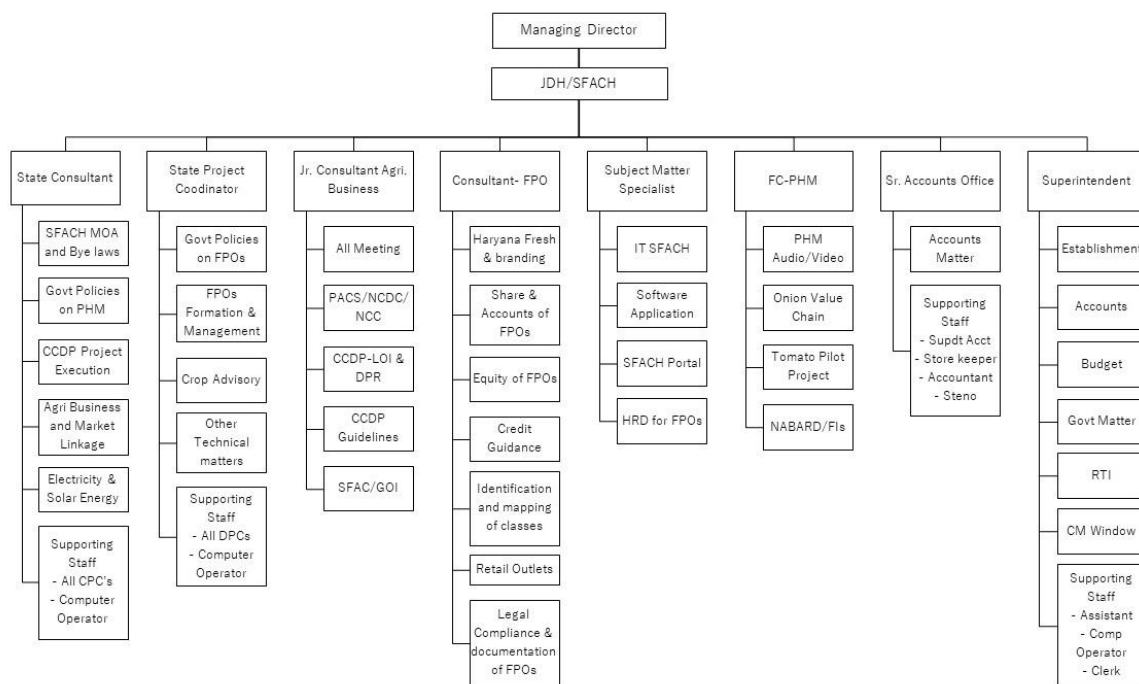
### iii) Executive Body

The designation address, and occupations of the members of the Executive Committee to whom the operation of the Society is entrusted as required under Section 33 (1) of the Haryana Registration & Regulation of Societies Act, 2012 as applicable to the Haryana State, are as follows:

**Table 5.1.2 The budget allocation and the amount utilized under the Mera Pani Meri Virasat Scheme for the year 2019-20 to 2021-22**

Sr. No.	Name	Address	Designation in the Society
1.	Director General Horticulture/ Director Horticulture	Department of Horticulture, Udhyan Bhawan, Sector-21, Panchkula	Ex officio Chairperson & MD, SFACH
2.	General Manager, Agri Business/ Representative of CA, HSAMB	HSAMB, Mandi Bhawan, Sector-6, Panchkula	Ex-Officio Member
3.	Additional Director nominated by DG, Agriculture	Department of Agriculture, Krishi Bhawan, Sector-21, Panchkula	Ex-Officio Member
4.	Additional Director nominated by DG Animal Husbandry and Dairy	Department of Animal Husbandry and Dairy Development, Pashudhan Bhawan, Bays No. 9-12, Sector-2, Panchkula	Ex-Officio Member
5.	Joint Director nominated by Director Fisheries	Fishery Department, SCO No.6/16, Panchkula	Ex-Officio Member
6.	GM, NABARD nominated by CGM, NABARD	NABARD Building, Sec-34, Chandigarh	Nominated Member
7.	General Manager nominated by CGM, PNB	PNB Zonal Office, Sector-17 B, Chandigarh	Nominated Member
8.	Sh. Sulender Pal, President	M/s Radour Farmers FPO	Nominated Member
9.	Sh. Inderjeet Singh, President/ Member	M/s Safe Agro Producer Company Ltd	Nominated Member
10.	Joint Director Horticulture	Udhyan Bhawan, Sector-21, Panchkula	Ex-Officio-Member-cum-Member Secretary

Source: Department of Horticulture



Source: SFACH

**Figure 5.1.1 SFACH Activities Hierarchy and Work Allotment Chart**

iv) PG Promotion Activities

- To assist the identified PGs in meeting compliance requirements as per CCDP scheme guidelines for the Creation of Backward and Forward Linkages and also assist in preparing required documents including DPR as per scheme guidelines.
- Guidance to FPCs in obtaining Term Loan from the Bank/FIs as well as various permissions, NOCs and licenses from various statutory authorities of Central/State Departments.
- Guidance to PGs/FPCs in outreaching potential markets through meeting with buyers.
- To provide manpower support for technical and marketing support to PGs after the establishment of the integrated packhouse and provide assistance to PGs under the cluster extension programme.
- Coordination with banks/financial institutions to enable the PG in preparing detailed bankable project reports including a business plan for the proposed supply chain infrastructure/ processing facility.
- Coordination with SFAC, New Delhi for availing the assistance of schemes like equity grants, credit guarantee schemes and venture capital assistance.

v) Strengthening of Backward & Forward Linkages

**Backward Linkages:**

- Identification of potential crop clusters and Bhagwani village.
- To provide crop advisories to the cluster farmers.
- To create post-harvest management infrastructures in the vicinity of crop clusters to ease the aggregation of horticulture produce for better marketing interventions.
- Identification, mobilization, and sensitization of farmer groups for participation in Backward and Forward Linkages in the process,
- Formation of PGs under the banner of Small Farmers' Agribusiness Consortium Haryana (SFACH)
- Registration of various PG like Horticulture, Agriculture, Animal Husbandry and Fisheries under the Producer Companies Act-2013.
- Coordination with State Government Departments/ Organizations, Indian Council of Agricultural Research (ICAR)/ organizations, State Agricultural Universities (SAUs),



private sector to introduce innovative technologies to PGs etc.

- Programme for replacement of plastic sheets of poly house with 70% assistance.

#### **Forward Linkages**

- Providing subsidy/assistance (70-90%) to PG for create of logistics farm to market i.e. creation of Post-Harvest Management infrastructure/centre with facilities like aggregation centre, sorting/washing/grading, cold storages, ripening chamber, modified atmospheric chambers, reefer vans, waste management along with the facilities like solar power, water, sanitation maintaining food safety and hygiene standards, catering the needs of end users like Retailers, Processors, Exporters and public in large
- Preparing a cluster-wise business plan for the PGs, which would include a plan to provide business opportunities, connecting PGs with off-season markets, institutional buyers, processing industries and export markets/APEDA.
- Launched “Haryana Fresh” to facilitate PGs under a Haryana govt. trademark.
- Organizing capacity-building workshops, and training for the Board of Directors (BoDs) and other key members of the PG on entrepreneurship, business planning and management related to aggregation/sale of horticulture Produce.

#### **5.1.4 Extracted Lessons**

SFACH played an important role in establishing and promoting FPOs, acting as a collective platform for farmers, enabling them to raise funds for joint purchases and transport, and increasing their bargaining power. However, according to interviews with the DOH, the process of setting up FPOs had the following problems.

- The extension officers in each municipality encourage farmers to organize their PGs. However, awareness of organizing is low in India, and some people prefer to do things their own way. To address this issue, it is important to show that organized farm management is more profitable and to provide examples of successful farmers. As examples of successful organizing appear, some farmers will be inspired by them and become interested in organizing.
- As for the number of PGs, once project goals are set, activities can be carried out accordingly. Currently, the goal is to form 50-80 PGs per year, with no target set for each District. At each stage of the application process, the maximum number of days for processing is not specified. This makes the process time-consuming. The time from application to formation is at least 2 months. This is due to the high number of incomplete applications, and the most time is spent correcting the documents. Measures could be taken to address this problem, such as simplifying the paperwork process and establishing a window for assistance with the paperwork process.

### **5.2 Lesson Learnt from The Crop Cluster Development Programme (CCDP)**

#### **5.2.1 Introduction**

The Crop Cluster Development Programme (CCDP) is an initiative launched by the Government of Haryana in collaboration with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The aim of the programme is to promote sustainable agriculture and enhance the income of small and marginal farmers by promoting crop diversification, value addition, and market linkages.

Under the CCDP, specific crop clusters are identified in different regions of Haryana, based on their agro-climatic conditions and the cropping pattern prevalent in the area. The focus is on promoting crops that have higher market value, such as fruits, vegetables, and high-value crops like mushrooms, beekeeping, and spices. The programme provides technical assistance and training to farmers to adopt improved cultivation practices, post-harvest management, and value addition techniques to increase productivity and quality.

The CCDP also facilitates market linkages for the farmers, by connecting them with buyers, processors, and exporters. This helps the farmers to get better prices for their produce and reduce their dependence in traditional markets. The programme also provides financial assistance to farmers for establishing small agro-processing units, setting up cold storage facilities, and purchasing equipment for value addition.

Overall, the CCDP is playing a crucial role in promoting sustainable agriculture and enhancing the income of small and marginal farmers in Haryana. By promoting crop diversification, value addition, and market linkages, the programme is contributing to the economic development of the state and improving the livelihoods of farmers.

Under the CCDP scheme, the government provides financial assistance and technical support to farmers to encourage them to diversify their crops. The scheme was launched in the year 2017-18, and since then, it has been implemented across various districts of Haryana.

The key objective of the CCDP scheme is to increase the productivity of land by promoting crop diversification, reducing the water consumption by the farmers, and promoting sustainable agriculture. The scheme also aims to increase the income of farmers by promoting crops that have a higher market value.

Some of the major crops that are being promoted under the CCDP scheme in Haryana include maize, pulses, oilseeds, fruits, and vegetables. The scheme was expected to benefit a large number of farmers in the state and help in achieving the government's goal of doubling farmers' income by 2022.

### **5.2.2 Background**

Haryana is continuously setting new directions in the agriculture and horticulture sector. The state government is making efforts towards increasing the profit and income of the farmers through diversification.

Haryana, the second largest contributor of food grains to the national pool, has taken many policy initiatives for diversification towards horticulture and promotion of agri-business. Haryana has mapped around 400 horticulture crop clusters and formed 700 Farmer Producer Organizations.

To strengthen the backward and forward linkages in the clusters, the State has launched an ambitious Scheme – “Crop Cluster Development Program (CCDP)” with an outlay of Rs. 510.35 crore for establishing on-farm Integrated Packhouses through PGs.

Furthermore, horticulture plays a vital role in Haryana's economy by driving its continued diversification and contributing to rural prosperity while also conserving precious natural resources like groundwater. To effectively build and develop this sector, a comprehensive systems approach is required, encompassing the entire value chains involved. Every link in the chain is important and interconnected. One key link is the establishment of profitable market demand. Without access to such a market, farmers lack the incentive to invest in their farms. Similarly, processors require a reliable, affordable, and local supply of quality raw materials to expand their operations and view local farmers as long-term partners. Access to experienced extension services and market information is crucial for farmers to take advantage of market opportunities. Without such support, they may miss out on valuable prospects. Moreover, reliable sources of quality inputs are essential for farmers to efficiently produce the required quantities and meet market demand. To address these challenges, the Crop Cluster Development Programme (CCDP) was launched, specifically focusing on backward and forward integration in horticulture farming in Bhagwani Villages. The program aims to enhance the socio-economic security of farmers, achieve nutritional security, establish transparent institutional delivery mechanisms, generate rural employment, increase horticultural crop area and productivity, and develop organized marketing of horticultural products. One of the program's key strategies is to promote the collectivization of produce through farmer groups, enabling small farmers to overcome obstacles in selling to modern markets like supermarkets and large retailers. Additionally, the CCDP educates farmers about modern technologies to help them adapt to market requirements. The CCDP recognizes the importance of a coordinated supply chain, which includes aggregating produce, establishing market linkages, ensuring access to quality inputs and agro-services, and developing post-harvest management infrastructure. By facilitating access to fair and remunerative markets and encouraging adherence to global standards, the program aims to achieve the goals of ensuring quality, meeting quantity demands, and achieving seamless product delivery.

Overall, the Crop Cluster Development Programme (CCDP) in Bhagwani Villages is a comprehensive scheme that acknowledges the significance of horticulture in the state's economy. It addresses the challenges faced by small farmers in accessing markets, inputs, and knowledge, and seeks to foster

sustainable development and growth in the horticulture sector while ensuring the well-being of farmers and promoting the marketing of high-quality horticultural products.

### **5.2.3 CCDP at Glance**

So far, 33 integrated packhouses have been established and 35 are under progress. By the end of the current financial year, a total of 100 such integrated packhouses are targeted to be established.

Further, to ensure end to the end value chain for farmers and farm produce, a total of 37 Agri Sector Companies have executed 54 MoU with 34 PGs for trading and marketing of PGs produce with a buy-back mechanism to boost agri-business activities. In a short span of 10 months trading of 13400 MT horticulture commodities valued at more than Rs. 14 crores have been materialized and are expected to rise to over Rs. 200 crores.

The CCDP was launched to resolve several issues including aggregation of produce: Cluster formation, farmers groups and Market linkages like Packhouses, Collection centers, Grading – packing and standards. Besides this, it also aims to resolve sanitary and phytosanitary measures including issues of pesticide residues, and microbiological contamination including pests, diseases, aflatoxins, and heavy metals.

Market access issues like legitimate barriers to trade: Domestic and export including national and international standards like IPPC and Codex and GAP protocols, Organic farming, and quality test labs.

Haryana intends to achieve complete modernization of the horticulture supply chain in the State from end-to-end approach connecting Farmers with the market & consumers. There is a huge impact of this project. Under Har Khet-Swasth Khet Abhiyan, about 75 lakh soil samples will be collected and tested in 3-4 years and Soil Health Cards (SHC) for every acre will be distributed to farmers.

To increase the people participation and awareness about soil testing, the work for collection of soil samples and distribution of Soil Health Cards is being performed through engagement of ‘Kisan Sahayaks’ (local villagers) and ‘Science Students’ of Government Colleges, Government Senior Secondary Schools under ‘Earn While-You Learn’ programme. An incentive of Rs. 40 per soil sample is also being provided to Kisan Sahayaks and Science Students. They were trained by the Department for soil sample collection. With this strategy, the state has collected 30 lakh soil samples in the year 2022-23 which is eight times faster as compared to previous years (2015-2020).

CCDP has only built 34 packhouses in the five years since 2018, as shown in Table 3.3.16.

The following reasons may explain why the construction and operation of the packhouses has not progressed as planned.

i) Lack of funds on the part of the PG:

The fact that the CCDP only covers PG could be problematic in this regard. This may be due to the fact that it does not cover the private sector or large farmers.

ii) Delays in administrative procedures:

Prior to the construction of a packhouse, the business model of the PG is reviewed by several government agencies. This review is complex and time-consuming, resulting in delays. Bidding for construction also takes time, which is difficult to shorten since this is done according to procedures set by the government.

iii) Land acquisition:

As a result of the hearing, the acquisition of land for the packhouse is not required, and common land or Voluntary Donation of Land by PG members will be utilized.

iv) Smooth operation of packhouses contracted with the food industry:

Packhouses contracted with private off-takers in the food industry are operating effectively. At the same time, however, some PGs are underutilizing PG’s packhouses and not maximizing PG’s benefits, resulting in non-utilization. It is possible that the lack of success has not necessarily led to PGs being more proactive in their CCDPs. Efforts to connect with the forward market need to be strengthened in order to achieve higher utilization rates.

v) As for the operation of packhouses, each crop has a limited harvest season, so careful planning

is required to ensure effective operation throughout the year. This is a key challenge.

#### **5.2.4 Extracted Lessons**

To inform future efforts, the following cross-cutting lessons learned from the project, and these include:

##### **(1) Expert support for cultivation and packhouse operations:**

There is a need for the provision of agricultural technology, assistance in accessing markets, access to quality seeds, fertilizers and other agricultural inputs, and the provision of professional support, such as advice on farm management and financial planning. This support contributes to the overall success and growth of the agricultural value chain.

##### **(2) Rational Decision-Making by Farmers for Technology Adoption:**

Farmers are rational decision-makers who carefully evaluate the risks and benefits associated with adopting new technologies. They consider factors such as the suitability of the technology for their specific context, its affordability, and manageability. Providing evidence-based information and demonstrating the positive impact of technology adoption can encourage farmers to embrace new practices.

##### **(3) Utilizing Training Platforms for Multiple Purposes:**

The main harvesting season is a few months a year and packhouses are not used during the rest of the year. Also, at present, packhouses are not used as training grounds for PG members. Each farmer goes to his/her own training institute for training. Packhouses can be used as training platforms. Training platforms not only impart agricultural knowledge, but also serve as a valuable resource for farmers. Training platforms can disseminate information on relevant topics such as nutrition education and disease prevention. In addition, organizing agricultural fairs through these platforms allows farmers to explore innovative technologies and connect with stakeholders, fostering cooperation and partnerships.

##### **(4) Cultural and Regional Considerations for Gender Inclusivity:**

At present, few women participate in the running of packhouses. Gender inclusivity efforts in agriculture and market systems must take into account the diverse social, cultural, and regional contexts in which women operate. Adapting interventions to respect cultural norms and addressing region-specific challenges can enhance the effectiveness and sustainability of gender inclusion initiatives. Active engagement of women, capacity-building, and tailored support are essential for empowering women in the agricultural sector.

##### **(5) Financial Institutions for Agricultural Financial Inclusion:**

To address the unique financial needs of farmers, non-banking financial institutions (NBFIs) play a crucial role. They offer customized financial products that align with the seasonal nature of agricultural activities, cash flow fluctuations, and risks associated with farming. NBFIs provide risk management solutions, extend accessibility through innovative delivery channels, and contribute to financial literacy and capacity-building for farmers. A network of PGs with these financial institutions needs to be established.

##### **(6) Continuous information exchange with counterparts:**

Currently, there is no information exchange between PGs and their counterparts after the handover of packhouses. Through continuous exchange of information with partners, the solution is to revitalize the sector through long-term coherence and strategic partnerships' and 'strengthen forward market linkages for the use of packhouses'. This intervention approach allows for deeper collaboration between key stakeholders, real-time feedback and adaptive interventions. It also promotes the expansion and sustainability of the agricultural value chain through the efficient use of packhouses and responsiveness to market needs.

##### **(7) Post handover monitoring system for packhouses:**

There is currently no specific monitoring by the DOH after the packhouses have been constructed and handed over to the PG. There is a need for a regular monitoring system to ensure that operations are

carried out properly. Furthermore, Continue to build long-term cooperative relationships with counterparts and exchange information on a sustained basis to achieve sustained results.

## Chapter 6 Outline of the Proposed Project Scope

### 6.1 General

In this chapter, the entire frame of the Project will be evaluated based on the analysis of existing secondary data, sample survey results, and Preliminary Project Report (PPR) review results, and the points to be noted for preparation of the Draft Final Report (DFR) will be clarified. In addition, the basic concept and outline of the four components will be organized. However, the final project scope, implementation plan, and cost will be decided through the discussion between JICA and DOH, Haryana.

### 6.2 Overall Project Frame

#### 6.2.1 Executing Agency

Department of Horticulture (DOH), Haryana State Government.

#### 6.2.2 Location of the Project

The target area of the Project is all districts in Haryana.

#### 6.2.3 Project Objective

The objective of the Project is to promote sustainable horticulture and improve farmer's income by promoting the production and marketing of horticulture crops through the support of crop diversification and infrastructure development as well as capacity development for strengthening value chain, thereby contributing to economic and social development in Haryana state.

#### 6.2.4 Scope of Works

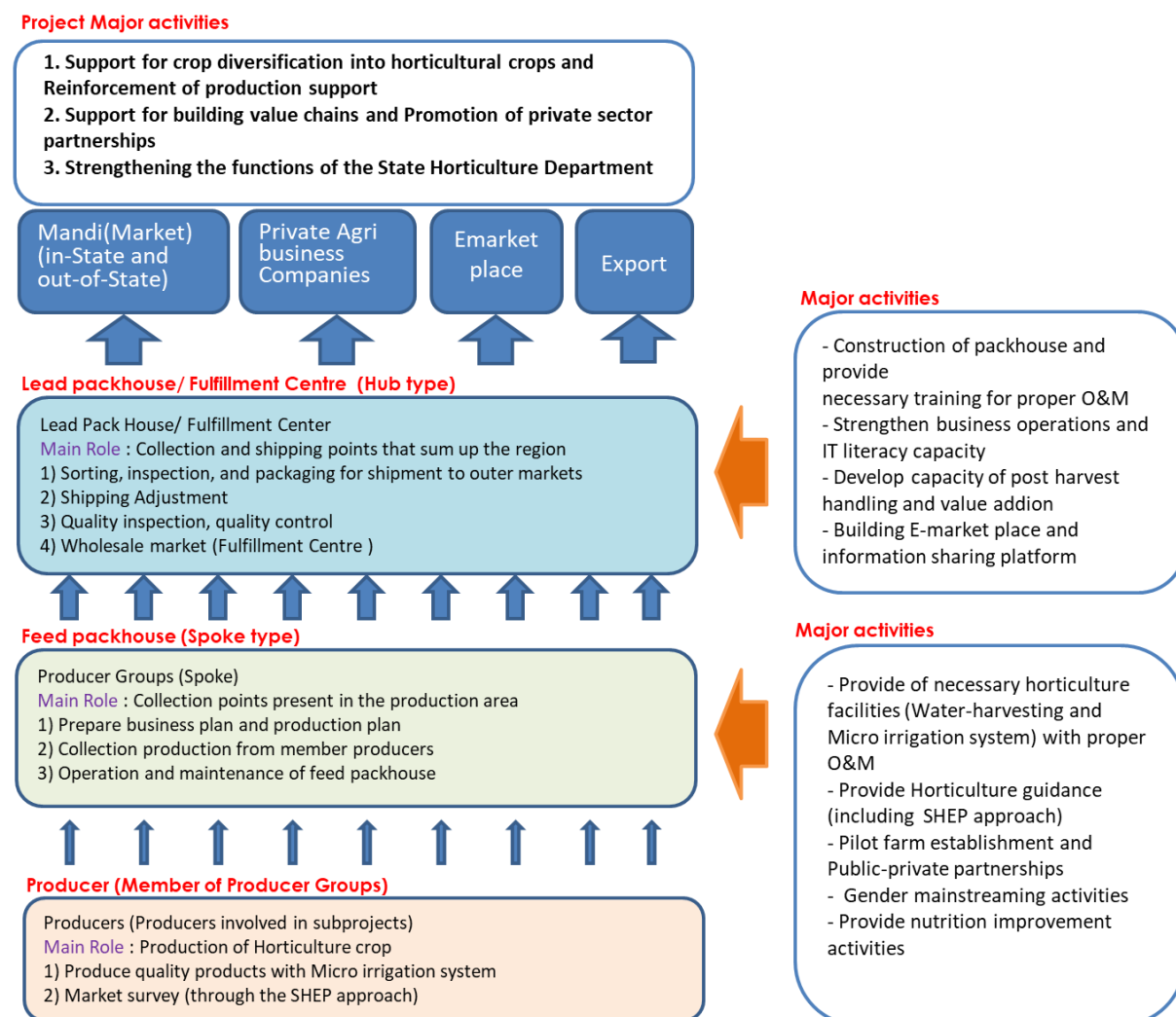
The project component is broadly divided into i) Support for crop diversification into horticultural crops and Reinforcement of production support, ii) Support for building value chains and Promotion of private sector partnerships, and iii) Strengthening the functions of the State Horticulture Department. Under the project components, the scope of works is arranged as shown in Table 6.2.1 below.

**Table 6.2.1 Scope of Works**

Component 1	Support for crop diversification into horticultural crops and Reinforcement of production support
1.1	Formation and strengthening of PGs
1.2	Water-harvesting and Micro irrigation system
1.3	Horticulture guidance
1.4	Pilot farm establishment and Public-private partnerships
Component 2	Support for building value chains and Promotion of private sector partnerships
2.1	Infrastructure development for building value chains
2.2	Building an E-market Place and an information-sharing platform
2.3	Branding
Component 3	Strengthening the functions of the State Horticulture Department
3.1	Installation of PMU and DPMU
3.2	Strengthening the capacity of DOH
3.3	Strengthening the capacity of horticulture extension services
3.4	Baseline Studies and Impact Assessment

Source: JICA Survey Team

The main activities included in the Project are organized as shown in the figure below.



Source: JICA Survey Team

**Figure 6.2.1 Summary of Project Approach**

### 6.2.5 General Approach to the Project

The hub-spoke model proposed here consists of a central collection point (hub) and collection points (spokes) that deliver agricultural products to the hub. In this model, produce collected at the spokes is collected at the hub, stored and processed, and then efficiently delivered to the consumption area. This provides logistical efficiencies, cost savings and quality control, and gives smallholder farmers access to larger markets.

There are four approaches to project implementation.

#### **Project Approach 1: Crop Diversification for Sustainable horticulture and Raising the Farmers' Income**

The Project supports crop diversification to achieve the Project's goal of promoting sustainable agriculture in mitigating excess use of underground water and increasing farmers' incomes. Farmers are empowered with marketing and cultivation skills and encouraged to divert their cultivation from cereal crops to horticulture crops such as vegetable and fruits for better profit by promoting off-season cultivation, introducing high-value crops, and changing post-harvest handling and marketing.

#### **Strategic Crop**

The Project identifies fifteen strategic crops. Strategic crops are defined as crops that can be cultivated in agroecological conditions, and farmers can easily find their markets for selling. The list of strategic

crops is as under. Target crops were selected from the following perspectives. The Project will support these 15 crops as anchor crops and the cultivation of other crops.

- It should be selected during the target crops for cluster development, a policy of DOH (a certain number of PGs and farmers deal with the target crop).
- It should potentially increase productivity and production through technology transfer and equipment introduction.
- Crops with reliably high production are appropriate for constructing packhouses (which are more likely to lead to economic benefits).
- Highly cost-effective in terms of value-added improvement and cost reduction

**Table 6.2.2 Strategic Crop**

	Strategic Crop	Name of crop	Cluster	Productivity and output improvement potential	Production	Cost-effectiveness
1	✓	Potato	✓	✓	✓	✓
2	✓	Tomato	✓	✓	✓	✓
3	✓	Onion	✓	✓	✓	✓
4		Cauliflower	✓		✓	✓
5		Radish	✓		✓	✓
6		Leafy vegetables	✓		✓	
7	✓	Kinnow	✓	✓	✓	✓
8	✓	Carrot	✓	✓	✓	
9		Cabbage	✓		✓	
10		Brinjal	✓		✓	
11	✓	Guava	✓	✓	✓	✓
12	✓	Peas	✓	✓	✓	✓
13		Chilies	✓		✓	✓
14		Mango	✓		✓	✓
15		Watermelon	✓		✓	✓
16	✓	Garlic	✓	✓	✓	
17		Musk melon	✓		✓	
18	✓	Capsicum	✓	✓	✓	✓
19	✓	Ginger		✓✓		✓
20	✓	Peach		✓✓		
21	✓	Strawberry	✓	✓		✓
22		Litchi	✓			✓
23		Aonla	✓			✓
24		Cucurbits	✓			
25	✓	Okra	✓	✓		✓
26		Flower	✓			✓
27		Lemon	✓			✓
28		Sapota	✓			
29		Baby corn	✓			✓
30		Sweet corn	✓			✓
31		Exotic vegetables	✓			✓
32		Ziziphus mauritiana	✓			✓
33	✓	Honey		✓✓		✓
34	✓	Mushroom		✓✓		✓

Source: JICA Survey Team

### **Project Approach 2: Empowerment of Producers Group for enhancing the capacity of Production and Marketing**

To strengthen farmers' production capacity through crop diversification and obtain immense bargaining power for marketing, the Project will support farmers by forming and strengthening 500 eligible Producer Groups (PGs). Terms of PGs have been used as farmers' groups as business entities in several schemes and projects in India. There has been an image that PGs have many shareholders, which is also



set as a condition of receiving support from current methods. Since the Project will not target large-scale farmers' groups (e.g., PGs formed by SFAC/SFACH, etc.) but also small-scale ones (e.g., PGs created with self-promoted, SHGs, etc.), terms of PGs were agreed to be used for target farmers' groups instead of PGs in the Project. The PGs is categorized in 5 categories as per the following table;

**Table 6.2.3 Breakdown of Packhouse (category-wised)**

Categories	Estimated Proposed Unit	PG member	Function
Category-1	275	Up to 20	Aggregation
Category-2	50	Minimum 20	Aggregation and sorting/Grading
Category-3	100	Minimum 50	S&G and Packing and either selling direct to market or send it to Lead Packhouse
Category-4	50	Minimum 75	Same as above but bigger volume
Category-5	25	Minimum 125	Long term storage and Arbitrage marketing (mostly potato)

Source: JICA Survey Team

The Project will support target PGs in terms of i) strengthening their business management and operation, ii) strengthening their production capabilities, and iii) developing necessary infrastructure development. With support from the Project, PGs, as independent business entities, first prepare their business plans, which include marketing strategy, possible market linkages, supply chains, necessary facilities and their operation, technical training needs for member farmers, financial plan, and management arrangement for implementing business plans. Based on the plans, PGs operate their businesses. By applying for subsidies by the Project, PGs establish feed packhouses, which will function as interfaces between distribution and production and be utilized for post-harvest processing.

The detailed framework of selection of Target PGs and its procedure will be described in Attachment 6.2.1.

### **Project Approach 3: Value Chain Infrastructure Development**

As part of strategy to strengthen the distribution of horticultural crops, the Project will embark on developing a value chain infrastructure as well as capacity development in post-harvest management etc of target PGs and DOH/PMU staffs. This component involves creating an e-marketplace to facilitate sharing of distribution information, such as market prices and direct transaction status. Additionally, a platform will be developed to promote cooperation and information sharing among PGs, aimed at enhancing operations by sharing best practices. By aligning the Market Creation through the HUB-SPOKE model (described in the figure 3), we will build e-markets and infrastructure facilities, like processing plants equipped with cold storage and logistics. This initiative will foster support in making the value chain. Furthermore, the physical market will be synchronized with a digital system (DX) encompassing all the services proposed in the E-market, reinforcing an integrated approach to distribution within the value chain.

### **Project Approach 4: Strengthening the capacity of DOH**

In commitment to sustainable Development in horticulture, a key policy will be the comprehensive strengthening of the Department of Horticulture (DOH) capacity rather than outsourcing to external consulting firms. The initiative includes evaluating the overall project implementation plan, procuring essential equipment and tools, conducting state and district-level workshops, and providing hands-on training in vegetable cultivation techniques. By enhancing the operational capabilities of the government agency through these targeted activities, we aim to establish a sustainable agricultural development framework that is reliant on internal expertise and aligned with best practices. This approach ensures a sustainable growth path that leverages government capabilities and knowledge, fostering self-reliance and long-term success in the horticulture sector.

Activities in each component are described below.

### 6.3 Component 1: Support for crop diversification into horticultural crops and Reinforcement of production support

#### 6.3.1 Formation and Strengthening of PGs

**Table 6.3.1 Outline of Activity**

Activity	Purpose	Target Audience	Implementers	Envisaged number of beneficiaries
Technical Support Group	Providing technical assistance and financial support (PGs management costs)	PGs	Technical Support Group	500 PGs

Source: JICA Survey Team

Under the Central Sector Scheme for "Formation and Promotion of 10,000 FPOs" and previous similar schemes, PGs have been strengthened. In addition, financial support for covering management costs and equity grants have been provided for PGs under the "10,000 FPOs" scheme. Since this "10,000 FPOs" scheme will be finished soon, these supports for PGs will be taken over by the Project.

Target PGs to be supported by the Project are assumed to be (i) existing PGs that have not received the support of the "10,000 FPOs" scheme and CCDP and (ii) PGs to be formed and registered in accordance with the guideline of the "10,000 FPOs" scheme by themselves either under Company Act, Cooperative Act, or with local administration body (district, or panchayat). PMU will prepare implementation norms and guidelines on strengthening PGs, including eligible PGs, eligible assistances, application and selection procedures, etc. PMU will announce the application for strengthening PGs. Any potential PGs interested could apply for these supports.

The detailed framework of selection of potential PGs and its procedure will be described in Attachment 6.2.1 and Attachment 6.3.1.

The below table shows lists of supports for formation and strengthening PGs-Technical Support Group (TSG) to be selected and contracted with the PMU. TSG will either provide direct support for the eligible PGs or coordinate with other concerned parties who could provide support for these PGs.

**Table 6.3.2 Supports for forming and strengthening PGs**

#	Item	Details
1.	Sensitization the potential PGs and individual farmers	- TSG undertakes the sensitization of the potential farmers for working together for the farming, Post-harvest management and marketing.
2.	Training to CEO/BoDs	- TSG undertakes organizational capacity building for PGs through lecture mode (inviting concerned persons as lecturers and dispatching representatives of PGs to concerned institutes, etc.) and On the Job Training mode on a day-to-day basis for CEO and board members. - Assumed topics to be covered by the lectures are: i) the role of PGs in integrated horticultural Development, ii) By-laws and membership (including the participation of women farmers), iii) organizational structure, iv) roles and responsibilities of the Executive Committee, and its members (BoDs), v) roles and responsibilities of general members, vi) holding meetings, vii) financial management, viii) record-keeping, ix) networking & resource mobilization, etc.
3.	Market survey with SHEP concept	- TSG supports PGs to prepare business plan from the viewpoint of market needs, which is the basic concept of the SHEP approach for sustainable and effective implementation of business plans. - Representatives from both board and general members (about 30 are assumed) of PGs will visit destinations with potential market opportunities to understand demands and qualification of markets, and possibilities of having linkages. - TSG will support holding planning sessions where SHEP concept is explained

#	Item	Details
		to PG members and destinations of market visits are decided. - TSG will make necessary arrangement for market visits.
4.	Business planning	- PGs will prepare business plan in consideration of the results of market survey, with confirming marketing strategy and possible market linkages, necessary facilities and their operation, and technical training needs for member farmers. Financial plan and management arrangement for implementing business plan are also included. - TSG will support business planning through series of discussions with PG core members.
5.	Implementation of business plan	- For effective and smooth implementation of business plans by PGs, TSG under supervision of PMU as well as Project Management Consultant (PMC) will assist PGs in adequately managing their organizations and financial issues, procuring inputs, adopting good agricultural practices, aggregating produces, managing their quality, processing, and packaging, developing supply chain and market linkages, etc. through providing necessary guidance and coordinating with concerned parties and market-related actors in the private sector.
6.	Supports for building facilities	- Subsidies for building facilities (feeding packhouses) will be provided by the Project (Component 2.1). TSG will seisitize potential PGs and individual farmers to form new PGs to apply for supports for building facilities such as micro irrigation facilities and Packhouses etc and support PGs in preparing all necessary documents and arrangements in contacting concerned parties.
7.	Provision of technical training	- Technical training for member farmers of eligible PGs will be planned and conducted by the Human Resources Development Unit of PMU and District extension workers (Component 1.3). - In consideration of the technical training needs of PG members, TSG will make necessary arrangements for farmers to receive necessary training by coordinating with Human Resource Department (HRD) and PG motivators (Horticulture Extension Service).
8.	Covering management costs of PGs	- PMU will provide financial support to PGs for five years to cover such costs as salaries for CEO and Accountant, office rent, utility charges, minor equipment, travel and meetings, other miscellaneous expenses, etc. to the eligible PGs from category 2 - 5. - The amount of financial support will be a similar level to that applied for under the "10,000 FPOs" scheme and be different depending on the scales and characteristics of PGs.

Source: JICA Survey Team

The role of PG motivator is working on the principle of aggregation and dissipate the knowledge from the following perspective;

- a. Increase in income and livelihood of the members
- b. Collective purchase of inputs
- c. Consolidation of land holdings of the group members
- d. Information gaining and sharing among the group members
- e. Collective decision on any issues arising in the group
- f. Farming practices done collectively
- g. Combining various resources like cattle, machinery and other entities possessed by the group members
- h. Maintenance of record of the activities carried out in group

### 6.3.2 Water-harvesting and Micro irrigation system

**Table 6.3.3 Outline of Water-harvesting and Micro irrigation system**

Activity	Purpose	Target Audience	Ownership	Envisaged number of beneficiaries	beneficiary share	O&M
Installing ponds and solar pumps	To decrease excess use of ground water and control	Member of PGs	Individual	One large and one small pond per 500 PGs	20-30%	Individual

Activity	Purpose	Target Audience	Ownership	Envisaged number of beneficiaries	beneficiary share	O&M
	groundwater depletion					

Source: JICA Survey Team

This component will support installing horticultural facilities (micro-irrigation facilities) for PG members who have switched from cereal to horticultural crop cultivation to contribute to the Mera Paani, Meri Virasat scheme.

The component will also support installing water storage facilities such as Pond for PG members to mitigate groundwater depletion.

Eligibility criteria and terms and conditions are followings,

- i) The individual farmer must have the required catchment area.
- ii) Beneficiary has not taken subsidy up to the limit of 7 lacks on this component.
- iii) If a farmer has already availed subsidy in the community water tank is eligible to avail subsidy up to the limit of 7 lacks subject to the condition has the ownership of the leftover area.
- iv) Individual beneficiary means a family having a single ration card.
- v) Individual beneficiaries can avail of assistance only one time.
- vi) For vegetable crops are up to 0.9ha, and for perennial crop areas, up to 2.0 ha.

Selection Criteria

- i) Beneficiaries should be members of the PGs
- ii) A prerequisite for farmers is to possess a minimum of one hectare of land that is linked to a canal network.

#### (1) Water-harvesting facilities

To introduce a micro irrigation system under the Project, the water source shall be confirmed in advance. As shown in Table 6.3.4, 500 large ponds and 500 small ponds are planned to be newly established under the Project. To make sure water sources for micro-irrigation, cost provision for wells, boxes, and small ponds per PG are inclusive in the Project. At the initial stage of the Project, DPMU, along with the Technical Support Group, will assess the water resources, land availability, topography, etc., through the site investigation.

In Haryana, ample yearly sun light hours are enough, and it is presumed that suitable and feasible sites are capable of installing a Photovoltaic (PV) system to energize pumping machinery for lifting water. There are 500 PGs where solar pumps will be installed for each of the 500 large and small ponds.

For long-term and efficient use of water source facilities, proper O&M is essential. If the Project will develop the facility directly or indirectly, necessary training for the proper O&M should be planned and conducted by PMU under the guidance of PMC.

**Table 6.3.4 Outline of Ponds and Solar pumps (large and small)**

Items	Quantity	Size and Capacity	Ownership	Responsibility of O&M	Beneficiary Contribution
(1) Water harvesting pond and solar pump (large)					
Rainwater harvesting pond	500	15m x 8m x 3m For 2ha	Individual members of eligible PGs	Individual members of eligible PGs	30 %
Solar pump	500	5 Horse Power	Ditto	Ditto	20 %
(2) Water harvesting pond and solar pump (small)					
Rainwater harvesting pond	500	16m x 13m x 3m	Individual members of eligible PGs	Individual members of eligible PGs	30 %
Solar pump systems	500	5 Horse Power	Ditto	Ditto	20 %

Source: JICA Survey Team

This component will support farmers who suffer from a lack of water or scarcity of water by providing water-harvesting facilities such as ponds with solar pumps. It will also contribute to saving ground water that farmers face depletion problems in some areas. It is also recommended to make a yearly plan (cropping pattern) for cultivation based on water use.

## (2) Micro Irrigation Systems

This is a key component to promoting water-saving agriculture. At the same time, it will support installing horticultural facilities (micro-irrigation facilities) for PGs members and FIGs (small and marginal farmers) who have shifted from cereal to horticultural crop cultivation to contribute to the "Mera Paani, Meri Virasat" scheme. To maximize the effectiveness of water saving, a combination of drip irrigation with mulch will be introduced. The use of mulch will also contribute to saving the use of fertilizer and labor of weeding and contribute to the early harvesting of vegetables. Mini sprinklers for root and leafy vegetables and drip irrigation for fruits will be introduced to save water use.

To measure the water use, water flow meter devices will be attached to the main water distribution channel so that farmers can recognize the effectiveness of micro irrigation systems.

In the same manner, as stated in (1) Water Source Facility, the necessity of irrigation at the target site would be firstly examined by DPMU along with the TSG. Only after confirmation of water source availability on-farm irrigation development can be implemented under the Project. Complying with the policy of the Indian Government, the irrigation system to be installed on the farm under the Project will be limited to water-saving irrigation, e.g., drip irrigation and micro-sprinkler irrigation. Therefore, if the necessity of irrigation and availability of irrigation water at the site at present or in the near future during the Project period is confirmed, the Project will provide the micro irrigation facilities.

All farmers under the eligible PGs without micro irrigation facilities are eligible to be provided the irrigation facilities if the farmers have or will obtain an irrigation water source. Actual situations, whether the farmers have irrigation facilities or existing/planned water sources, are to be confirmed by DPMU along with the TSG through site visits and interviews with the farmers. If the farmers are selected as beneficiaries of this component, they have to make a contribution (15%) of a part of the cost of irrigation facilities in terms of contribution money of PGs.

The Project will provide micro irrigation facilities to farmers having an accessible water source. The facilities must be properly managed by farmers. Necessary training will be provided by the supplier of the facilities. The farmers can purchase necessary materials for maintenance, such as spare parts of the equipment, from the supplier.

**Table 6.3.5 Outline of Micro Irrigation Facilities**

Items	Quantity	Expected Number of Beneficiaries	Size and Capacity	Ownership	Responsibility of O&M	Beneficiary Contribution
(1) Mini Sprinkler System (root and leafy vegetables)						15%
1) Integrated Package of Mini Sprinkler	21,742 acres	8,700 (2.5 acre per famer)	5% of Crop Command Area, the unit cost is as per 0.4 ha	Individual members of eligible PGs	Individual members of eligible PGs	
(2) Drip Irrigation System (vegetables)						15%
1) Integrated Package of Drip Irrigation	21,444 acre	8,600	1 roll=1.2m x 400m (25 micron)* for 21,444 acres	Individual members of eligible PGs	Individual members of eligible PGs	
2) Mulch Sheet	1,047 acre	1,000	1 roll=7m x 10 m (200 microns) * for 1,047acre	Ditto	Ditto	
(3) Drip Irrigation						15%

Items	Quantity	Expected Number of Beneficiaries	Size and Capacity	Ownership	Responsibility of O&M	Beneficiary Contribution
System (Fruits)						
1) Integrated Package of Drip Irrigation	21,742 ha	8,700 (2.5 acre per farmer)	5% of Crop Command Area of root and leafy vegetables	Individual members of eligible PGs	Individual members of eligible PGs	
(4) Others						
1) UV Sheet rain shed tunnel (tomato)	21,444 acres	8,600	1 roll=1.2m x 400m (25 micron)* for 21,444 acres	Individual members of eligible PGs	Individual members of eligible PGs	15%

Source: JICA Survey Team

### Selection Criteria

- i) Beneficiaries should be members of the PGs
- ii) A prerequisite for farmers is to possess a minimum of one hectare of land.

### 6.3.3 Horticulture guidance

Provide training to PG members in necessary agricultural techniques.

Collaborate with agricultural training institutions, agricultural colleges, and centers of excellence to upgrade the skills of farmers through training programs and workshops focusing on improving cultivation techniques.

**Table 6.3.6 Outline of Horticulture training**

	Outline of the training	Target/ Participants/ Contents	Trainer	Duration and No of Participants
1	Climate-smart horticulture on vegetables (general)	<p>Target:</p> <ol style="list-style-type: none"> <li>1. PGs members (Preference should be given to PGs member, in particular women)</li> <li>2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target)</li> </ol> <p>Contents:</p> <ul style="list-style-type: none"> <li>- Agronomical practices (sowing, harvesting etc)</li> <li>- General horticulture guidance. Training content will be determined according to PG's request.</li> </ul>	District Extension officer and TSG, and PMC	40 persons in 2 times of trainings per batch, 3 days, Each 500 PGs i.e if average member per PGs is considered 100 so total beneficiaries would be 50,000
2	Climate-smart horticulture on fruits (general)	<p>Target:</p> <ol style="list-style-type: none"> <li>1. PGs members (Preference should be given to PGs member, in particular women)</li> <li>2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target)</li> </ol> <p>Contents:</p> <ul style="list-style-type: none"> <li>- General horticulture guidance such as modern technique of establishment of plantation crop.</li> <li>- Training content will be determined according to PG's request.</li> </ul>	District Extension officer and TSG, and PMC	40 persons per batch, 3 days, 2 times, Each 500 PGs i.e. max average member per PGs is considered 80 so total beneficiaries 40,000
3	Climate-smart horticulture on exotic vegetables	<p>Target:</p> <ol style="list-style-type: none"> <li>1. PGs members (Preference should be given to PGs member, in particular women)</li> <li>2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target)</li> </ol> <p>Contents:</p> <ul style="list-style-type: none"> <li>- Horticulture guidance such as package and practices on exotic crops</li> <li>- Training content will be determined according to PG's request. (Preference:</li> </ul>	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 600 for focal 5 district (Ambala, Yamunanagar, Panchkula, Gueugram, Faridabad)

	Outline of the training	Target/ Participants/ Contents	Trainer	Duration and No of Participants
		Ambala, Yamunanagar, Panchkula, Gurugram, Faridabad)		
4	Climate-smart horticulture on fruits	Target: 1. PGs members (Preference should be given to PGs member, in particular women) 2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target) Contents: - Training on introduction of fruits crops such as Dragon fruits, Apple ber, Strawberry - Training content will be determined according to PG's request. (Preference: Sirsa, Hisar, Biwani)	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 360 for focal 3 district (Sirsa, Hisar, Biwani)
5	Cultivation techniques on floriculture	Target: 1. PGs members (Preference should be given to PGs member, in particular women) 2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target) Contents: - Training on the protected floriculture. - Training content will be determined according to PG's request. (Gurugram, Faridabad)	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 240 for focal 2 district (Gurugram, Faridabad)
6	Cultivation techniques on spices, medicinal and aromatic plants	Target: 1. PGs members (Preference should be given to PGs member, in particular women) 2. FIGs in the cluster (the Project will not exclude FIGs other than the eligible PGs as a target) Contents: - Training on package practices - Training content will be determined according to PG's request. (Ambala, Kaithal, Palwal, Bhiwani, Mahendragarh, Yamunanagar)	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 720 for focal 6 district (Ambala, Kaithal, Palwal, Bhiwani, Mahendragarh, Yamunanagar)
7	Cultivation techniques on mushrooms	Target: - Landless farmers in the cluster - The preference should be given to women Selection criteria: - Farmers in pre-existing pockets/cluster of mushroom identified by PMU - In and around catchment area of processing unit Contents: - Training on cultivation under the control condition and Value addition - Training content will be determined according to PG's request. (Sonipat, Panipat, Kurukshetra)	District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 360 for focal 3 district (Sonipat, Panipat, Kurukshetra)
8	Beekeeping techniques in focal areas	Target: - Landless farmers in the cluster - The preference should be given to women Selection criteria: - Farmers in pre-existing pockets - In and around catchment area of processing unit Contents: - Training on rearing of bees and by product and value addition	Center of Excellence, District Extension officer and TSG, and PMC	20 persons per batch, 3 days, 2 times i.e max average member per PGs is considered 120 so total beneficiaries 240 for focal 2 district (Sonipat, Gurugram)

	Outline of the training	Target/ Participants/ Contents	Trainer	Duration and No of Participants
		- Training content will be determined according to PG's request. (Sonipat, Gurugram)		
9	Nutrition improvement	Target: 1. PGs members (Preference should be given to PGs member) 2. FIGs in the cluster (the Project will not exclude FIGs as a target) 3. Preference should be given to Women and Child Contents: - Described in 1.3.11	PMU gender expert and TSG, and PMC	40 persons per batch, 2 days, 1 time, Each 500 PGs i.e max average member per PGs is considered 40 so total beneficiaries 20,000

Source: JICA Survey Team

Training by each institution shall be redeveloped as video learning materials and made available at District office or PG office.

Horticulture Extension Services, TSG and PMC will provide training. (See Training Structure).

Each cultivation training shall be targeted to areas with high production of the target crop. The following sites will be selected. Exotic vegetables (Sonipat, Gurugram), fruits (Sirsa, Hisar, Biwani), flowers (Gurugram, Faridabad), medicinal plants (Ambala, Kaithal, Palwal, Bhiwani, Mahendragarh, Yamunanagar), Beekeeping (Sonipat, Gurugram).

In particular, only women will be targeted for Food processing, in which women are engaged.

In addition, activities related to nutrition improvement will be carried out as a service sector.

### (1) Visual aid training material preparation collaboration with training institutes

Department of Horticulture has faced a lack of human resources for extension because of budget limitations. Therefore, this component will provide big help for them and also for farmers, especially small and marginal farmers. To make this training aid effective, collaboration among DOH and other training institutes, such as agricultural colleges and centers of excellence, is recommended to provide more practical, advanced techniques for farmers. A video camera will be provided for shooting. A shooting team will be employed for taking and editing materials. Training by each institute shall be redeveloped as video learning materials and made available at District office or PGs office with projectors.

At present, advanced, and bigger farmers take advantage of the training provided by those training institutes. If DOH and training institutes can provide such effective visual aid materials with projectors to PGs and Farmers' Interest Groups, even those materials will reach small and marginal farmers. It would be a bottom-up of farmer's knowledge and skills. It is indispensable to improve the comprehensive condition in Haryana.

Horticulture Extension Services, PGs motivators, and the Technical Support Group will provide this training.

The preparation of visual aid training materials and collaboration with training institutes in horticulture training plays an essential role in the effective education and dissemination of gardening techniques. Through this approach, even advanced techniques such as grafting become more accessible and easier to understand.

#### 1) Importance of Visual Aids Training Materials

Facilitation of Understanding: Complex techniques in horticulture often require visual materials to be fully understood.

Practical Guidance: Visual aid training materials can assist learners in trying out techniques themselves by demonstrating the process step by step.

#### 2) Collaboration with Training Institutes

Sharing of Expert Knowledge: Collaborating with grafting experts or horticulture educational institutions ensures that the materials include the latest methods and accurate information.



Joint Development: Developing materials in collaboration with multiple institutions (CSS Haryana Agriculture University, Maharana Pratap Horticulture University, Horticulture Training Institute, Krishi Vigyan Kendra, Centre of Excellence) allows for the provision of effective educational programs.

### 3) Examples of Grafting Training

Video Tutorials: Capturing the grafting process step by step in video form allows learners to study at home. 3D Models and Illustrations: Visualizing each stage of grafting through 3D models or detailed illustrations. Live Demonstrations: Offering learners hands-on learning experiences through live demonstrations by experts.

### 4) Sharing of Technology and Resources

Online Platform: Establishing an online platform for sharing each institution's expertise and resources ensures the provision of the latest educational methods.

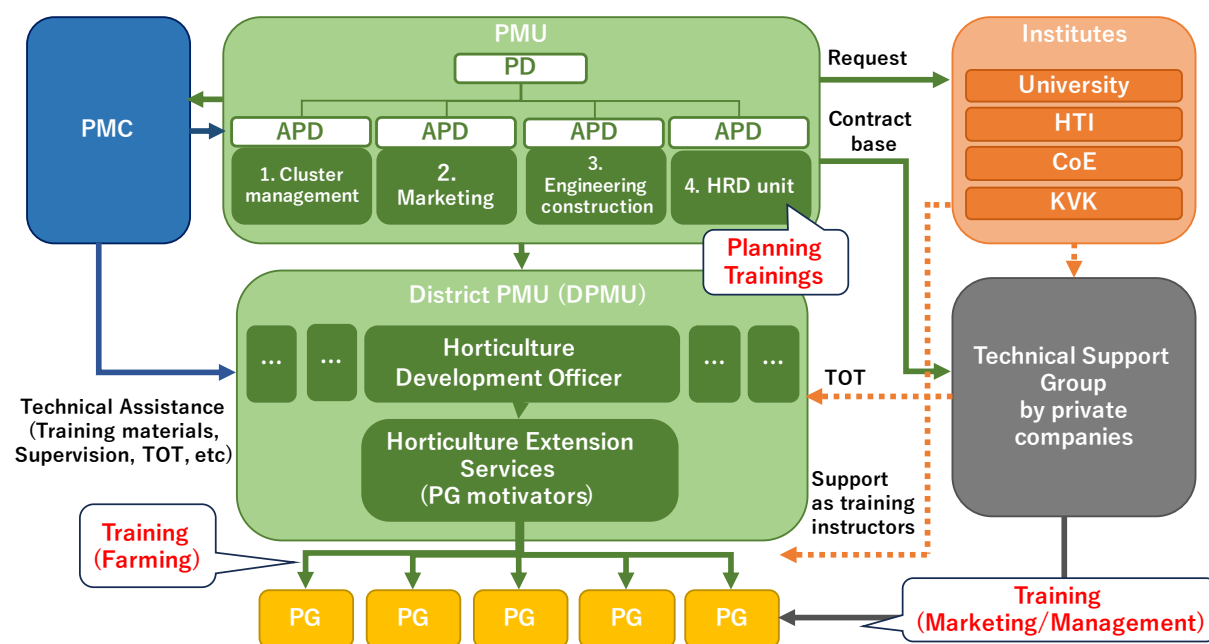
## (2) Climate-smart horticulture training

Support for crop diversification into horticultural crops and Reinforcement of production support are important activities in the agricultural sector. These activities aim to promote crop diversification by encouraging farmers to grow horticultural crops such as fruits, vegetables, and flowers, which have high commercial value.

One of the main components of these activities is support for crop diversification into horticultural crops. This involves providing assistance to farmers in the Development of horticultural production areas, such as improving facilities for greenhouse and open-field cultivation. Additionally, support is given to farmers through training and technical assistance to help them improve their skills in horticultural crop production.

Reinforcement of production support is another important aspect of these activities. This involves strengthening the production support system to ensure that farmers have access to the necessary inputs, such as seeds, fertilizers, and pesticides, to produce high-quality horticultural crops. Technical assistance is also provided to help farmers manage pests and diseases, which are common problems in horticultural crop production.

By promoting crop diversification into horticultural crops and providing production support to farmers, these activities help to increase farmers' income and improve their livelihoods. Moreover, they contribute to the Development of a more sustainable agricultural sector by promoting environmentally friendly practices and reducing reliance on a few crops.



Source: JICA Survey Team

**Figure 6.3.1 Agricultural Extension System**

In this Project, as shown in the diagram above, the Project Management Consultant (PMC) will provide technical transfer on farming techniques to District extension workers or technical support groups, and District extension workers or technical support groups will teach farming techniques to the eligible PGs, FIGs and individual farmers in the clusters in a cascade approach to farm extension activities. The PMU will request training instructors from cooperating training institutions, as shown in the figure (e.g., University, HTI, CoE, and KVK). The Cooperating Institutions will provide training to the PGs as requested by the PMU, collaborating with a technical support group.

This cascade model facilitates a systematic approach to disseminating farming techniques from experts to local farmers through intermediaries such as the District's extension officers or technical support groups. It ensures that the expertise of the Project Management Consultants reaches the grassroots level while also allowing for customization to local conditions and needs. The result is a more effective and sustainable implementation of advanced farming practices, leading to potential improvements in crop yield, sustainability, and overall agricultural success within the District.

Furthermore, the concept and experience of the JICA initiative of the Small Horticulture Empowerment Project (SHEP) will be introduced on a pilot basis. The concept of the SHEP approach is thinking from the economic theory "grow to sell" and based on a psychological theory, "a mechanism for unlocking farmer motivation." Key points for these steps are a) a participatory baseline survey carried out by farmers and extension officers together, b) a stakeholder forum for farmers to contact and discuss with actors from the agricultural industry sector, c) demand -driven technical training for farmer's requirement identified in a market survey. The essence of the SHEP approach is farmers' decision-making based on their own collecting information and analysis of the potential market for conducting agricultural business. In the Project, farm management for beneficiary farmers shall be integrated by the following items of a) awareness of market demand by access to market information and competitors, b) identification of production techniques and products to be applied, and c) continuous updating of the farm management and techniques to meet market demands. Training contents could be setup based on the SHEP approach in the Project. SHEP approach can encourage farmers to make decisions for their agricultural activities and to generate ownership and business mind. In the Project, recommended crops for each target district have been considered by DOH as target crops for the supply chain survey in the JICA survey as below. Although these crops will be recommended for beneficiaries, at the initial stage of the Project, a baseline survey will be conducted by a third party for the identification of current agricultural produces and market demands for each District and cluster. The result will be shared with farmers for further detail planning. In the training program for farmers, a market survey will be conducted by farmers themselves for awareness of market needs, and an action plan will be formulated, which is a business plan including cropping patterns, varieties, and techniques to be applied.

The followings are the summary of the Climate-smart horticulture training component.

### **1) Climate-smart horticulture on vegetables (general vegetables except for exotic and medicinal plants and mushrooms)**

Farmers in Haryana have enjoyed a geographical advantage in their State. Since the State has two big trade areas such as Delhi and Chandigarh, some farmers from another State said that Haryana farmers could sell their products to such big cities without any effort. Now is the time to reject such jokes, fertilizers, insecticides, and fungicides to less use of those. For that purpose, the provision of cropping patterns and the introduction of climate-adaptable seeds and varieties are awaited. If they can control water-use properly, they can save water, and it also contributes to the reduction of insecticides and fungicides use since some of the diseases and insect occurrences are caused by high humid and over-application of fertilizers. Farther more, water-saving cultivation will make vegetables better quality (high nutrition and better taste). It is very important to make Haryana products famous for healthy and tasty vegetables. The final goal is to produce high-quality vegetables and sell them at higher prices and, at the same time, to make agriculture more adaptable to changing climate. Haryana vegetables will contribute to people's health.

To realize profitable cultivation, cost and profit calculation training is provided. As for gender consideration, gender sensitization training such as "Work-Life Balance" is also included.

## **2) Climate-smart horticulture on fruits (general fruits except for peach)**

Compared to vegetables, fruit cultivation is more profitable in Haryana. Even though the initial input cost is bigger than vegetable cultivation, in subsequent years is not so costly, and it is not so labor-intensive compared to vegetable cultivation. First of all, they need to consider climate-adaptable varieties for sustainability.

The most important skill they need to know is again to control water and fertilizer application. The same as vegetables, if farmers can reduce the application of water and fertilizer, they can also reduce the application of insecticides and fungicides. And they can improve the quality, taste, aroma, and nutritional contents of fruits.

In addition to that technique, the introduction of pruning and training is recommended to improve the aeration of trees to reduce diseases, make harvest easier and improve the quality of fruits.

## **3) Climate-smart horticulture on exotic vegetables for focal areas**

At present, Ambala, Yamunanagar, Panchkula, Gueugram, and Faridabad districts are active production areas of exotic vegetables. Usually, exotic vegetable cultivation is suitable for cooler areas. Though, demand from big cities such as Delhi and Chandigarh promote the production of exotic vegetables in these two districts.

If DOH wants to expand the areas of exotic vegetable cultivation, they need to consider adaptable seeds, varieties, and cultivation methods adaptable to hot weather. Some techniques were already introduced to Haryana, such as net tunnels and net houses, though the introduction of shade net is also suitable for Haryana. Some of the exotic vegetables need special techniques during post-harvest.

If DOH wants to expand the production of leafy exotic vegetables such as leaf lettuce, even they can introduce all weather-controlled hydroponic cultivation in collaboration with private sectors. In Japan and other advanced countries, plant factories (hydroponics) became very popular to accommodate the fast-food industry's demand.

Most exotic vegetables are nutritious; therefore, they can be used as healthy vegetables to control lifestyle-related diseases. This is the most important marketing strategy for health-conscious people.

## **4) Climate-smart horticulture on fruits (Peach)**

As a model area, climate-adaptable seeds and varieties, advanced techniques such as pruning, training, cutting, and grafting should be introduced in these areas. An adequate amount of water and fertilizer application should be identified, and such data should be shared with other areas that follow their model. In addition, protected cultivation will be introduced to improve the appearance of fruits as one of the marketing strategies.

## **5) Cultivation techniques in floriculture**

A Centre of excellence for floriculture is planned in Jhajjar district, and one international modern flower market is planned in Gurugram by the Haryana government. At present, in these two areas, flower cultivation is conducted mainly in Haryana. However, demand from big cities is still expanding year by year, along with the growth of the middle class. Based on their demand, floriculture farmers need to choose good varieties and improve their cultivation techniques, such as light management to change the sipping season, cutting and grafting for propagation, and seed harvesting. Value addition by providing good packaging and having a good marketing strategy to compete with other states.

## **6) Cultivation techniques on spices, medicinal and aromatic plants**

Generally, it is known that the quality of spices, medicinal plants, and aromatic plants depends on the application of water and fertilizer. If farmers apply less amount of water and fertilizer, they can improve the quality. Therefore, farmers in arid areas can produce higher quality ones. It is important to identify such suitable areas for production. Then, introduce water-saving cultivation in accordance with professional guidance.

In the case of medicinal plants, farmers in the Morni Hills area export their products to other States and even to other countries after drying and peeling skin.

### **7) Cultivation techniques on mushroom**

Mushroom cultivation could be done even in landless farmers if the spawn and casing soil are available. The most important technique is to control humidity and to protect from direct sunshine. At present, most mushrooms are sold raw. That is a reason why mushrooms are cultivated in these three areas close to big cities.

However, there is a scope to process as dried mushrooms and pickles.

In the Morni Hill area, farmers produce special mushrooms which have medicinal properties. Therefore, they are sold at higher prices and sent to pharmaceutical companies. Such a choice of variety is also important for marketing.

For mushroom cultivation, it is important not only to have cultivation techniques but also to know the value of mushrooms and how to process it.

### **8) Beekeeping techniques**

In Haryana, oil seed production is popular in several districts. Among them, Sonipat and Gurugram are the main producers of honey. There is a center of excellence in beekeeping in Sonipat. Along with the expansion of health-conscious people, the demand for honey is increasing. Even large quantity of honey is exported to other countries. It is very profitable even for small-scale farmers. The initial input is also not so big. Therefore, it is recommendable to landless farmers if the training and materials are available.

### **9) Nursery raising techniques**

To be planned the enhancement of seedling production based on the State strategy and plan for the promotion/Development of target crops and clusters. Based on the cluster development strategy/ plan, the seedling production plan will be depicted. Current State seedling production is not enough for the promotion of new clusters aiming at production and shipping the competitive horticulture products to the adjacent major markets. To be designed and implemented the nursery and seedling production enhancement plan based on the cluster development strategy and plan of the State. The Hi-tech Nursery will play seedling production center, hi-tech nurseries, planting material, training and capacity building of farmers for marketing and implementation through the PGs, institutional Development of PGs, creating cadres for managing supply chain, developing MIS system, geotagging of the assets created, GIS mapping of horticulture resources, and Aadhar linking to prevent duplication of beneficiaries.

Usually, the production of the nursery is labor-intensive and skill-needed work. However, it is suitable for small landholders. SHGs can earn more money from the seedlings than from the production of vegetables. Since nursery raising is short period work and seedlings are repeatedly harvested from small strips of land.

### **(3) Food processing for women**

To be planned the strengthening of the existing food science training center to support secondary food processing, e.g., pickles, fermented food, juice, puree, etc.

A food science training center shall be developed for the products that are not available for sale in fresh because of bad outlook or out of size or shape, in spite of the same quality (taste, sugar contents, etc.)

Food processing has been introduced as SHG activities. However, the technique level is still local production and consumption. It is necessary to improve the techniques and promote commercial-scale production. It includes branding and marketing strategy. To promote more professional activities, the introduction of processing machinery and places for production like pack houses. Special training and collaboration with the private sector are also necessary to expand their business. Based on their locality, they need to produce local products based on the availability of raw materials to reduce the loss of products and the cost of processing.

### **(4) Provision of Farm Machinery**

Horticultural crops are more labour-intensive to farm than grain crops. And the work is often done by women. Therefore, in order to reduce the amount of work done by women, farming instruments (Weeder, seeder, etc.) will be provided to PGs. (Gender consideration)

**Table 6.3.7 Outline of Provision of Farm Machinery**

Items	Quantity	Type of machinery	Ownership	Responsibility of O&M	Beneficiary Contribution
Farming instruments1	2,500 (5 per PG)	Weeder	Individual members of eligible PGs	Individual members of eligible PGs	30 %
Farming instruments2	2,500 (5 per PG)	Seeder	Individual members of eligible PGs	Individual members of eligible PGs	30 %

Source: JICA Survey Team

## (5) Nutrition Improvement

**Table 6.3.8 Outline of Nutrition Improvement**

	Outline of the training	Target/ Participants/ Contents	Trainer	Duration and No of Participants
1	Nutrition Improvement Program	Target: PGs members (Preference should be given to women and child in the eligible PGs) Contents: - Basic Principles of Nutrition - Dietary Planning and Assessment	District Extension officer and TSG, and PMC	20 persons in 2 days, Each 500 PGs i.e. so total beneficiaries would be 10,000
2	Sensitization of nutrition sensitive intervention	Target: PGs members (Preference should be given to women and child in the eligible PGs) Contents: - Health worker visits to measure blood pressure and weight.	District Extension officer and TSG, and PMC	Once a year, each 500 PGs i.e. average member per PGs is considered 100 so total beneficiaries 50,000
3	Dissemination of kitchen garden for nutrition improvement	Target: PGs members (Preference should be given to female members in the eligible PGs) Contents: - Teaches about home garden. - Teaches how to use Seed, Shade net, Poly-frame for small tunnel, Water can, Sprayer, Fertiliser, Insecticide and Fungicide.	District Extension officer and TSG, and PMC	20 persons in 2 days, 2times, Each 500 PGs i.e. so total beneficiaries would be 20,000
4.	Dissemination of recipes using nutritious ingredients	Target: PGs female members Contents: - Hold competition. - Provision of Printed materials	District Extension officer and TSG, and PMC	50 persons in 1 days, 4times, Each 500 PGs i.e. so total beneficiaries would be 100,000

Source: JICA Survey Team

In addition, it is necessary to collaborate with Women and Child Development. After improving the quality of vegetables and fruits, nutritional analysis is necessary to prove how those products are good for people's health. Then, utilize such data for marketing. Raw vegetables and fruits are sold directly to restaurants, hotels, hospitals, and consumers who are interested in healthy food and who are willing to pay higher prices for their health. In the case of processed food, it is more reachable to people since it will have a longer shelf life.

Key activities of Building Partnerships will be undertaken to build partnerships, establish collaborations with businesses, and discuss and plan specific activities.

To promote "Haryana Fresh" in schools, it is necessary to collaborate with other departments, such as the Department of school education and welfare. Farmers can produce specific vegetables based on the market survey through the SHEP approach.

In addition to the above-mentioned activities, the promotion of kitchen gardens for nutritious vegetable cultivation is also targeted for nutrition improvement. Dissemination of recipes using such nutritious vegetables.

### Support to activate women sub-groups in PGs:

Supports will be provided to women sub-groups established in PGs to facilitate their economic activities. Women sub-groups comprising female members of PGs and spouses of male members of PGs will be established with a purpose of enhancing their involvement in decision-making process as well as improving access to and control over resources. Women sub-groups will prepare their activity plans (Women Sub-Group Activity Plan) after they receive technical training programmes. The Project will provide materials and equipment necessary to implement the Women Sub-Group Activity Plan. Assumed activities include mushroom cultivation, food processing, nursery production, etc.

### 6.3.4 Pilot farm Establishment and Public-private partnerships

The test plots for private companies to test new varieties and technologies will be attached to the Vegetable Center of Excellence.

**Table 6.3.9 Outline of Pilot farm Establishment and Public-private partnerships**

Activity	Purpose	Ownership	Scale	O&M
Pilot farm at Centre of Excellence in CoE PHM (Post-harvest management) or/and HTI Karnal	A test farm is proposed to set up on the CoE's facility to attract private companies. Demonstration and Training of Trainers to be conducted.	DOH	One pilot farm at the one existing Center of Excellence for vegetable	CoE
Establishment of Village of Excellence	Demonstrate agricultural skills and knowledge using farmers' existing land and share the information in the village.	PGs	1 site of 225 each PGs	PGs
Public-private partnerships	Implement a pilot project for private technology.	DOH	Continuous work	-

Source: JICA Survey Team

It is proposed to establish a test site within the vegetable COE. The pilot site can allow private companies with high technology in seeds, agricultural machinery, agrochemicals, fertilizers, etc., to test their technologies and deploy them in India.

The private companies would not be limited to Japanese companies but would be actively invited to participate.

#### (1) Pilot farm Establishment under Centre of Excellence

A pilot farm serves as a focal point for innovative agricultural practices in Haryana, offering hands-on learning experiences and allowing for localized adaptation of new technologies. It acts as a safeguard, letting farmers and extension workers test methods on a smaller scale, minimizing the risk of larger failures. Such hands-on experiences not only inspire farmers but also provide invaluable feedback to technology developers, ensuring rapid iterations. This approach ensures cost-effectiveness and relevance to local socioeconomic and climatic conditions. Functionally, the pilot farm acts as a training and resource hub, hosting workshops and providing access to essential farming resources, which also helps networking among farmers.

To establish the pilot farm, it is assumed the components of Capex (Capital Expenditure) and Opex (Operational Expenditure) as below.

**Table 6.3.10 Component of Capex of a Pilot farm**

Component	Description	Responsibility	O&M
Land Preparation	Soil testing, levelling, ploughing, and other preparatory activities to make the land suitable for cultivation.	DOH	CoE, DOH
Training and Demonstration Area	A shaded structure for hosting training sessions, workshops, and demonstrations for farmers and extension workers.		
Irrigation System	Introduction and setup of drip irrigation systems, sprinklers, and water storage facilities.		
Research and Storage	A dedicated space for conducting research, storing harvested		

Component	Description	Responsibility	O&M
Facility	crops, seeds, and equipment.		
Greenhouse or Polyhouse	Controlled environment structures for testing and growing crops under specific conditions.		
Basic Amenities	Essential facilities like sanitation, drinking water supply, and resting areas for the staff and visitors.		
Equipment and Materials	Purchase of necessary horticultural tools, machinery, and training materials.		

Source: JICA Survey Team

**Table 6.3.11 Component of Opex of a Pilot farm**

Component	Description	Responsibility
Maintenance and Repairs	Routine upkeep and repairs for infrastructure, tools, and equipment.	DOH
Salaries	Wages for the staff, including trainers, maintenance personnel, and researchers.	
Utilities	Ongoing costs associated with water, electricity, and other essential utilities required for farm operations.	
Equipment and Supplies Renewal	Periodic replacement of worn-out tools, purchasing additional supplies, and updating the existing equipment.	

Source: JICA Survey Team

## (2) Village of Excellence

Some farmers in rural areas are difficult to access to Center of Excellence, and it creates gaps in knowledge among farmers. To improve the situation, the concept of a "Village of Excellence" is proposed. Village of Excellence serves as a localized hub in rural areas, acting as an extension of the pilot farm and bringing the advancements and knowledge right to the doorsteps of farmers who might find it challenging to access centralized facilities. By leveraging the expertise and leadership of benevolent farmers, this model focuses on peer-to-peer learning, ensuring that knowledge dissemination is effective and relatable.

225 Village of Excellence is proposed to be established by utilizing producer group leaders and existing facilities. Hence, Capex can be minimized, and only necessary horticultural tools, machinery, and training materials shall be prepared upon the establishment of the Village of Excellence. Operation costs, maintenance and repairs cost, and incentives for producer group leaders shall be considered.

## (3) Industry-Government-Academia Collaboration

**Table 6.3.12 Outline of Industry-Government-Academia Collaboration**

Activity	Purpose	Ownership	O&M
Pilot project on Internet of Plants (IoPs) proposed to be set up at Maharana Pratap Horticultural University, Karnal in collaboration of Kochi University.	To foster collaboration between industry, government, and academia through the use of IoP, thus accelerating innovation and Development in the farming sector.	DOH (CoEs) A consortium of industrial companies, government agencies, and academic institutions.	Technologies: IoP: DOH, Agricultural University in Haryana, Seed company

Source: JICA Survey Team

**Table 6.3.13 Acceleration Plans for Public-Private Partnerships**

Category	Component	Description
Online Initiatives	Webinars & Virtual Workshops	Host topic-specific sessions where both public and private entities present their viewpoints, solutions, and requirements. These can be recorded for future reference and shared widely.
Online Initiatives	Online Networking Platforms	Develop platforms specifically designed for stakeholders in the pilot farm and Village of Excellence project to connect, discuss, and collaborate.
Online Initiatives	Online Hackathons	Organize events where tech experts, agri-professionals, and businesses collaborate to solve specific challenges

Category	Component	Description
		faced by the pilotfarm or Village of Excellence.
Offline Initiatives	Stakeholder Workshops	Organize events where representatives from the public sector, businesses, and the farming community come together to discuss, plan, and strategize.
Offline Initiatives	Field Days	Arrange specific days where private entities can visit the pilot farm and Village of Excellence, witness demonstrations, and interact with the community.
Offline Initiatives	Trade Fairs & Expos	Rent stalls in agricultural fairs to showcase technologies, methods, and achievements, attracting potential private partners.
Offline Initiatives	Investor Meets	Host exclusive meetings with potential investors or business incubators where detailed presentations about the potential and requirements of the Project are showcased.
Other Program	Mentorship Programs	Engage industry experts to mentor producer group leaders or Village of Excellence representatives, enhancing their skills and network.
Other Program	Collaborative Research	Facilitate partnerships between private companies, research institutions, and the pilot farm for mutual benefit.
Other Program	Reward Programs	Encourage businesses to offer rewards for the farming community under the initiative, fostering goodwill and deeper collaboration.
Other Program	Media Partnerships	Collaborate with media for stories, interviews, and updates to increase visibility.

Source: JICA Survey Team

#### 6.4 Component 2: Support for building value chains and Promotion of private sector partnerships

After years of implementing PGs Initiative, there has been a significant increase in vegetable production in various States. State Governments have placed great emphasis on promoting open and protected vegetable cultivation. However, despite these positive developments, the marketing of vegetables remains a challenge for farmers, primarily due to the lack of infrastructure for proper post-harvest management. Issues such as sorting, grading, packaging, and transit storage hinder the farmers' ability to effectively market their produce.

Small and marginal farmers, who constitute a significant portion of the agricultural sector, find it particularly difficult to invest in post-harvest handling facilities such as Pack Houses and Distribution Centres (Fulfilment Centres). Although there are provisions for partial financial assistance under various schemes of the Government of India, there is still a significant gap that prevents these farmers from accessing the necessary resources. Even Producer Groups (PGs), with their own equity base, struggle to generate sufficient funds to establish the required infrastructure.

Recognizing the crucial role of post-harvest infrastructure in the value chains of fruits and vegetables, which can enable farmers to realize the true value of their crops, the Project aims to assist these Producer Groups. JICA intends to provide financial assistance to help create post-harvest management (PHM) infrastructure. Given that the JICA Project focuses on strengthening horticultural value chains, supporting these Producer Groups in developing PHM infrastructure can have a significant and positive impact on the agricultural sector.

Support constructing the following four types of packhouses as infrastructure development for building value chains.

The PGs are eligible for facility provisioning support. The criteria for the provision of infrastructure facilities will follow the CCDP.

This component includes four types of value chain-related infrastructure development.

##### Facility design proposals

The core of the proposed system is a hub-spoke network model

##### Hub-Spoke network model

The Hub-Spoke network model is a transportation system design that involves a central hub and multiple spokes connecting to it. The hub serves as a centralized location where products are consolidated through



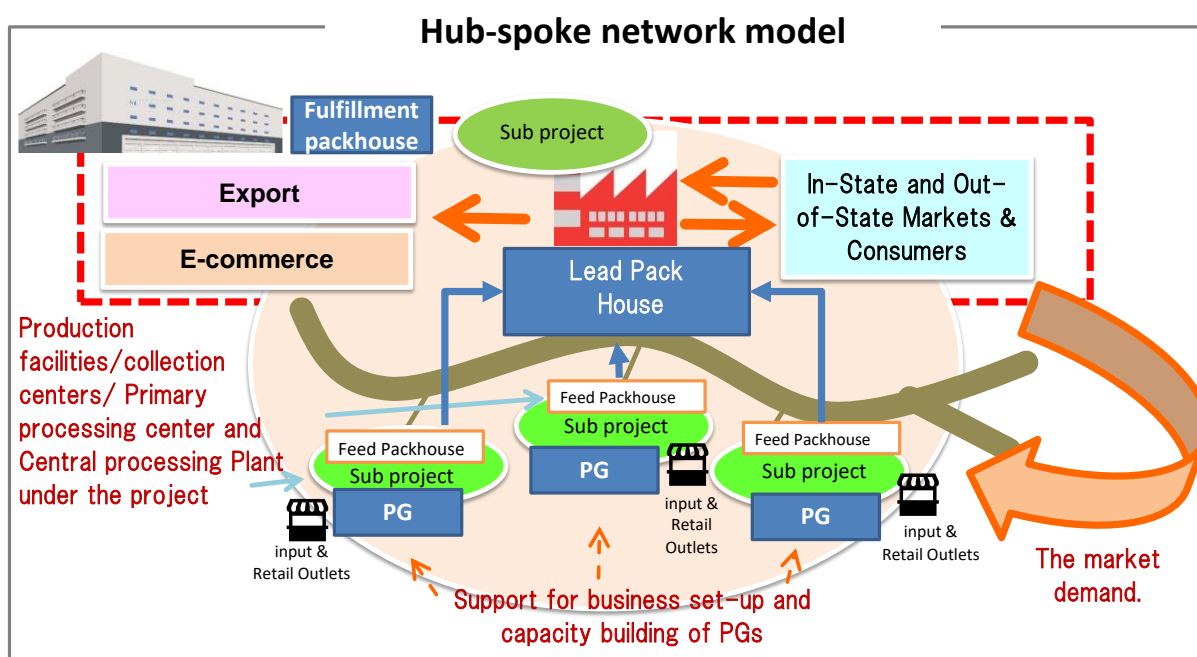
the spokes and redistributed to various destinations. This model is commonly used in logistics, transportation, and supply chain management to optimize the flow of goods and reduce transportation costs.

In the context of agricultural production, the Hub-Spoke network model can be an effective approach for improving the distribution of agricultural products. By establishing hubs that serve as lead pack houses, agricultural products brought to speak by farmers can be consolidated and processed at the hubs and distributed to various destinations through various market channels. This can improve the efficiency of transportation, reduce costs, and provide farmers with greater access to markets.

To implement the Hub-Spoke network model for agricultural production, it is important to consider factors such as the location of the hub, the number and location of spokes, and the transportation infrastructure required to support the network. Additionally, the model may require investment in facilities such as storage and processing facilities, as well as marketing and distribution channels to connect farmers with markets.

Overall, the Hub-Spoke network model can be a promising approach for improving the efficiency and sustainability of agricultural production and distribution. Through effective implementation and management, this model can provide benefits to farmers, consumers, and the overall agricultural sector.

We also propose that an e-market function be added to the pack houses.



Source: JICA Survey Team

**Figure 6.4.1 Image of Hub- Spoke network model**

i) Feed packhouses:

Feed packhouses are modern infrastructures with conveyor belt systems for sorting, grading, washing, drying, weighing, and packing agricultural produce. These packhouses serve as the initial step in organized post-harvest management in horticulture, essentially acting as the first procurement point in this sector. They should enable small-batch procurement of horticultural products and be constructed close to the farm gate.

ii) Lead Packhouse:

Lead Packhouse is an environmentally controlled warehouse space that serves as a distribution hub, evolving as market place doing off line and online market through different marketing channels of same commodity (Potato, Onion etc.). Designed for the short-term handling of produce, refrigerated warehouses (hubs) are the key to effectively distributing fresh produce. They are typically built near consumption centers and at the front end, where refrigerated transport connects them to supply sources.

iii) Fulfilment centers:

Fulfilment centers as distribution centre to cater the need of urban cluster, built near cities, will collect produce from feed and lead packhouses, distribute it on a larger scale, properly store the produce for advantageous pricing, sort and package products according to customer specifications, and directly sell products to consumers.

iv) Retail outlets:

Retail outlets for agricultural products are stores where consumers can purchase agricultural products directly. These retail outlets include supermarkets, farmers' markets, and other sales outlets. They are built near the production area and in gathering places.

Currently, the Small Farmers Agri-Business Consortium (SFACH) has successfully promoted approximately 400 PGs across the State, with a specific focus on fruits and vegetables. The number of member farmers, their land holdings, and the prevailing agro-climatic conditions play crucial roles in determining the overall output of each Producer Group (PG). To ensure effective infrastructure planning, the proposed facilities have been carefully designed based on the total quantity of fruits and vegetables being produced by these PGs.

The breakdown of Category, Estimated number of Packhouse, Member of PGs is as follows;

**Figure 6.4.2 Breakdown of Packhouse**

Categories	Estimated Proposed Unit	PG member
Feed Packhouse Category-1	280	Up to 20
Category-2	36	Minimum 20
Category-3	36	Minimum 50
Category-4	36	Minimum 75
Category-5	14	Minimum 125
Total	402	
Lead Packhouse	4	-
Fulfilment Centre	3	-

Source: JICA Survey Team

**Figure 6.4.3 The category-wised annual plan of Packhouse**

Year	Financial Year	Proposed						FC	Lead PH
		C-1	C-2	C-3	C-4	C-5	Total		
		<b>50 lakhs</b>	<b>100 lakhs</b>	<b>300 lakhs</b>	<b>600 lakhs</b>	<b>800 lakhs</b>		<b>50 crore</b>	<b>30-40 crore</b>
Year - 1	2024-25	20	0	0	0	0	20	0	0
Year - 2	2025-26	40	3	3	3	2	51	0	0
Year - 3	2026-27	40	3	3	3	2	51	1	1
Year - 4	2027-28	40	6	6	6	2	60	0	0
Year - 5	2028-29	40	6	6	6	2	60	0	1
Year - 6	2029-30	40	6	6	6	2	60	1	1
Year - 7	2030-31	40	6	6	6	2	60	0	1
Year - 8	2031-32	20	6	6	6	2	40	1	0
Year - 9	2032-33	0	0	0	0	0	0	0	0
	<b>Total</b>	<b>280</b>	<b>36</b>	<b>36</b>	<b>36</b>	<b>14</b>	<b>402</b>	<b>3</b>	<b>4</b>

Year	Financial Year	Proposed						FC	Lead PH
		C-1	C-2	C-3	C-4	C-5	Total		
		Collection Centre	Packhouse	Packhouse-cum-Cold Storage	Packhouse-cum-Cold Storage	Packhouse-cum-Cold Storage-humidity control		Fulfillment Centre	Lead Packhouse
		2 in each district per year, i.e. 40 in 20 districts per year to cover 50% of the identified clusters (537)	3/6 in major 6 clusters per year	3/6 in major 6 clusters per year	3/6 in major 6 clusters per year	2 in major 2 clusters per year			
	Commodity	Mix Commodities, mainly vegetables	Mix Vegetables (2), Tomato (2), Kinnow (2)	Potato (2), Tomato (2), Kinnow (2)	Potato (3), Kinnow (3)	Potato (1), Onion (1)			
		280	70%	Tranche - 1	Year 1 to 4	182	45%		
		122	30%	Tranche - 2	Year 5 to 9	220	55%		
		<b>402</b>	<b>100%</b>		<b>Total</b>	<b>402</b>	<b>100%</b>		

Source: JICA Survey Team

The following is a description of the expected facilities for each packhouse.

#### 6.4.1 Infrastructure development for building value chains

##### (1) Feed packhouse

Feed packhouses are divided into five categories according to size. The maximum number of members, number of Proposed Units, Estimated cost, Subsidy, Total Cost, and throughput per day of each Category is as shown below;

**Figure 6.4.4 Breakdown of Feed packhouse**

Category	Packhouse specifications	Function	Characteristics
<b>1</b>	PG member: Up to 25 Proposed Units: 280 Estimated cost: 0.5 Cr Subsidy: 90% (Project: 45%, Interest free loan: 45%) Throughput/day: 2 MT	<ul style="list-style-type: none"> <li>Aggregation</li> </ul>	<ul style="list-style-type: none"> <li>Grading tables (four SS tables of 1 M X 3M dimension); Complete made of SS-304</li> <li>Electrical weighing machine (Capacity 100 Kg) with a wide platform</li> <li>Plastic crates (10 Kg &amp; 20 Kg) – (250 crates (150 of 20 Kg &amp; 100 of 10 Kg)</li> <li>Cold Room 5-10 MT (Solar based)</li> <li>Office furniture &amp; fixtures (Chairs, Table, small almirah)</li> <li>Water Point and Water Harvesting system</li> <li>Electricity point</li> </ul> <p>AREA:</p> <ul style="list-style-type: none"> <li>Covered area: 750 Sq. Feet.</li> <li>Open area: 1500 Sq. feet</li> </ul>

Category	Packhouse specifications	Function	Characteristics
2	PG member: Up to 50 Proposed Units: 36 Estimated cost: 1.0 Cr Subsidy: 80% (Project: 40%, Interest free loan: 40%) Throughput/day: 2-4 MT	<ul style="list-style-type: none"> <li>Aggregation and sorting/Grading</li> </ul>	<ul style="list-style-type: none"> <li>Grading tables (four SS tables of 1 M X 3M dimension); Complete made of SS-304*8</li> <li>Cold room 5-10 MT (Solar Based)</li> <li>CS 20MT</li> <li>Electrical weighing machine (Capacity 100 Kg), with wide platform *2(200kg)</li> <li>Plastic crates (10 Kg &amp; 20 Kg) – (500 crates (300 of 20 Kg &amp; 200 of 10 Kg)</li> <li>Office furniture &amp; fixtures (Chairs, Table, small almirah)</li> <li>Water Point and Water Harvesting system</li> <li>Electricity point</li> </ul> <p>AREA:</p> <ul style="list-style-type: none"> <li>Covered area: 1350 Sq. feet.</li> <li>Open area: 2,400 Sq. feet</li> </ul>
3	PG member: Up to 75 Proposed Units: 36 Estimated cost :3.0 Cr Subsidy: 80% (Project: 40%, Interest free loan: 40%) Throughput/day: 5-10 MT	<ul style="list-style-type: none"> <li>S&amp;G and Packing and either selling direct to market or send it to Lead Packhouse</li> </ul>	<ul style="list-style-type: none"> <li>Recommended Plant &amp; Machinery</li> <li>Sorting-grading line (flet bed conveyor - 20feet length)</li> <li>Pre-cooler (one chamber of 2 MT per batch)</li> <li>Grading tables (four SS tables of 1 M X 3M dimension); Complete made of SS-304</li> <li>Cold Room (250 MT for Fruits &amp; Vegetables)</li> <li>Cold Rooms (2000 MT for Potato/Onion)</li> <li>Electrical weighing machine (Capacity 100 Kg), with wide platform - A</li> <li>Electrical weighing machine (Capacity 1000 Kg), with wide platform - B</li> <li>Plastic crates - (1000 crates (650 of 20 Kg &amp; 350 of 10 Kg)</li> <li>Wooden Pallets (30 numbers) (Euro Pallet of 1 M X 1.2 M)</li> <li>Hydraulic Pallet Jack (Capacity 1 MT)</li> <li>Desert Cooler &amp; Industrial Exhaust</li> <li>2 - Nos - Vans for Transportation upto 3-4 MT carrying capacity</li> <li>Office furniture &amp; fixtures (Chairs, Table, small almirah, Computer, Printer etc.)</li> <li>Water Point and Water Harvesting system</li> <li>Electricity point</li> <li>DG Set</li> </ul> <p>AREA:</p> <ul style="list-style-type: none"> <li>Covered area: 3200 Sq. feet.</li> <li>Open area: 10,000 Sq. feet</li> </ul>
4	PG member: Up to 100 Proposed Units: 36 Estimated cost :6.0 Cr Subsidy: 80% (Project: 40%, Interest free loan: 40%) Throughput/day: 11-25 MT	<ul style="list-style-type: none"> <li>Same as above but bigger volume</li> </ul>	<ul style="list-style-type: none"> <li>Sorting-grading line (flet bed conveyor - 20feet length)</li> <li>Sorting-grading line (flet bed conveyor - 40 feet length with 4.5 feet divided in three parts )</li> <li>Grading tables (SS tables of 1 M X 3M dimension);</li> <li>Pre-cooler (one chamber of 2 MT per batch)</li> <li>Cold Storage (Options)</li> <li>1- Cold Store (4000 MT) for Potato/Onion</li> <li>2- Cold Store (250x4 MT) for Fruits &amp; Vegetables + Cold room</li> <li>Crate washing line</li> <li>Electrical weighing machine (Capacity 100 Kg), with wide platform - A</li> </ul>

Category	Packhouse specifications	Function	Characteristics
			<ul style="list-style-type: none"> <li>• Electrical weighing machine (Capacity 1000 Kg), with wide platform - B</li> <li>• Plastic crates - (3000 crates (2000 of 20 Kg &amp; 1000 of 10 Kg)</li> <li>• Wooden Pallets (150 numbers) (Euro Pallet of 1 M X 1.2 M)</li> <li>• Hydraulic Pallet Jack (Capacity 1 MT)</li> <li>• Hand trolley and other material handling equipment's</li> <li>• Office furniture &amp; fixtures (Chairs, Table, small almirah, Computer, Printer etc.)</li> <li>• 4 - Nos - Vans for Transportation upto 3-4 MT carrying capacity</li> <li>• Water Point and Water Harvesting system</li> <li>• Electrification</li> <li>• Electrical Point</li> <li>• DG Set</li> </ul> <p>AREA:</p> <ul style="list-style-type: none"> <li>• Covered area: 12800 Sq. feet</li> <li>• Open area: 30,375 Sq. feet (for vehicle movement, parking and green area)</li> </ul>
5	PG member: Up to 125 Proposed Units: 14 Estimated cost :8.0 Cr Subsidy: 80% (Project: 40%, Interest free loan: 40%) Throughput/day: 26-50 MT	<ul style="list-style-type: none"> <li>• Long term storage and Arbitrage marketing (mostly potato)</li> </ul>	<ul style="list-style-type: none"> <li>• Sorting-grading line (flet bed conveyor - 20feet length) 5MT/hous</li> <li>• Sorting-grading line (flet bed conveyor - 40 feet length with 4.5 feet divided in three parts )</li> <li>• Mechanical Grading Line for round crops (Capacity 2MT per Hr)</li> <li>• Grading tables (SS tables of 1 M X 3M dimension);</li> <li>• Pre-cooler (one chamber of 2 MT per batch)</li> <li>• Cold Storage (Options)</li> <li>• 1- Cold Store (Up to 5000 MT) for Onion</li> <li>• 2- Cold Store (up to 10000 MT) for Potato</li> <li>• 3- Cold Store (250x8 MT) for Fruits &amp; Vegetables</li> <li>• Crate washing line</li> <li>• Electrical weighing machine (Capacity 100 Kg), with wide platform - A</li> <li>• Electrical weighing machine (Capacity 2000 Kg), with wide platform - B</li> <li>• Electrical weighing machine (Capacity 30 MT), with wide platform - C</li> <li>• Plastic crates - (4000 crates (2750 of 20 Kg &amp; 1250 of 10 Kg)</li> <li>• Wooden Pallets (150 numbers) (Euro Pallet of 1 M X 1.2 M)</li> <li>• Hydraulic Pallet Jack (Capacity 1 MT)</li> <li>• Hand trolley and other material handling equipment's</li> <li>• Office furniture &amp; fixtures (Chairs, Table, small almirah, Computer, Printer etc.)</li> <li>• 6 - Nos - Vans for Transportation upto 3-4 MT carrying capacity</li> <li>• Water Point and Water Harvesting system</li> <li>• Electrical Points</li> <li>• DG Set</li> </ul> <p>AREA:</p> <ul style="list-style-type: none"> <li>• Covered area: 12800 Sq. feet</li> </ul>

Category	Packhouse specifications	Function	Characteristics
			<ul style="list-style-type: none"><li>Open area: 30,375 Sq. feet (for vehicle movement, parking and green area)</li></ul>

Source: JICA Survey Team

The assumed floor plan of each feed packhouse is shown below.

Category 1

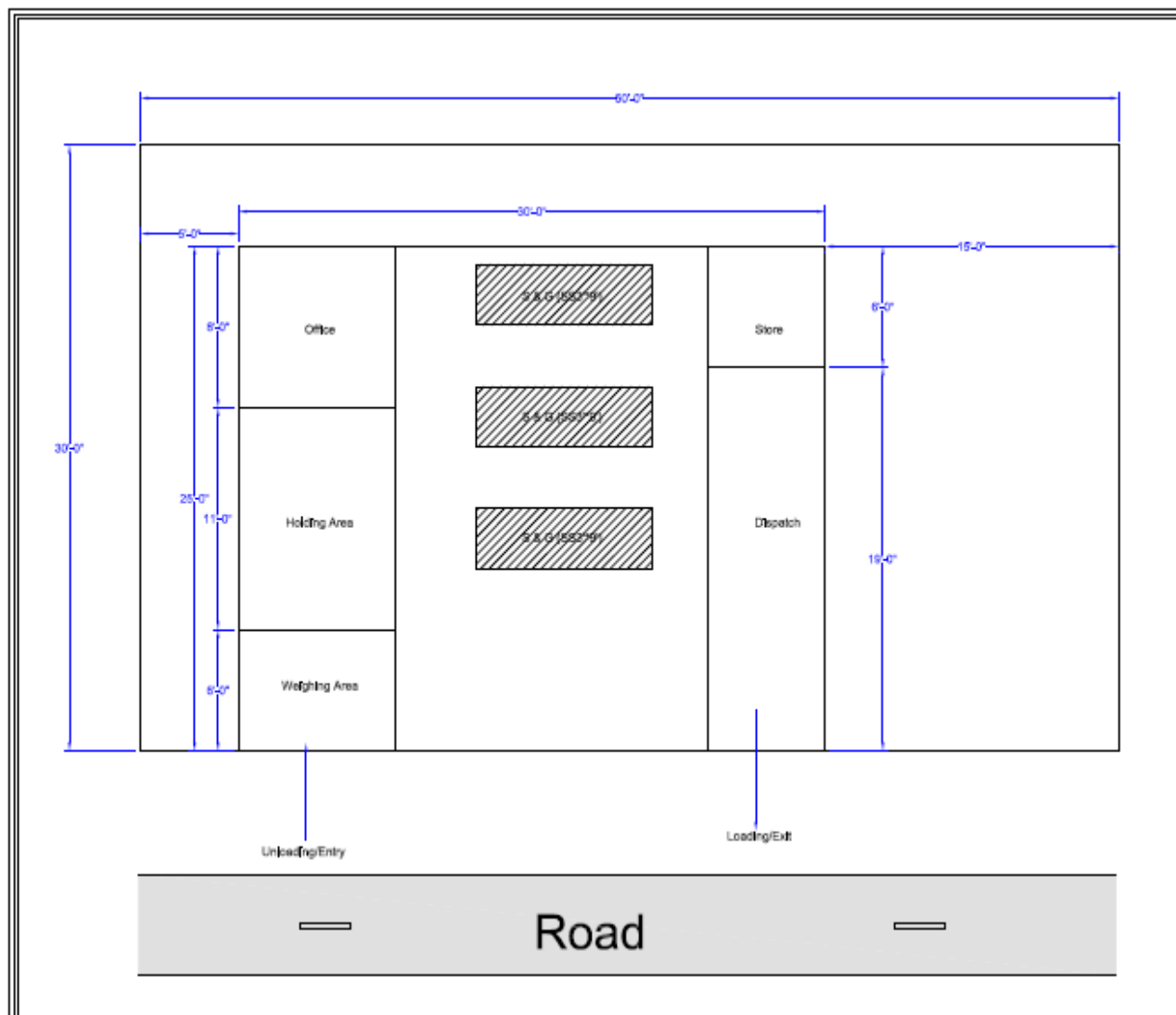


Figure 6.4.5 Design of Feed packhouse (Category 1)

Category 2

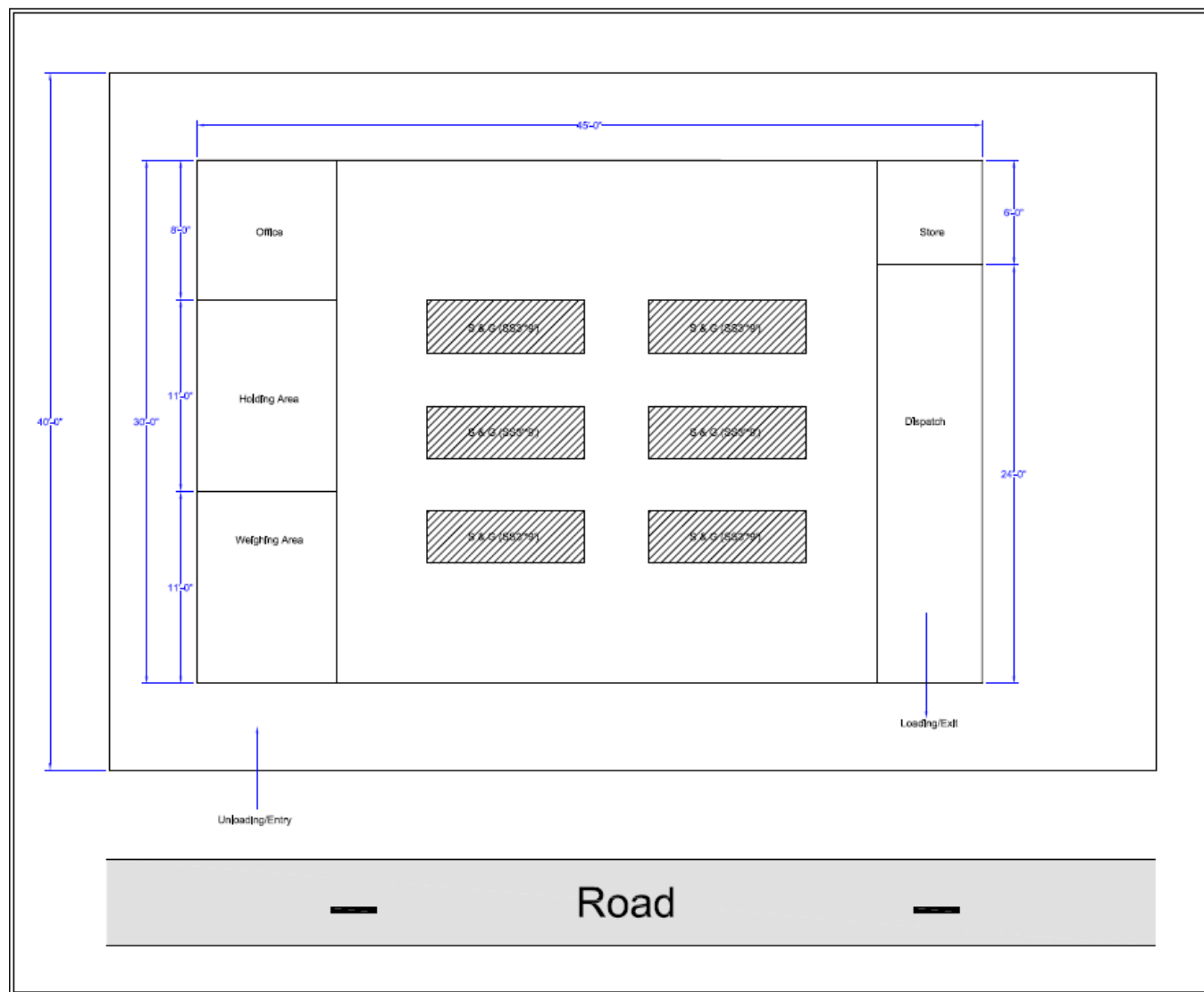


Figure 6.4.6 Design of packhouse (Category 2)



Category 3

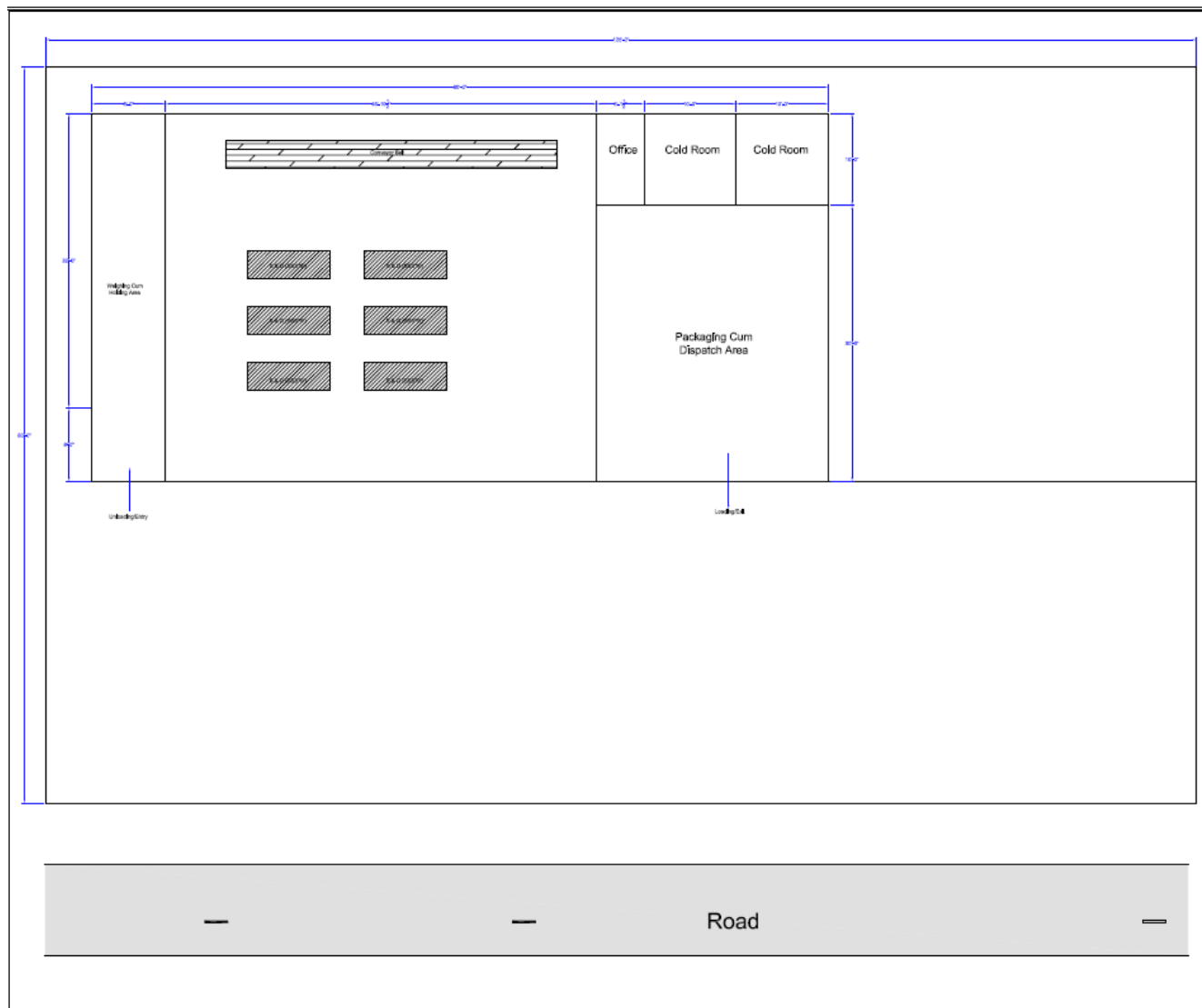


Figure 6.4.7 Design of packhouse (Category 3)

Category 4

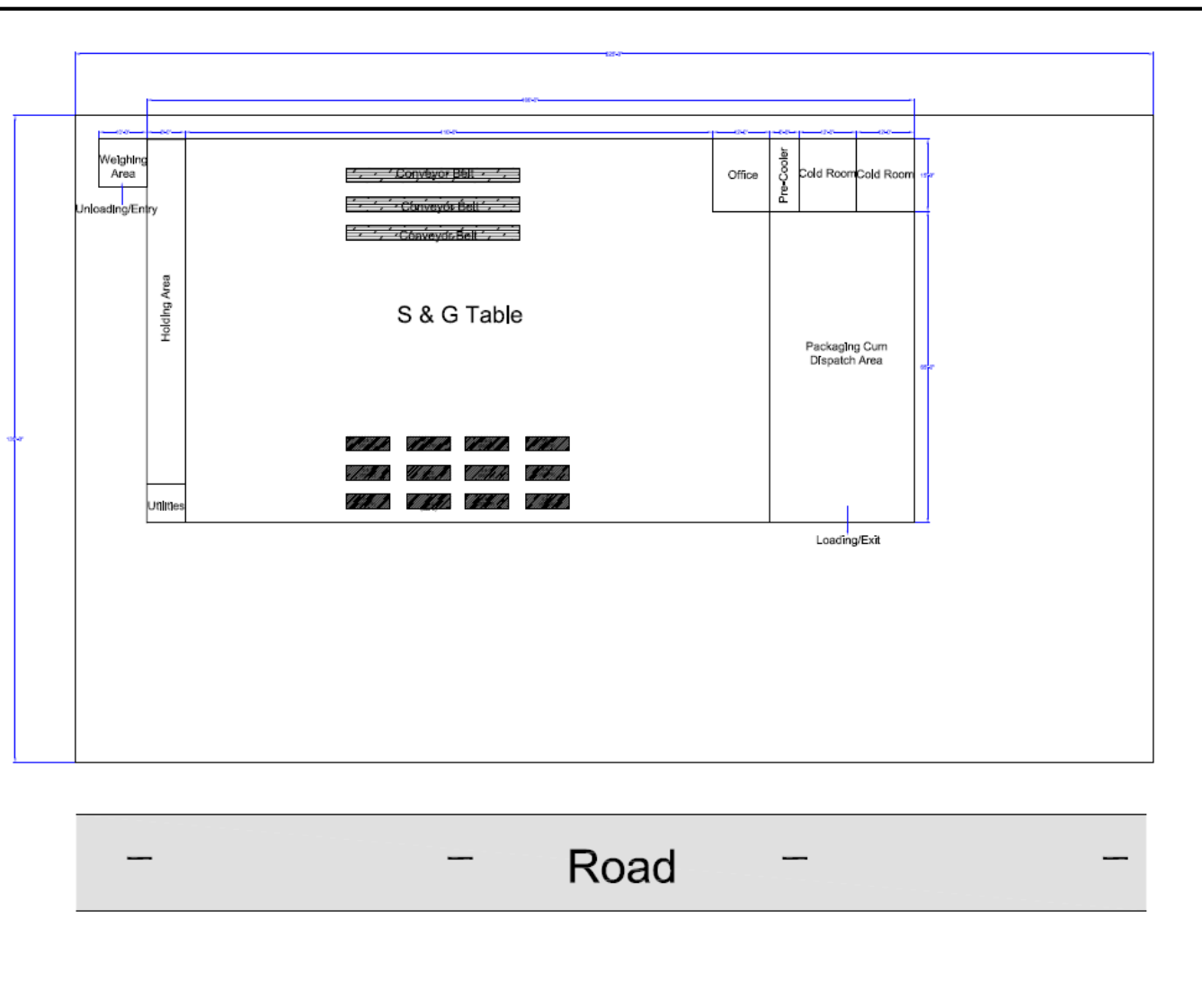


Figure 6.4.8 Design of packhouse (Category 4)

Category 5

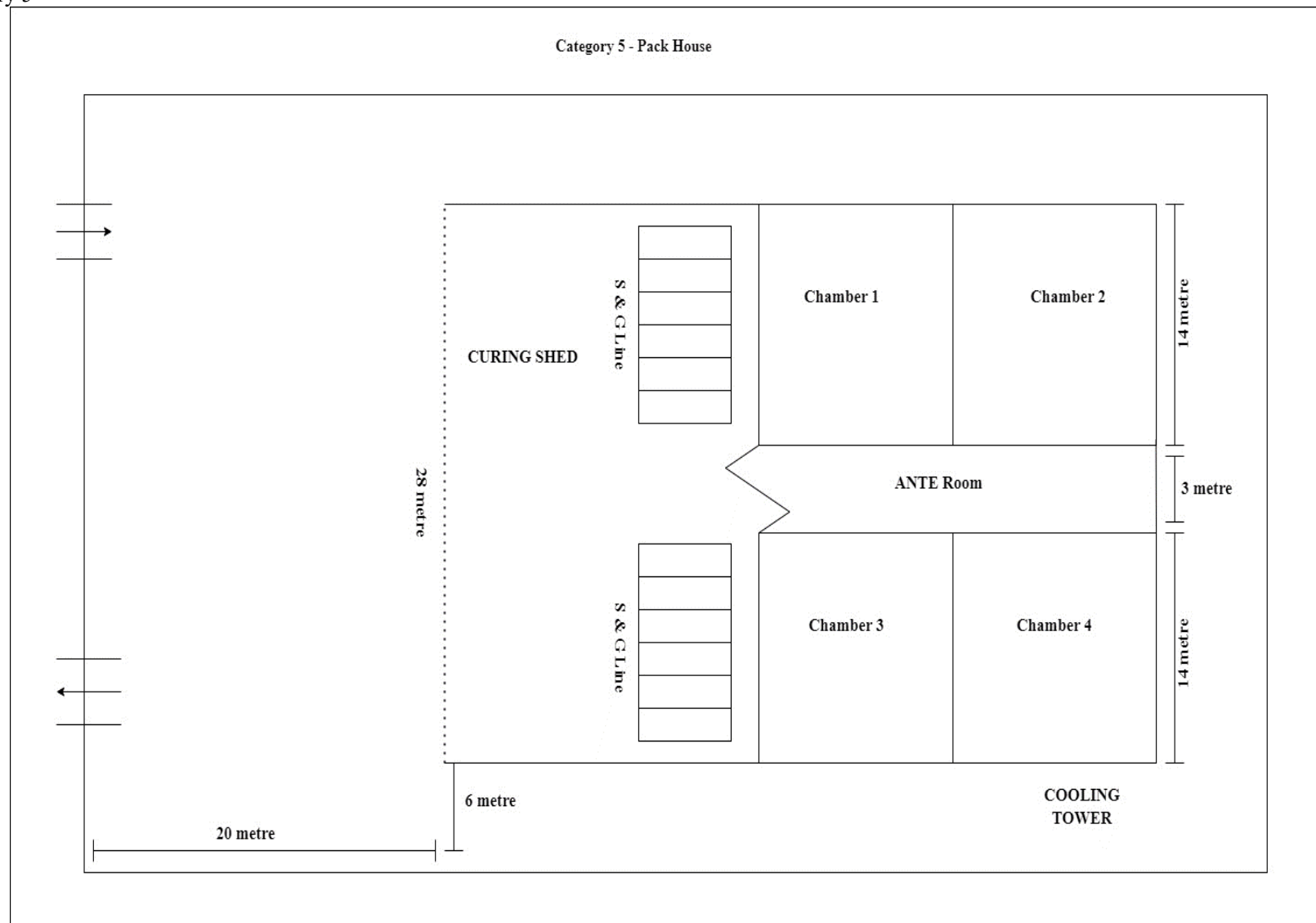


Figure 6.4.9 Design of packhouse (Category 5)

**(2) Lead Packhouse:**

**Table 6.4.1 Breakdown of Lead packhouse**

Lead pack house	Pg federation Proposed units: 4 (1 potato, 1 onion and 2 multi crops) Estimated cost :30.0 cr Subsidy: 80%	<ul style="list-style-type: none"> <li>• Sorting-grading line (flet bed conveyor – 20feet length)</li> <li>• Sorting-grading line (flet bed conveyor - 40 feet length with 4.5 feet divided in three parts )</li> <li>• Mechanical grading line for round crops (capacity 2mt per hr)</li> <li>• Grading tables (ss tables of 1 m x 3m dimension);</li> <li>• Pre-cooler (two chamber of 5 mt per batch)</li> <li>• Ripening chambers</li> <li>• Cold store multi-commodity multi-purpose cold rooms with 25 mt capacity</li> <li>• Processing line</li> <li>• Reefer vehicles</li> <li>• Crate washing line</li> <li>• Electrical weighing machine (capacity 100 kg), with wide platform - a</li> <li>• Electrical weighing machine (capacity 2000 kg), with wide platform - b</li> <li>• Electrical weighing machine (capacity 30 mt), with wide platform - c</li> <li>• Plastic crates - (4000 crates (2750 of 20 kg &amp; 1250 of 10 kg)</li> <li>• Wooden pallets (150 numbers) (euro pallet of 1 m x 1.2 m)</li> <li>• Hydraulic pallet jack (capacity 1 mt)</li> <li>• Hand trolley and other material handling equipment's</li> <li>• Office furniture &amp; fixtures (chairs, table, small almirah, computer, printer etc.)</li> <li>• Water point and water harvesting system</li> <li>• Electrical points</li> <li>• Canteen</li> <li>• DG set</li> </ul>
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Source: JICA Survey Team

Lead packhouse

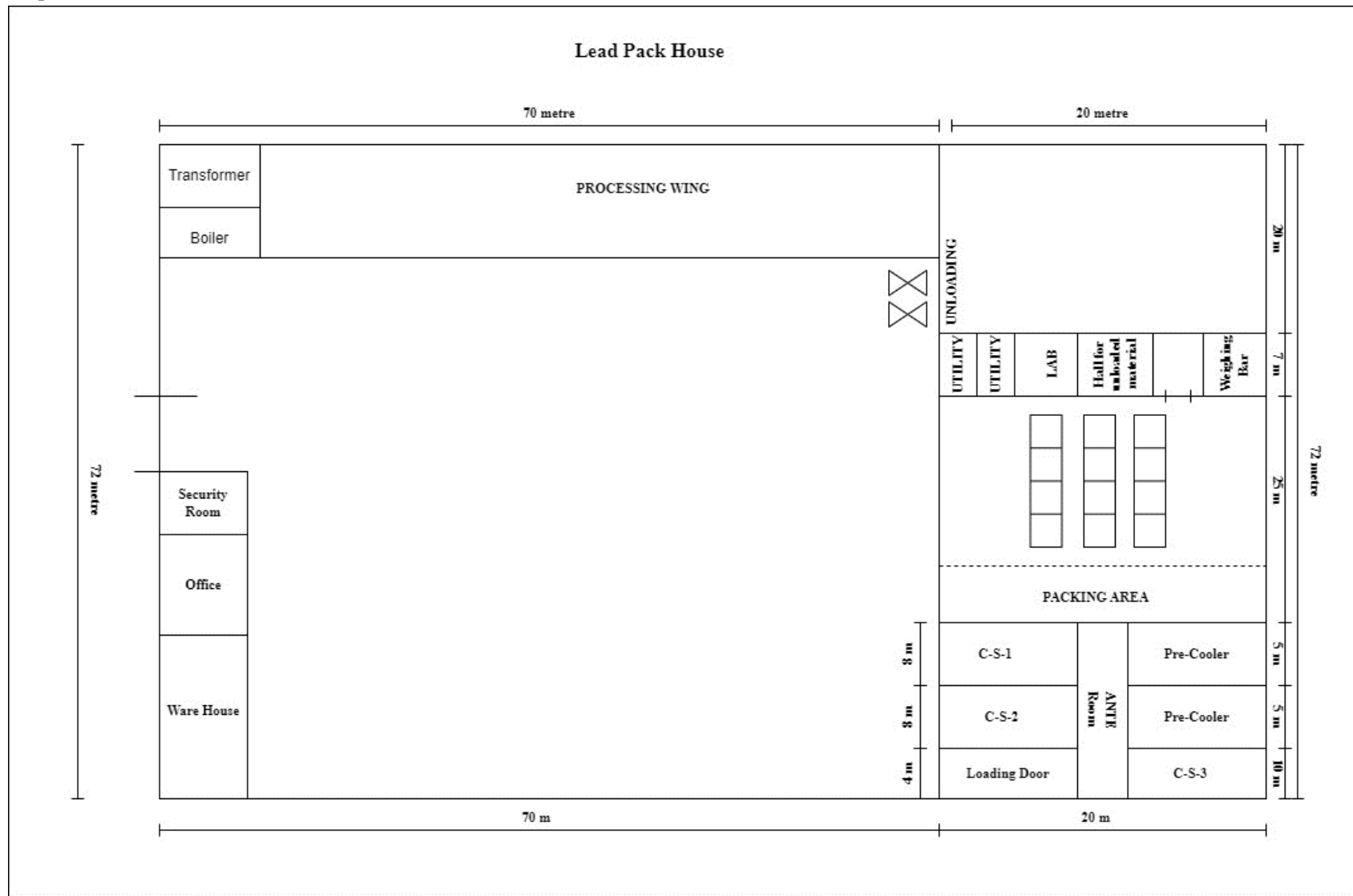


Figure 6.4.10 Design of Lead packhouse

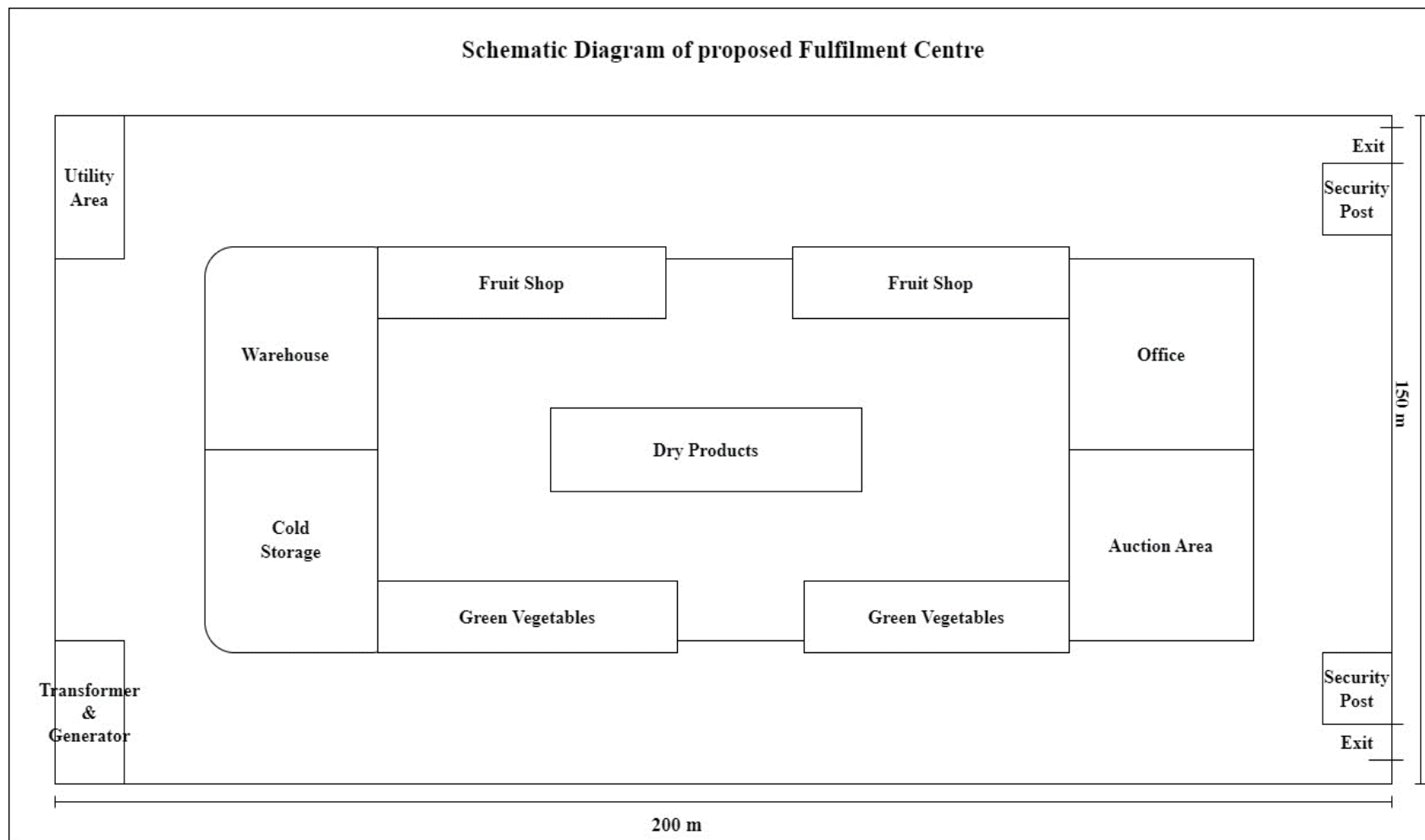
**(3) Fulfilment centers:**

**Table 6.4.2 Breakdown of Fulfilment centre**

Fulfilment centers:	Outsourcing to private companies Proposed units: 3 Estimated cost :50.0 cr Subsidy: 80%	<ul style="list-style-type: none"> <li>• Sorting-grading line (flet bed conveyor - 20feet length)</li> <li>• Sorting-grading line (flet bed conveyor - 40 feet length with 4.5 feet divided in three parts )</li> <li>• Mechanical grading line for round crops (capacity 2mt per hr)</li> <li>• Grading tables (ss tables of 1 m x 3m dimension);</li> <li>• Pre-cooler (two chamber of 5 mt per batch)</li> <li>• Ripening chambers</li> <li>• Cold store multi-commodity multi purpose cold rooms with 25 mt capacity</li> <li>• Processing line</li> <li>• Reefer vehicles</li> <li>• Crate washing line</li> <li>• Electrical weighing machine (capacity 100 kg), with wide platform - a</li> <li>• Electrical weighing machine (capacity 2000 kg), with wide platform - b</li> <li>• Electrical weighing machine (capacity 30 mt), with wide platform - c</li> <li>• Plastic crates - (4000 crates (2750 of 20 kg &amp; 1250 of 10 kg)</li> <li>• Wooden pallets (150 numbers) (euro pallet of 1 m x 1.2 m)</li> <li>• Hydraulic pallet jack (capacity 1 mt)</li> <li>• Hand trolley and other material handling equipment's</li> <li>• Office furniture &amp; fixtures (chairs, table, small almirah, computer, printer etc.)</li> <li>• Water point and water harvesting system</li> <li>• Electrical points</li> <li>• DG set/power backup</li> <li>• Others supportive assets</li> <li>• Auction hall (including auctioning facilities viz. Display screens etc)</li> <li>• B2B distribution halls</li> <li>• Loading unloading dock</li> <li>• Cafeteria</li> <li>• Parking area</li> </ul>
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Source: JICA Survey Team

Fulfilment centre



**Figure 6.4.11 Design of Fulfilment centre**

### 6.4.2 Building an E-market Place and an information sharing platform

This component will create an e-marketplace to facilitate the sharing of distribution information, including market prices and direct transaction status, as well as a platform to promote cooperation and information sharing among PGs, aiming to improve operations by sharing best practices.

Market Creation by HUB-SPOKE

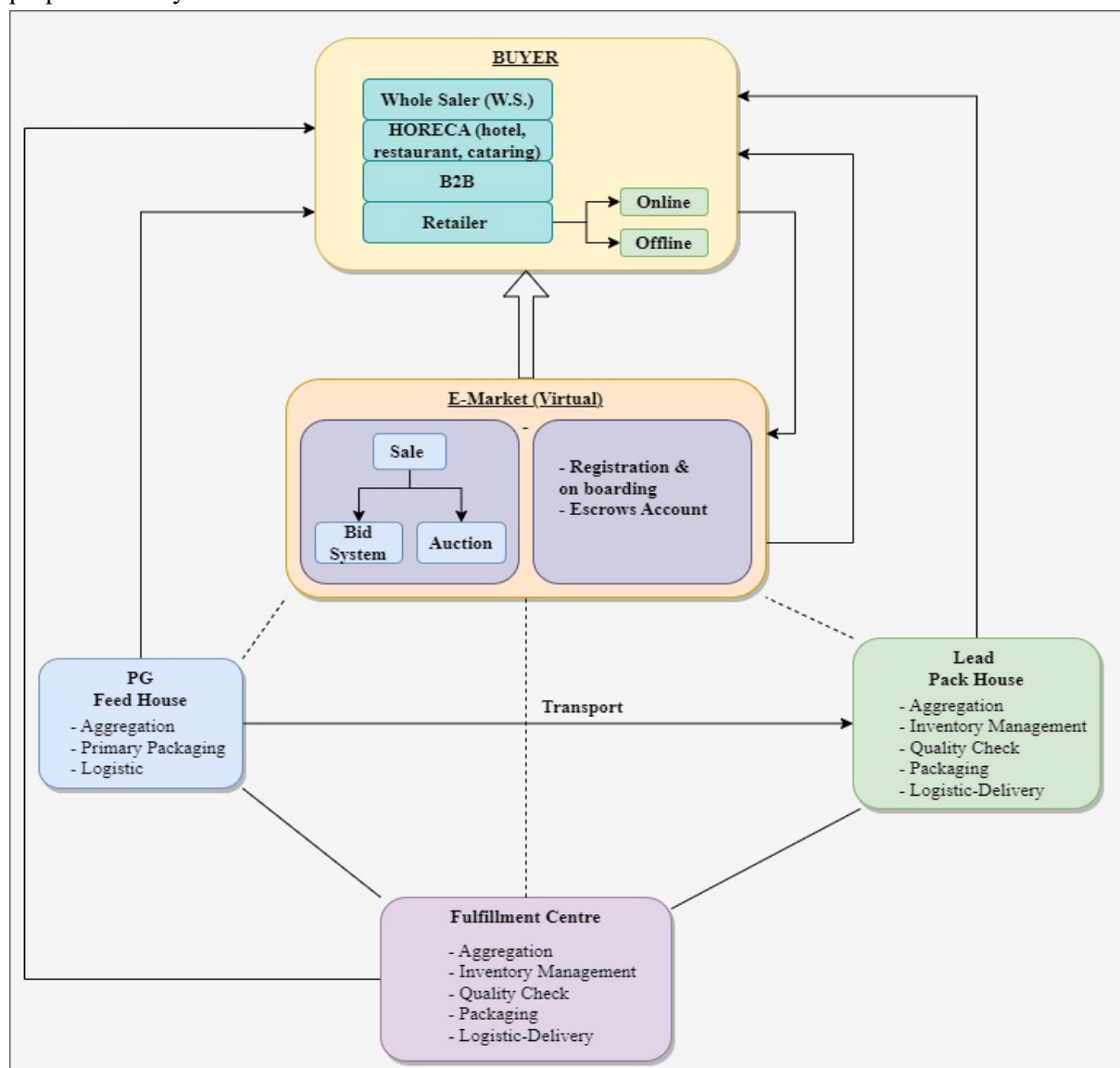
E-markets will be built along with HUB-SPOKE model infrastructure facilities (e.g., processing plants with cold storage and logistics) that will be established to support value chain building.

The physical market will function in sync with the digital system (DX) that incorporates all the services proposed in the E-market.

#### Physical Setup-

The market will be constructed with HUB-SPOKE and other supporting facilities like cold storage and processing plants with logistics. It will be equipped with all the necessary facilities, such as cold storage and cleaning and packaging services for the crops. and associated facilities will work in-synch with the proposed digital system as an operative platform incorporating all proposed services.

Creation of Cold Storage, Processing and Packaging Facilities (near Markets): The infrastructure facility will be part of the broader frame of the Agriculture transformation, and it will work in support of the proposed DX system.



Source: JICA Survey Team

Figure 6.4.12 Physical Setup of the DX system



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## **Administration And Management Setup (With Customer support Call Centre)-.**

### **PMU /PMC mobilisation for DX and its Management & Operation -.**

The State has a lack of expertise and workforce to conceive and implement large-scale digital systems on its own. The skilled manpower, Know-how of the latest technologies as well as administrative processes and procedures under the Government framework are the key factors as a bottle neck of New innovative.

Considering the fact the administrative setup / Special Purpose Vehicle (SPV) with expert Manpower (PMU/PMC team headed by the Client Authorities), This team will be responsible for initiating the process, controlling and executing all administrative and procedural tasks in collaboration with the Departments, Implement the proposed DX Platform as well as Data Centre, govern all activities, Prepare, and get approved all requisite policies through respective Department of Gov. or Haryana / India. Initially, this setup will be Implemented and operationalized by this team for a specific duration (Subject to the Government's discretion). After that, the same will be transferred to the Government nominated Agency / Department for further taking care.

### **The Call Centre -.**

Change management and its implementation always remain a big challenge. this is equally hard to beneficiary to understand the functionality and for this purpose and to resolve their routine grievances, a fully functional and equipped for this purpose and to resolve their routine grievances, a fully functional and equipped "Call Centre" will be a crucial part of this proposed system. The operation of these systems will be outsourced to the private sector.

The Graphical Idea of this whole setup showing integration with existing Agristack blocks (servers and services) is given below:

### **Data Centre Setup:**

The Government of India and other State departments are already implementing digital infrastructure for related services and the same also available as The Government of India and other State departments have already implemented digital infrastructure for related services and the same also available as infrastructure blocks available on a shared basis (even the cloud also available). However, the need for a dedicated server and data storage infrastructure is vital to implement and manage a large scale. Its setup is driven by huge data and transactions. It will also provide ease of execution and cost-effectiveness in the long run to own the system.

The Data center will also work as an "Infrastructure-as-a-service" to other private players or departments for further. It will also provide shared common building blocks to private service providers who are interested in providing innovative services based on shared resources under the DX program. It will also provide shared common building Blocks to private service providers who are interested in providing innovative services based on shared resources under the DX program. The proposed system will pave the path to making self-sustainable and resource full to earn revenue also.

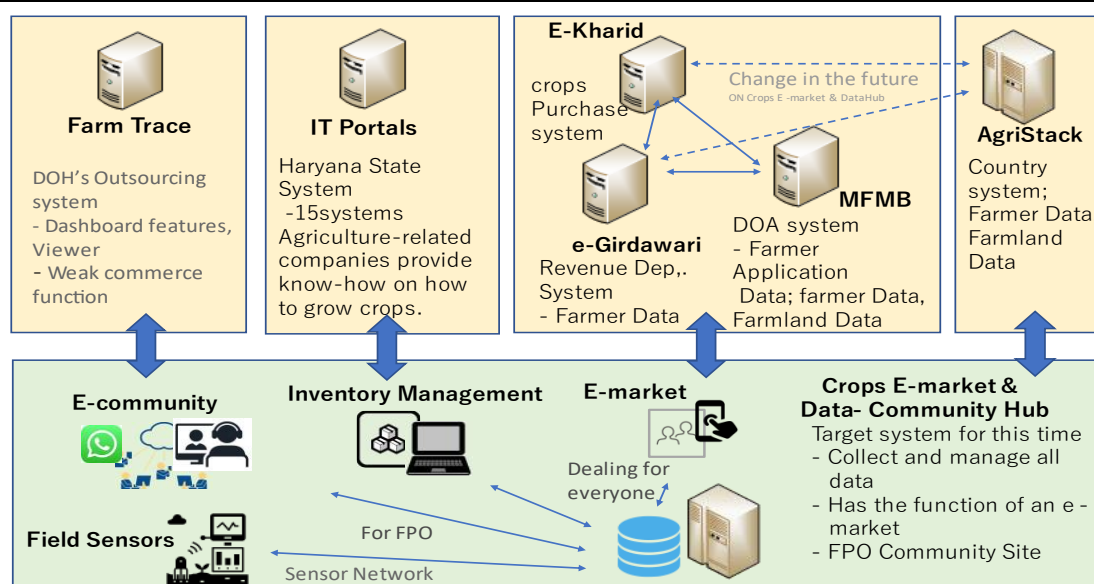
### **DX Portal (Software Modules)-**

The Government of India and its policies, under the InDEA and "Agristack" program, emphasize for shared the fact that Government of India and policies.

The InDEA and "Agristack" program emphasizes for shared utilization of building blocks as well as services being implemented and operationalized by various government and private sector. The system is in the development stage and still in this scenario.

We have designed it optional, and anyone can be selected based on suitability i.e. Fully owned and developed platform with all essential services and data blocks.

Below is the structure of the Portal with its Modules / Services:



Source: JICA Survey Team

**Figure 6.4.13 The structure of the Portal with its Modules / Services**

The above architecture shows the proposed layer of functionality with real-time data collection, processing, and generating results integrating with existing digital infra (building blocks) created and maintained under InDEA and the "Agristack" program.

The Government of India and its policies, under the InDEA and "Agristack" program, emphasize for shared utilization of building blocks as well as services being implemented and operationalized by various government and private sectors.

**Top Layer** - The above layer displays the available digital platforms and applications being implemented and maintained by the Haryana State Government as well as the Government of India, i.e., Farm Trace (A full fledged portal to provide functionality for registration and management of Farmers Group (Producers Groups) and related activities, E-Kharid (Crop Purchase System), e-Girdwari (Farmers Land and Revenue records management system), MFMB (The application provide interface to record and manage farmers farmland and crop production record with trading record through Producer Groups).

**Bottom Layer** – This is the proposed layer to implement and maintain the proposed system under the DX proposal for Haryana Horticulture (Agriculture) Department. This layer will be created with the tight integration (at the data layer) of the top layer (existing digital building blocks/application platforms). Broadly the capabilities included in the core 5 functionality. A brief description is below:

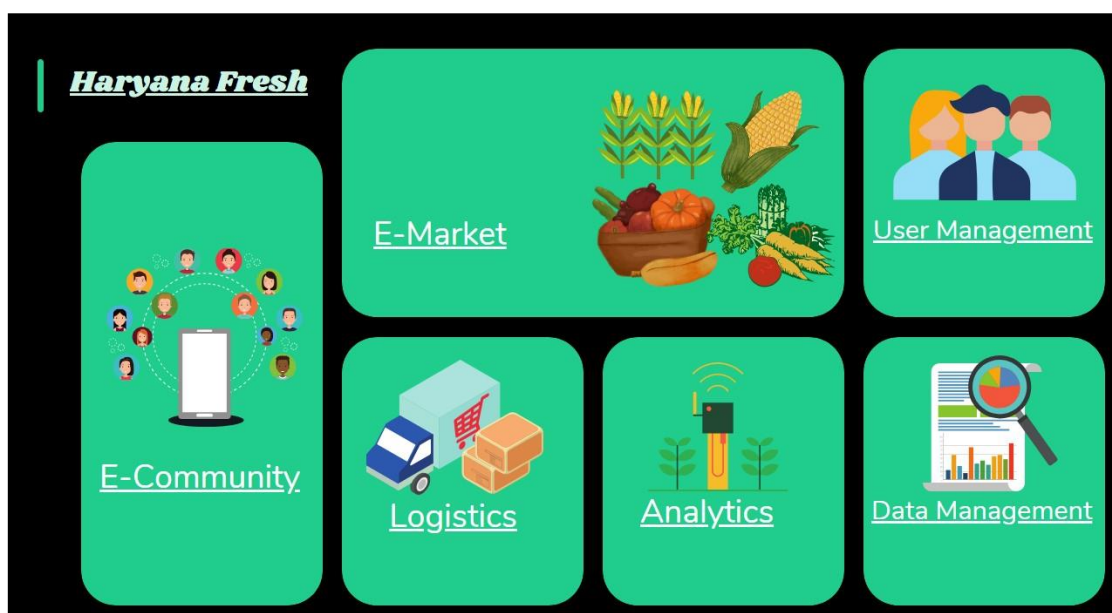
- i) **Crops e-market & Data community Hub** – the central data repository, or master database, for all records pertaining to farmers, their farms, corporate production, government-controlled trading (via digital or e-market), producer group records, their operations, and management, as well as information about the farmer's producer group community and chat data exchanged between them. The "Agristack" building blocks (several linked databases and servers) and this core system are directly integrated and communicate with one another. Additionally, it will feed all necessary data in a bidirectional, real-time way to the proposed system.
- ii) **E-Market** – An individualized and fully functional commercial platform that will offer e-marketing and trading functionality to frames as well as suggested buyers (Micro or Small Food Industries, Domestic/International Buyers) to sell and buy through availability, quality, or map-based geographic location with visual filters and figures. This platform also offers large buyers and sellers (such as PGs and Government Food Supply Departments) an auction- or bidding-based trade option.
- iii) **Inventory Management** – The suggested system connected to inventory and commercial/revenue-related data provides record management functionality to each individual user through this application interface. Additionally, this will make it easier for the government to distribute Direct Benefits to needy farmers who are poor according to government-prescribed standards in the event of any bad circumstances. Additionally, all

financial transaction records will be accessible here for archival purposes. The system will directly integrate with the above two modules (data sets).

- iv) E-Community – This will be the government-controlled social platform to provide the functionality to create, communicate and collaborate register farmers, PGs, and other stakeholders. The application will work in an integrated manner with the first two modules and pull-push information from various knowledge-based building blocks available under InDEA and Agristack.
- v) Field Sensors – This IoT will sense and collect real-time data directly from farmland and other infra created and identified under the proposed system to feed the proposed master platform / DX Server. This information will be collected data in various formats, and the system will modulate the information to feed the Analytics engine to produce real-time advisory and other predictive/analytical reports to farmers and Government Departments.

The proposed DX Portal will work as a single platform with all requisite functionality for its dedicated / registered Users (like Department, PGs, Farmers and Big Agro-Business Houses etc.) also provide a platform to Small and medium-sized enterprises (SMSEs), Individual farmers, Domestic buyers etc. to buy or sell products through self-registration services.

Based on the above functionality, below is an indicative DX portal UI page for your understanding: Below are the screenshots for the proposed system low fidelity wireframes:

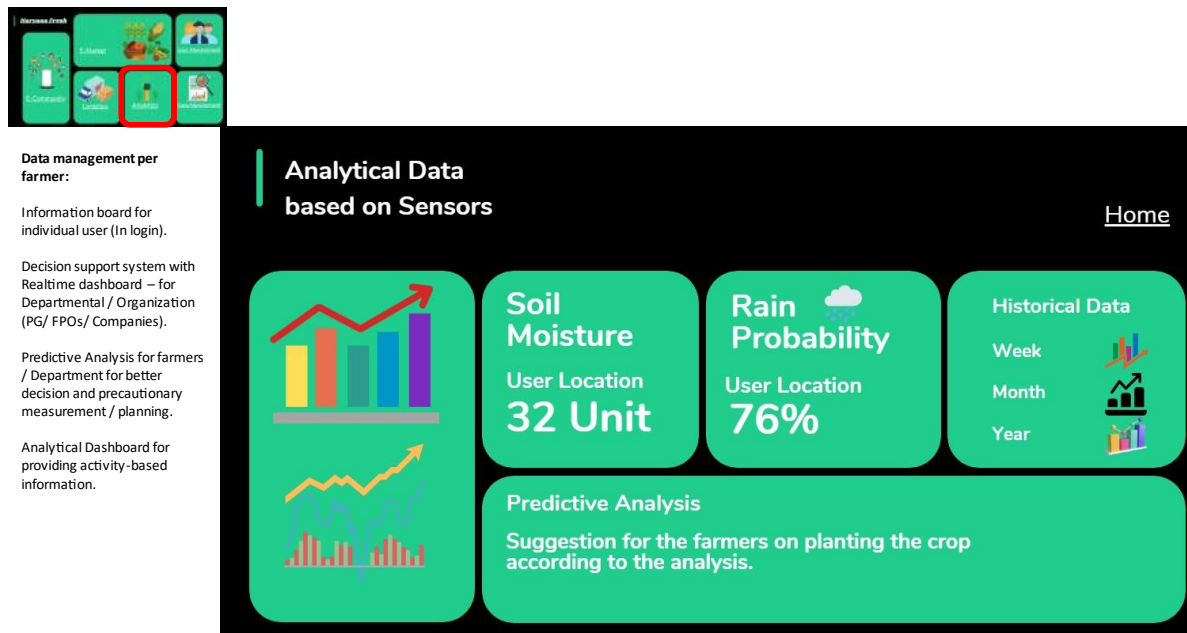


Source: JICA Survey Team

**Figure 6.4.14 Structure of the Portal with its Modules / Services**

Below are the major functionalities proposed under the Web Based (Browser / mobile platform based) platform:

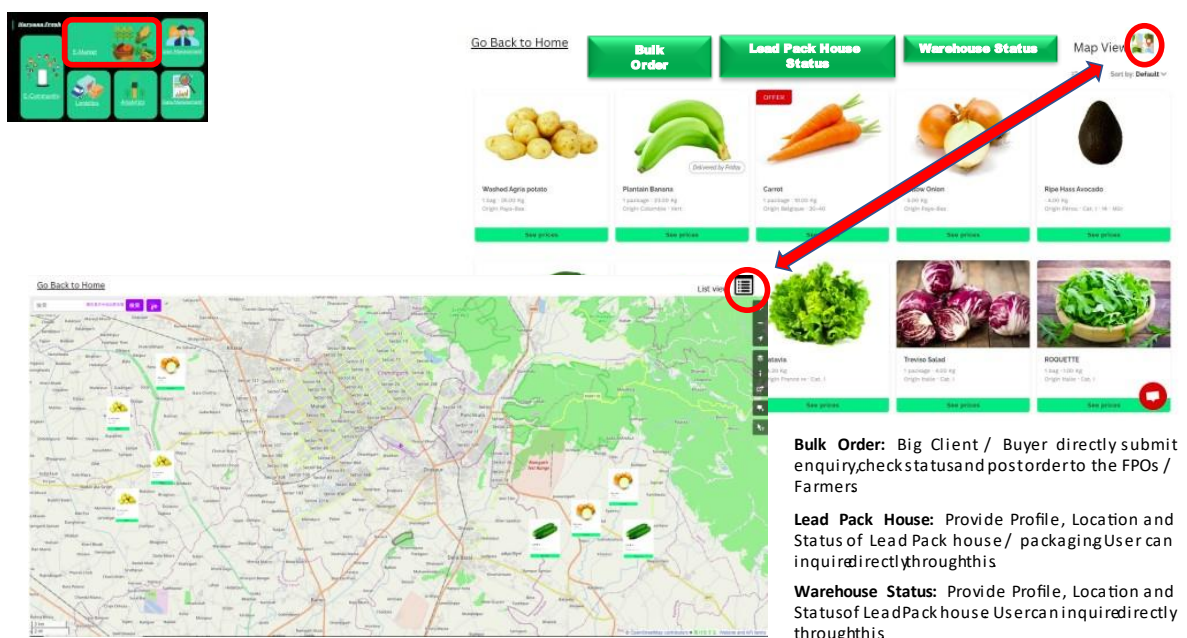
1. Registration - Functionality to register by the department through Unique Farmer Identity (UFID) or Self Registration through Know Your Customer (Based on Unique Identification Number). The login-based access and digital profile will provide secure access to all available services in a seamless manner. A user can register as a seller or buyer or for both sections with due formalities digital.
2. E-Record - This Functionality maintains all the records related to the registered user and transactions made by a user. This will also provide a predictive and analytical dashboard of usage and user activities.
3. News Board - This unique section will provide location-based (in individual user login) weather forecasts, Soil & Water conditions. Expert forecasting for Crop harvesting etc.



Source: JICA Survey Team

**Figure 6.4.15 Structure of the Portal with its Modules / Services**

- E-Market - A fully functional marketplace with a display of products (to select), crops its price and availability. The e-market also provides functionality to search products based on auto analysis or manual search on the facts like Season availability, Best Price, Market availability, Demands and surplus products, Discounts, In-Trends This platform also provides a facility to buy or sell products directly.

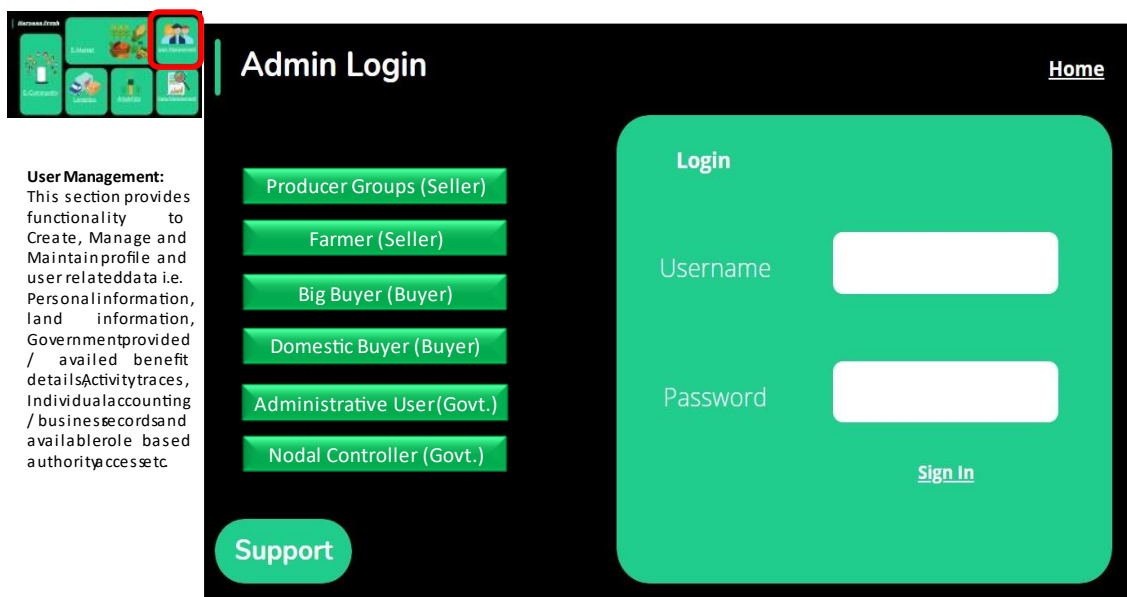


Source: JICA Survey Team

**Figure 6.4.16 Structure of the Portal with its Modules / Services**

- E-Inventory – A dedicated inventory management module. It records inventory based on auto entries/activities as well as manual entries (if required). (Note – E-Market and E-Inventory will work together to generate and maintain sales invoices and inventory records and vice versa.
- Account Module – It will provide the functionality to maintain and manage the

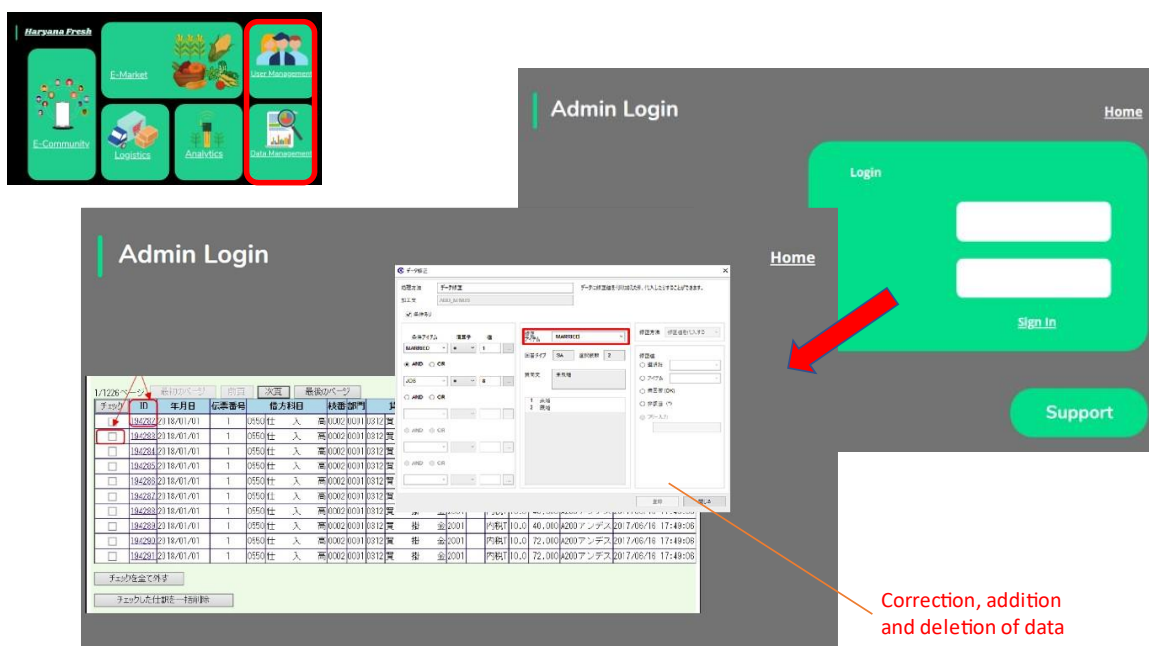
accounting/financial record of the user/s through their logins. Will integrate with Direct Benefit Transfer (DBT) system and payment gateways for financial transaction execution.



Source: JICA Survey Team

Figure 6.4.17 Structure of the Portal with its Modules / Services

7. Geo-Fencing and Land Record Management Module - Provide a place to capture (automatically) farmers' land records and its geo location with It will also support the government to analyse the production capacity and trends for further planning and decision.

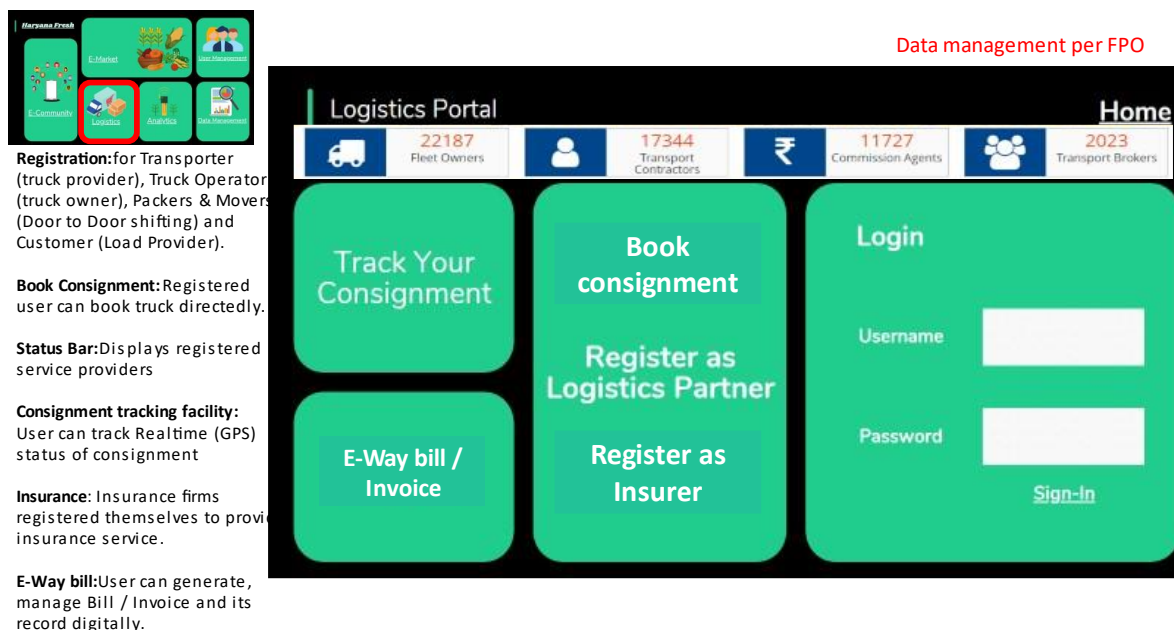


Source: JICA Survey Team

Figure 6.4.18 Structure of the Portal with its Modules / Services

8. Supply-Chain and Logistic Module - This module will facilitate the companies who are registered on the Portal for logistic activities as well as managing and monitoring the supply chain for products.





**Registration:** for Transporter (truck provider), Truck Operator (truck owner), Packers & Movers (Door to Door shifting) and Customer (Load Provider).

**Book Consignment:** Registered user can book truck directly.

**Status Bar:** Displays registered service providers

**Consignment tracking facility:** User can track Realtime (GPS) status of consignment

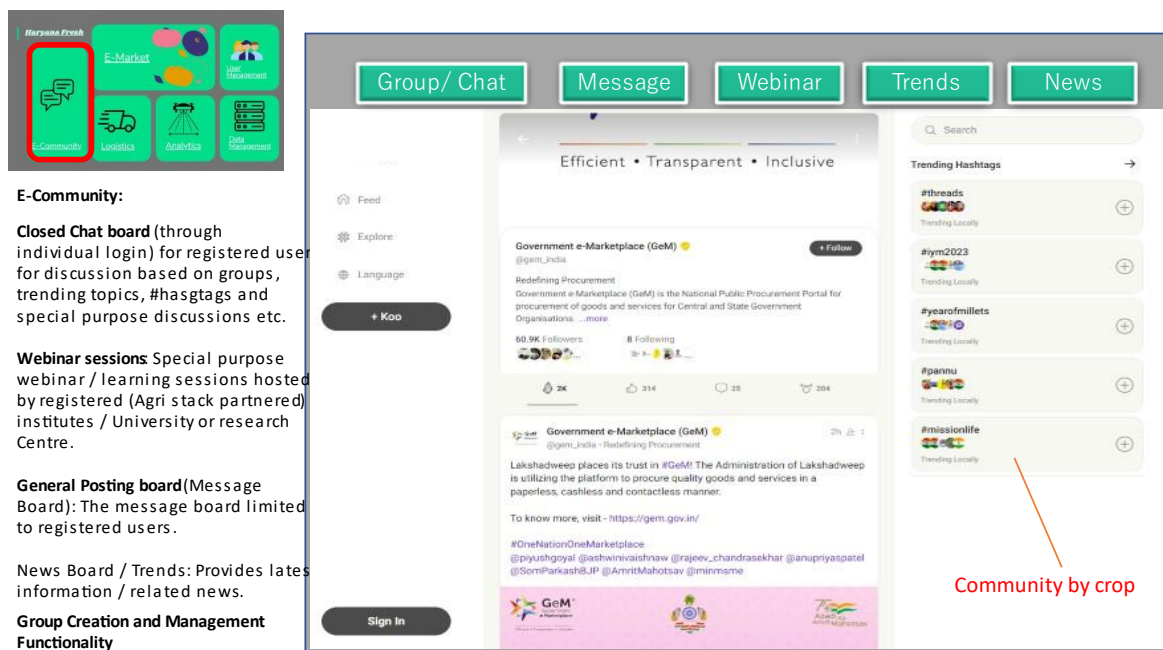
**Insurance:** Insurance firms registered themselves to provide insurance service.

**E-Way bill:** User can generate, manage Bill / Invoice and its record digitally.

Source: JICA Survey Team

**Figure 6.4.19 Structure of the Portal with its Modules / Services**

9. Compliance & Insurance Management - This unique and integrated functionality will assist farmers in alerting about insurance, obtaining the service provider companies will integrate their servers to provide insurance and financial transactions. Other statutory compliances will also do through this module directly from personal login.
10. E-Community - A social platform available through individual login (for private chat and mail) as well as a group discussion platform for information exchange. Users also interact with people through this social platform. This will also integrate with other platforms to extend the global reach.



**E-Community:**

**Closed Chat board** (through individual login) for registered users for discussion based on groups, trending topics, #hashtags and special purpose discussions etc.

**Webinar sessions:** Special purpose webinar / learning sessions hosted by registered (Agri stack partnered) institutes / University or research Centre.

**General Posting board** (Message Board): The message board limited to registered users.

**News Board / Trends:** Provides latest information / related news.

**Group Creation and Management Functionality**

Source: JICA Survey Team

**Figure 6.4.20 Structure of the Portal with its Modules / Services**

11. Other Miscellaneous Functionality: In this head, various supportive functionalities, as well as other functionalities identified and instructed by in this head, various supportive functionalities

as well as other functionalities identified and instructed by the department/s, will be implemented.

### 6.4.3 Branding

**Table 6.4.3 Outline of Branding activity**

Activity	Purpose	Implementation	Scale	Use of Funds
Promotion and sales promotion of Haryana Fresh, a vegetable produced in Haryana	To establish "Haryana Fresh" as a renowned and trusted brand for quality vegetables produced in Haryana, enhancing market reach and customer loyalty.	Lead Executers: PMU, Supervisors: PMC	Duration: 5 years	<ul style="list-style-type: none"> <li>• Marketing Survey,</li> <li>• Marketing Campaigns,</li> <li>• Packaging Development</li> <li>• Quality Certification</li> <li>• Distribution Channels Expansion</li> </ul>

Source: JICA Survey Team

Support the Development of a brand called "Haryana Fresh" to promote Haryana horticultural crops to aid local farmers by boosting their market value and consumer awareness, thereby contributing to the local economy.

In the step of Branding Strategy, the Brand Strategy Section will be launched. The section will define brand positioning, identify target markets, and create a pricing strategy.

The Development of the Sales Strategy steps include organizing pop-up events and produce markets, setting up online sales, and using Geographical Indications (GI) tags.

The Development of the Promotion Strategy step will encompass planning social media marketing, organizing collaborations with influencers, participating in exhibitions and trade fairs, developing a packaging and labelling strategy, and designing and adopting the 'Haryana Fresh' logo and mark.

Key activities of Building Partnerships will be undertaken to build partnerships, establish collaborations with businesses, discuss and plan specific activities, and promote Haryana Fresh in schools.

In addition, considering the fact that most of women groups are engaged in food processing in Haryana, the activities of food processing will be developed in accordance with Branding Strategy, Sales Strategy and Promotion Strategy.

**Table 6.4.4 Development of Branding Strategy**

1.1	Define Brand Positioning	Establish the brand's identity by focusing on quality, local freshness, and environmental friendliness.
1.2	Identify Target Market	Identify high-income, young, and health-conscious consumers as the primary target market.
1.3	Develop Pricing Strategy	Price products slightly higher than competitors to reflect the brand's high-quality image.
1.4	Approval of the "Haryana Fresh" Brand Name	Finalize and approve the brand name "Haryana Fresh."

Source: JICA Survey Team

**Table 6.4.5 Development of Sales Strategy**

2.1	Plan Product Placement	Place products in supermarkets frequented by the target market.
2.2	Organize Pop-up Events and Produce Markets	Host special events focusing on local vegetables to boost visibility and sales.
2.3	Set Up Online Sales	Develop an online sales platform to reach a wider audience, especially young consumers.

2.4	Utilize Geographic Indications (GI) Tags	Use GI tags to promote Haryana vegetables as a premium product.
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Source: JICA Survey Team

**Table 6.4.6 Development of Promotion Strategy**

3.1	Plan Social Media Marketing	Develop a social media marketing strategy to increase brand awareness and reach.
3.2	Plan Collaboration with Influencers	Partner with influencers to promote the brand to their followers.
3.3	Participate in Trade Shows and Exhibitions	Showcase products at trade shows and exhibitions to increase brand visibility and network with potential buyers and distributors.
3.4	Develop Packaging and Labelling Strategy	Design packaging and labels that highlight the health benefits, origin, and quality of the products.
3.5	Design and Adopt the "Haryana Vegetable" Logo and Mark	Develop a unique logo and mark for Haryana vegetables to enhance brand recognition.

Source: JICA Survey Team

**Table 6.4.7 Building Partnerships**

4.1	Establish Collaboration with the DOH	Work closely with the DOH to ensure successful branding efforts.
4.2	Discuss and Plan Specific Activities	Continually engage in discussions with the DOH to plan and implement specific branding activities.

Source: JICA Survey Team

## 6.5 Component 3: Strengthening the functions of the State Horticulture Department

### 6.5.1 Installation of PMU and DPMU

Establish an effective PMU (1) and DPMU (22)

The planning concept, an element of institution building to manage project activities, is as follows. For Government projects, Project Management Units (PMUs) will be established as State-level project management units (SPMUs) and district-level project management units (DPMUs). DPMUs will be established by each District. The SPMU will be headed by a Project Director (PD), who will be followed by a Additional Project Director (APD) appointed by the Department of Horticulture (DOH). In the state PMU, the Planning officer, Administrative officer and Superintendent officer are to be assigned as supporting staffs and also, Fruit Expert (1), Vegetable Expert (1), Floriculture Expert (1), Medicinal & Aromatic Plants Expert (1), Post Harvest Management Expert (1), Infrastructure Development (1), Institutional Development (1), Financial Management (1), Monitoring & Evaluation (1), Tender & Procurement (1), Branding & Marketing & Public Private Partnership(1), Food Processing & Quality Control (1), Geographical Information System Expert (1), Gender and Nutrition Expert (1), Environmental and Social Expert (1) are to be assigned as Subject Matter Specialists (SMS).

The DPMU will be headed by 22 Deputy Project Director (PD) appointed by the Department of Horticulture (DOH). Under Deputy Project Directors, Horticulture Extension Services (22), Marketing & Quality Control (22), Institutional & Farmer Group Development (22), Infrastructure Engineer (22), Horticulture Development Officer (44) and Environmental and Social management / monitoring (22) will be assigned.

The envisaged SPMU and DPMU structure is as follows;

**Table 6.5.1 PMU structure**

PMU (State Level)		
No.	Name of Position	No. of Personnel
1	Project Director (PD)	1



PMU (State Level)		
No.	Name of Position	No. of Personnel
2	Additional Project Director (APD)	4
3	Administrative Officer	1
4	Planning officer	1
5	Superintendent	3
6	Assistants	6
7	SMS	
7-1	Fruits Expert	1
7-2	Vegetable Expert	1
7-3	Post Harvest Management Expert	1
7-4	Packhouse/Infrastructure Development Expert	4
7-5	Institution Development	1
7-6	Financial Management	1
7-7	Monitoring and Evaluation	1
7-8	Tender and Procurement	1
7-9	Branding and Marketing and Public Private Partnership	1
7-10	Food Processing and Quality Control	1
7-11	Dx expert	1
7-12	GIS-MIS Expert	6
7-13	Gender and Nutrition	1
8	Drivers	4
9	Computer Operator	1
10	Private Secretary	1
11	Personal Assistant	6
12	Office Attendant	6
13	Peon	6
<b>Total</b>		45

Source: JICA Survey Team

**Table 6.5.2 DPMU structure**

DPMU (District Level)		
No.	Name of position	No. of Personnel
1	Deputy Project Director	22
2	Horticulture Extension Services (HES)	22
3	Marketing and Quality Control (MQC)	22
4	Institution and PG Development (I&PGD)	22
5	Infrastructure Engineer (IE)	22
6	HDO	44
7	Environmental and Social management / monitoring	22
8	Accountant	44
9	Computer Assistant	22
10	Office Attendant	22
11	Peon	22
<b>Total</b>		286

Source: JICA Survey Team

## 6.5.2 Strengthening the capacity of DOH

This activity mainly aims to strengthen the capacity of DOH necessary for project implementation. The contents are capacity building of PMU staff, Review of an overall project implementation plan, and procurement of necessary materials and equipment.

As for the content of the workshop/training, first, orientation workshops will be conducted, and the outline of the purpose and components will be explained. The Project will strive to have a common understanding among the PMU staff and other stakeholders through this orientation workshop. After that, the PMU staff will be provided with knowledge of project cycle management and basic knowledge of managing the Project in the PDCA cycle and necessary technical knowledge to carry out the Project. The contents of the capacity development workshops and trainings are as follows.

**Table 6.5.3 Outline of State-level workshop**

Outline of the workshop/Training	Target/ Participants	Duration and No of Participants
Orientation Workshop	Target/Participants: SPMU staff	1 time
	Target/Participants: DPMU staff	22 times (in each District)
Workshops on utilization of PDCA cycle and progress Review	Target/Participants: SPMU staff	10 times (Intermittently) No of Participants is as per the no of project staff.
	Target/Participants: DPMU staff	220 times (10 times in each District)
HRD training on Team building, leadership, motivation, and stress management	Target/Participants: PMU	6 times (Intermittently)

Source: JICA Survey Team

### (1) Review of the overall project implementation plan

It is proposed that a wide variety of activities be managed in an overall implementation plan. This plan will be owned by the PMU, DPMU, and PGs during project implementation and will be developed and updated as needed; after project completion, the overall plan will be owned by the DOH. In order to sustain project results after project completion, the activities necessary for a smooth transition will need to be incorporated into the institutional development component.

Flexible activity and budget management will be considered based on this plan. Progress will be monitored and evaluated by stakeholders as appropriate, and revisions will be made at least annually, taking into account farmers' needs and surrounding circumstances.

The PGs plans to develop strategic crops, production targets, and cultivation plans, while the DPMU and TSG plan to develop production plans accordingly.

### (2) Procurement of Equipment and Tools for PMU

The activities of Strengthening the capacity of DOH will involve procuring equipment and tools for PMU. The equipment, including office, furniture, and vehicles for project implementation by PMU, is considered tentatively as the following table.

The expected equipment and tools are also tentatively listed below.

**Table 6.5.4 Equipment and Tools for PMU**

Items	Amount
New building for State PMU in DOH	1
New building for DPMUs in 22 Districts	22
Furniture & office equipment for State PMU	1
Furniture & office equipment for 22 DPMUs	22
Procurement of new vehicles: New 6 vehicles (SPMU)	6
Hiring vehicles: 22 nos. (22 DPMUs)	22
Project Operational expenses	1
Countermeasures for COVID-19	1

Source: JICA Survey Team

### 6.5.3 Strengthening the capacity of horticulture extension services

In this component, workshops and training will be conducted for DOH staff for capacity building in project implementation and professional development, including SHEP awareness.

Activities include conducting State Level Workshops for planning and monitoring of implementation schedules, and SHEP approaches for various units, organizing District and Block-level workshops for various departments in each District, providing guidance on vegetable cultivation techniques to field-level officers and PG motivators guidance, and conducting overseas training and visits/training for project staff and other stakeholders.

State-level and District level workshops will be held for PMUs, PMCs, DPMUs, and training institutions to plan implementation schedules, monitor implementation schedules, and familiarize them with the SHEP approach. Vegetable cultivation techniques training will be held for DHO, HDO field-level officers, and PG motivators.

Training and capacity building for DOH staff in the horticulture sector. Improve their specialist knowledge. (including SHEP awareness)

Overseas Training programs will be conducted in Japan to deepen understanding of Japan's advanced agriculture and agricultural policies and to improve agricultural value chain development in Indian countries. These programs often include consultations with the Government and visits to private companies and distribution agencies that own advanced agricultural technologies.

#### (1) State-Level Workshop

To establish a common understanding of project implementation modalities, the project staff of State level will be given workshops as below. The workshops will be carried out by the PMU officials and PMC at the initial stage of the Project.

**Table 6.5.5 Outline of State level workshop**

Outline of the workshop	Target/ Participants	Duration and No of Participants
<ul style="list-style-type: none"> <li>• Role and function in HSHPP (Haryana Sustainable Horticulture Promotion Project)</li> <li>• Planning of implementation schedule</li> <li>• Monitoring of implementation schedule</li> <li>• Result analysis and planning for next year</li> <li>• Thematic issues related to horticultural techniques</li> <li>• Gender sensitization</li> <li>• SHEP approach for motivating farmers</li> </ul>	<ul style="list-style-type: none"> <li>• Target/Participants: PMU, PMC, DPMU, and Training Institutes.</li> <li>• It will be undertaken by the PMU officials and PMC.</li> <li>• Workshops can be scheduled intermittently.</li> </ul>	<p>5 days (Intermittently)</p> <p>No of Participants is as per the No of project staff.</p>

Source: JICA Survey Team

#### (2) District level workshop

For the same purpose as the state-level workshops, workshops will also be provided to the project staff at the district level as outlined below.

**Table 6.5.6 Outline of District level workshop**

Outline of the workshop	Target/ Participants	Duration and No of Participants
<ul style="list-style-type: none"> <li>• Role and function in HSHPP (Haryana Sustainable Horticulture Promotion Project)</li> <li>• Planning of implementation schedule</li> <li>• Monitoring of implementation schedule</li> <li>• Result analysis and planning for next year</li> <li>• Thematic issues related to horticultural techniques</li> <li>• Gender sensitization</li> <li>• SHEP approach for motivating farmers</li> <li>• Nutrition improvement for human health through vegetable &amp; fruit intake</li> </ul>	<ul style="list-style-type: none"> <li>• Target/Participants: DPMU, HES, MQC, I&amp;PGD, IE.</li> <li>• It will be undertaken by the PMU officials and PMC.</li> <li>• Workshops can be scheduled intermittently.</li> </ul>	<p>5 days (Intermittently)</p> <p>No of Participants is as per the No of project staff.</p>

Source: JICA Survey Team

### (3) Vegetable cultivation techniques training

For capacity development of DOH staff in the horticulture sector, the training will be planned based on the capacity assessment of farmers and PGs and the demand for target crops and markets.

COEs and training centers could be utilized for the training. The training curriculum must compose for the fulfillment of the contents as below. The trainees will be expected to extend their knowledge and experience learned from training to colleagues and to practice it on the job training of extension activities for farmers and PGs in the districts in charge.

**Table 6.5.7 Outline of Vegetable cultivation techniques training**

Outline of the Training	Target/ Participants	Duration and No of Participants
<ul style="list-style-type: none"> <li>• Cropping pattern</li> <li>• Water-saving techniques, Optimum use of water</li> <li>• On-time application of fertilizer</li> <li>• Plant protection techniques</li> <li>• Intercultural management (weeding, hoeing, earthing up, pruning and training, etc.)</li> <li>• Harvest and post-harvest techniques</li> <li>• Cost and profit of cultivation</li> <li>• Gender sensitization</li> <li>• SHEP approach for motivating farmers</li> <li>• Nutrition improvement for human health through vegetable &amp; fruit intake</li> <li>• Monitoring and evaluation of activities</li> </ul>	<ul style="list-style-type: none"> <li>• Target/ Participants: DHO, HDO, field-level officers, and PG motivators</li> <li>• It will be undertaken by the PMU officials and PMC.</li> <li>• Training can be scheduled intermittently.</li> </ul>	<p>3 days (Intermittently)</p> <p>No of Participants is as per the No. of project staff.</p>

Source: JICA Survey Team

### (4) Overseas Training (Necessary to discuss with DEA, JICA India Office)

Overseas Training programs will be conducted in Japan to deepen understanding of Japan's advanced agriculture and agricultural policies and to improve agricultural value chain development in Indian State of Haryana. These programs often include consultations with the Government and visits to private companies and distribution agencies that own advanced agricultural technologies.

**Table 6.5.8 Outline of Overseas Training**

Main Topics	Destination	Participants	Number of Participants
<p>Japanese agricultural technology, Agri-tech and the supply chain system</p> <ul style="list-style-type: none"> <li>• Observation of fruits and vegetables that can rise in Haryana</li> <li>• Observation of small-size farmers and the small agriculture machinery</li> <li>• Precision Agriculture</li> <li>• Crop Varieties</li> </ul>	Japan	<ul style="list-style-type: none"> <li>• PGs members</li> <li>• Officers of DPMU and PMU</li> <li>• Officers of DOH</li> </ul>	4 each

Source: JICA Survey Team

#### 6.5.4 Baseline survey and impact assessments

The Project will have 2 baseline surveys;

1. Before identifying the eligible PGs (under DOH's budget)

The contents of baseline survey which is to be conducted by DOH is to establish the availability of horticulture crops, potential for the diversification, potential for the introduction of micro irrigation and farmer's willingness in horticulture clusters.

2. After the identifying the eligible PGs (under the budget of JICA ODA Loan)

The contents of the baseline survey and impact assessment are as follows.

**Table 6.5.9 Outline of Baseline Survey and Impact Assessment**

Survey	Contents	Remarks
<b>Baseline survey</b>	- A household survey in approximately 30 households per	Survey to be carried out by resource agency, supervised by District PMU at each site, under the

Survey	Contents	Remarks
	the eligible PGs (500 PGs)	overall coordination of State PMU with technical and managerial support by project consultant and TSG for TOR preparation, selection of survey contractors, field execution, analysis & evaluation, report preparation, and dissemination. Through the process of these activities, we will strengthen the capacity of PMU and DOH staff.
<b>Mid-line survey</b>	A household survey in approximately 30 households per the eligible PGs (500 PGs)	• Survey to be carried out by resource agency, supervised by District PMU at each site, under overall coordination of State PMU. Through the process of these activities, we will strengthen the capacity of PMU and DOH staff.
<b>End-line survey</b>	A household survey in approximately 30 households per the eligible PGs (500 PGs)	• Survey to be carried out by resource agency, supervised by District PMU at each site, under the overall coordination of State PMU. Through the process of these activities, we will strengthen the capacity of PMU and DOH staff.

Source: JICA Survey Team

## 6.6 Convergence

As several government schemes and donor supported projects are implemented in the state, there is a high likelihood of overlapping of interventions as well as geographical coverage. Thus, the Survey Team has attempted to map out the government schemes and other projects that are implementing similar activities. In the table below, the concerned departments, schemes and projects are listed.

**Table 6.6.1 Summary Table of Potential Convergence Partners**

Scope	Key Project Activities	Potential Partner Departments, Schemes	Donor Assisted Projects
1.1	Strengthening of PGs	• SFAC	•
1.2	Micro Irrigation	• Mission for Integrated Development of Horticulture (MIDH). • Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) • Micro Irrigation & Command Area Development Authority (MICADA) Haryana • Command Area Development Authority (CADA) Haryana • Haryana Renewable Energy Development Agency (HREDA)	•
1.3	Horticulture guidance	• COE	•
1.3.1	Visual aid training material preparation	• COE • HTI	•
1.3.2-7	(Farm inputs (promotion of INM/ IPM, planting materials (seeds and seedlings))	• Krishi Vigyan Kendra (KVK) • MIDH • Paramparagat Krishi Vikas Yojana (PKVY)	• Known You Seed • COE for Citrus (Kinnow & Mandarin) at Progeny Orchard, Nanta, Kota • Ministry of Food Processing Industries Government of India • COE for PHM for Date Palm at Kutch
1.3.2-7	Training and Demonstration	• HTC • KVK • ICAR/ Council of Scientific & Industrial Research (CSIR) Institutes • HAMETI • ATMA • CoE	•
1.3.8, 1.3.9	Mushroom, Bee Keeping	• MIDH • COE	• National Institute of Health

Scope	Key Project Activities	Potential Partner Departments, Schemes	Donor Assisted Projects
			<ul style="list-style-type: none"> <li>• Ministry of Food Processing Industries Government of India</li> <li>• Indian Institute of Horticultural Research</li> </ul>
1.3.10	Nursery raising	<ul style="list-style-type: none"> <li>• CCDP</li> <li>• COE</li> </ul>	<ul style="list-style-type: none"> <li>• COE for cut flowers in Thally</li> <li>• COE for flowers at Krishnagiri</li> </ul>
1.3.13	Nutrition Improvement	<ul style="list-style-type: none"> <li>• Department of Education</li> <li>• Department of Medical Health and Family Welfare</li> <li>• ICDS</li> <li>• KVK</li> </ul>	<ul style="list-style-type: none"> <li>• National Institute of Health</li> </ul>
1.4	Public private partnerships	<ul style="list-style-type: none"> <li>• DOI</li> <li>• MSME</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
2.1	Infrastructure development		<ul style="list-style-type: none"> <li>•</li> </ul>
	Packhouse with the primary processing unit	<ul style="list-style-type: none"> <li>• MIDH</li> <li>• NABARD- RIDF</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
	Cold storage, refrigerated transport vehicle, an outlet for horticulture products	<ul style="list-style-type: none"> <li>• MIDH</li> <li>• SAMPADA</li> </ul>	<ul style="list-style-type: none"> <li>• FHEL (Fresh &amp; Healthy Enterprises Ltd.)</li> </ul>
	New and Upgrading of Post Harvest Centre/ Facilities	<ul style="list-style-type: none"> <li>• MIDH</li> <li>• Rashtriya Krishi Vikas Yojana (RKVY)</li> <li>• Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters (SAMPADA)</li> <li>• Pradhan Mantri Formalisation of Micro food Processing Enterprises (PMFME)</li> <li>• National Mission on Food processing</li> <li>• MSME (Directorate of Micro, Small, Medium Enterprises)</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
2.2	Building an E-market place and a information sharing platform	<ul style="list-style-type: none"> <li>• Farm Trace, IT Portals, E-kharid, e-Girdawari, MFMB</li> <li>• Agristack</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
2.3	Branding	<ul style="list-style-type: none"> <li>• MIDH</li> <li>• RKVY</li> <li>• One District One Product*</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

Source: JICA Survey Team

Depending on the project activities, PMU and DPMU shall identify the department, government schemes and projects to work with or to avoid duplication. The detailed modality and fund flow will vary depending on the identified department, schemes and projects; however, the following should be followed to facilitate the convergence.

**(1) Policy Decision To be Taken by the Governing Council**

To facilitate the convergence, the Governing Council shall discuss the policy of convergence and issue a letter to all the concerned departments to converge with the project during the initial stage of the project. This will give basis for other departments in the state to work with the project.

**(2) Taking Part in the District Monitoring Meeting Chaired by District Magistrate**

At each district, District Magistrate will hold the meeting with all the departments to follow up with the work progress. In this meeting, the potential departments/ schemes can be identified, and DPMU will begin negotiation with the officers concerned.

**(3) Direct Consultation with Projects and Other Organizations**

In case of the projects assisted by donor organizations, the PMU will directly approach the respective projects for consultation.

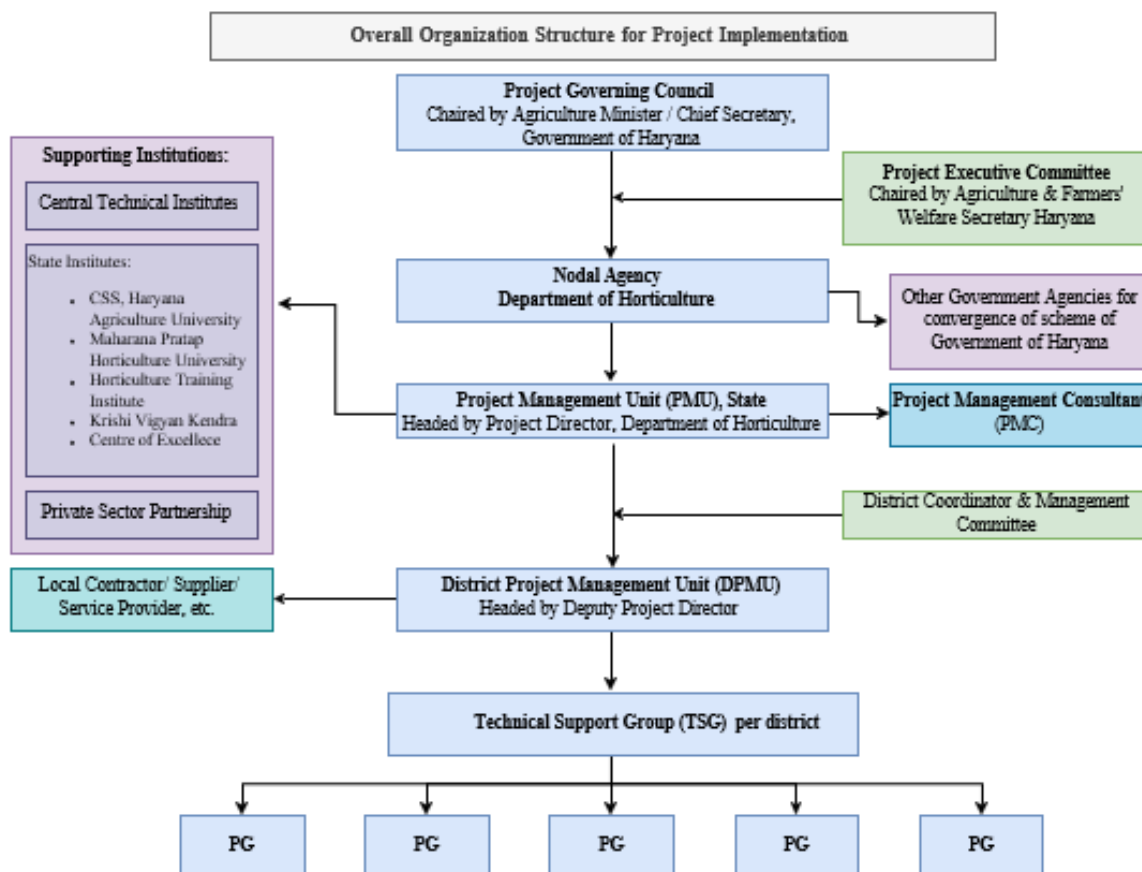
## Chapter 7 Implementation Plan

### 7.1 General

This chapter deals with the implementation plan of the Project, Haryana Sustainable horticulture promotion project, which is comprised of the project organizational structure, implementation procedure, fund flow, procurement plan, and implementation schedule.

### 7.2 Overall Project Organizational Structure

The overall project organization structure is proposed as shown below.



Source: JICA Survey Team

**Figure 7.2.1 Overall Organization Structure for Project Implementation**

The supporting institutions are administered by Central Technical Institutions, State Institutes, and Private Sector Partnership. The supporting institutions are responsible for sharing the knowledge, skills, and so on. Central Technical Institute are-

- i) IARI: To provide leadership for science-led sustainable and globally competitive agriculture for food, nutrition and livelihood security.

State Institutions are -

- i) CSS Haryana Agriculture University: To Provide human resources, skills and technology required for sustainable development of agriculture, including crop production, cooperation, forestry, agricultural engineering, community science and other allied disciplines by integrating education, research and extension.
- ii) Maharana Pratap Horticulture University: To develop diversified sustainable farming systems for improving productivity and profitability in horticulture and also to train the farmers and

extension functionaries for the effective dissemination of advanced horticultural technologies in Haryana and its neighbouring states.

- iii) Horticulture Training Institute: To challenges in the field of horticulture and to provide nutritional security to the masses the department with a vision “to make Haryana Modern Fruit and Vegetable Cultivation State with a vision to lead in domestic and export market” has earmarked
- iv) KVK: Extension
- v) CoE: To supply healthy vegetables seedling plugs throughout the year. Establishing intensive crop cultivation by demonstrating the latest agril technologies. To demonstrate production of high quality vegetables for both national & international market. To achieve optimum productivity & profitability per unit area.

### **(1) Project Governing Council**

The Department of Economic Affairs will be the nodal agency at the GOI level to review and monitor the project progress of the JICA-funded HRSHP.

GoHR will establish a State Level Project Governing Council (PGC) chaired either by the Agriculture Minister or Chief Secretary which will be decided by the Government of Haryana. The Secretary of Agriculture and Farmers Welfare will be the Secretary of this Committee. The PGC will meet once in six months to review progress, provide overall guidance and policy support and to facilitate inter-departmental coordination. The members of the PGC will include: (i) Secretary, Finance;(ii) Secretary, Agriculture and Farmers Welfare; (iii) Secretary, Rural Development; (iv) Secretary, Planning; (v) Secretary, of MSME / Industry; (vi) Secretary, Cooperatives, (vii) Secretary, Irrigation, and (viii) Project Director of HRSHP.

The Special Invitees to the PGC will include the Chief General Manager- National Bank for Agricultural and Rural Development (NABARD), National Cooperative Development Corporation (NCDC) regional office, representatives of the Haryana State Agriculture Marketing Board (HSAMB), and other state-level federations. Department of Horticulture (DOH) will be the nodal agency at the state level.

### **(2) Project Executive Committee**

GoHR will establish a Project Executive Committee (PEC) chaired by the state Secretary of Agriculture and Farmers Welfare, Haryana. The Project Director (PD) will be a member secretary. Project Implementation Agency and the representatives from government line departments (Additional Secretary of Finance, Director of Agriculture, Director of Planning / Economics and Statistics, Director of Industry, Chief engineer of Irrigation Department, Chief Executing Officer of State level Rural Livelihood Management, Managing Director of APMC, Representatives from JICA will be the members. The Special Invitees to the PEC will include the Farmer’s representatives.

The PEC will meet every quarter and the main function include.

- (i) Approving the Annual Work Plan and Budget (AWPB).
- (ii) Reviewing physical and financial progress.
- (iii) Reviewing progress towards achieving outcome indicators.
- (iv) Resolving implementation issues; and
- (v) Working towards achieving convergence between various government-sponsored activities and HRSHP activities.

Regarding the arrangement for the Project management and monitoring, PMU will act in the following roles.

- a. To organize PGC and PEC meetings.
- b. To submit the consolidated AWPB for approval of JICA, PEC and PGC.
- c. To prepare a Procurement Plan and submit it to JICA for approval.
- d. To prepare and submit consolidated progress reports annually and quarterly to JICA based on the progress reports submitted by PMU; and
- e. To undertake Monitoring & Evaluation (M&E) and Knowledge Management activities related to the project.

Regarding the financial arrangement, the financial unit under the PMU will act the following roles.

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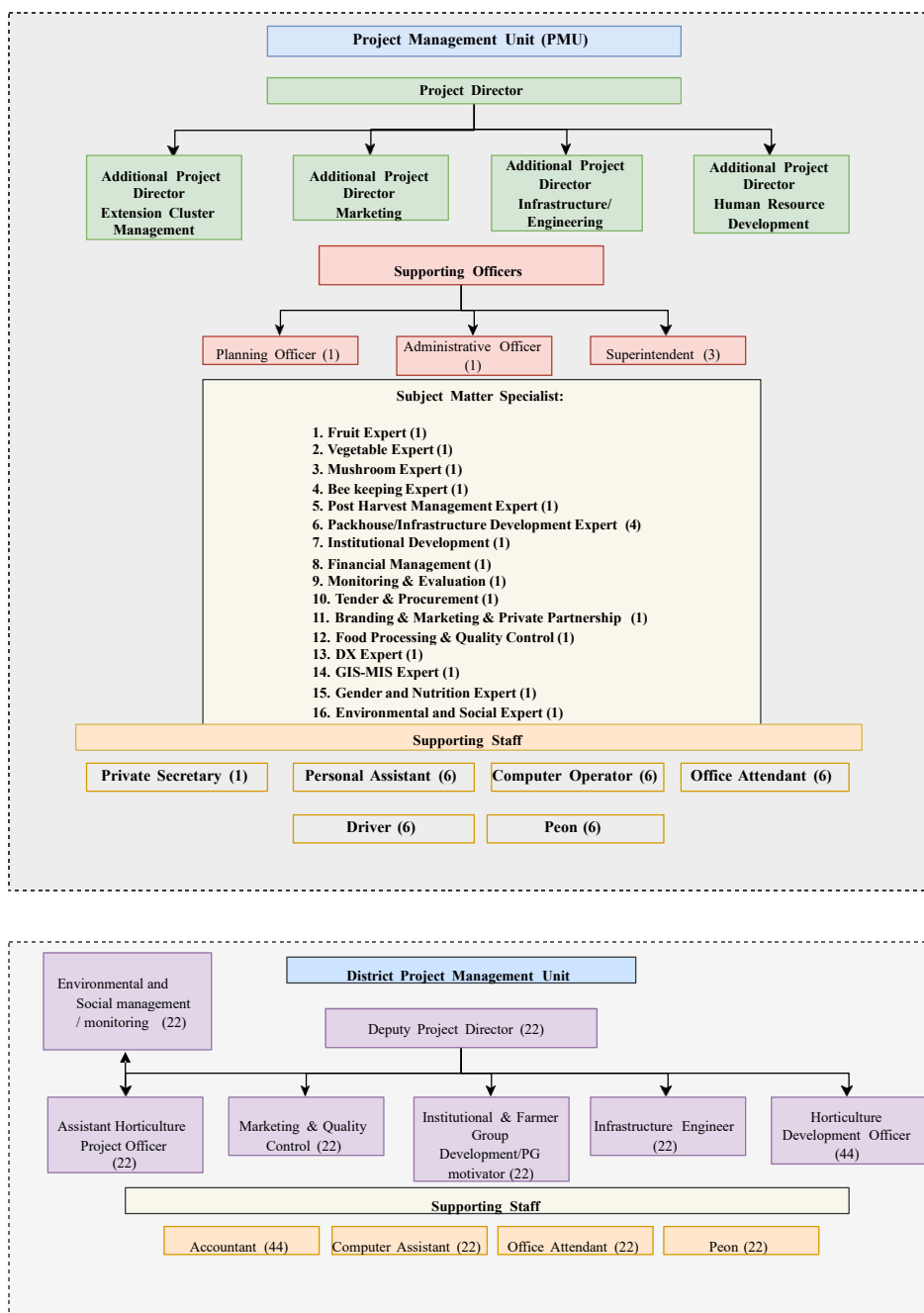
- a. To incorporate the budget requirements into the overall budget of the GoHR.
- b. To operate the Project Account for the timely release funds to PMU.
- c. To receive a statement of expenditure and supporting documents related to fund release to PMU and keep an account of fund release and utilization by each PMU.
- d. To prepare overall project financial statements.
- e. To prepare and submit the withdrawal applications to Department of Economic Affairs (DEA) for onward transmission to JICA; and
- f. To ensure preparation and submission of annual audit reports of PMU.

### **(3) District Coordination and Management Committees (DCMCs)**

The DCMC would be established in each District covered by the Project and would be chaired by the District Magistrate and co-chaired by the District anchayat Development Officer. The member secretary is a designated officer of District Project Management i.e., Deputy Project Director and members are district economics and Statistics Officer, District Agriculture Officer, General Manager of DIC (District Industry Centre), Executive Engineer Minor Irrigation, Farmer's representatives. The committee would coordinate project implementation at the district level and ensure linkages between the project, line agencies and other government agencies. The DCMC will meet quarterly basis. Project Management Unit (PMU)

The Department of Horticulture (DOH) will implement the Project through PMU and DPMU and DOH will depute efficient and qualified officers to run the project these officers will be supported by a group of domain experts and technical people hired from the market for the entire project period.

The Project Management Unit (PMU) and District Implementation Units (DIUs) will be formed as shown below.



Notes: \*) Dispatched from HRSHP  
Source: JICA Survey Team

**Figure 7.2.2 Organization Structure of Each PMU Office**

**Project Management Unit (PMU)**

The PMU will be responsible for the day-to-day implementation of the overall project activities, with District Project Management Units (PMUs) in the districts as needed. PMU will be headed by a full-time Project Director (PD). The main functions of the PMU will include the following:

- a. To coordinate and implement the project activities including procurement and

- consultation with JICA and under the guidance of PGC.
- b. To prepare Annual Work Plan and Budgeting (AWPB) and procurement plan for implementing the Project.
  - c. To finalize and execute partnership agreements/contracts with service providers and specialized institutions for implementing various project activities.
  - d. To establish an effective Monitoring & Evaluation (M&E) and management information system (MIS) to track the work progress from output, outcome, and impact perspectives.
  - e. To prepare and submit consolidated annual and quarterly progress reports to DOH.
  - f. To supervise and monitor the project-related activities and their progress towards achieving physical, financial and outcome related targets.
  - g. To prepare project financial statements and statements of expenditures related to project expenditure for submission to DOH;
  - h. To submit annual audit reports to DOH; and
  - i. To liaise with the state administration and line agencies to ensure coordination in project implementation.

The PD will be assisted by a core team staff comprising of various experts to manage the Project. The PD will be responsible for the day-to-day operations, including the following functions:

- a. Ensure that the PMU carries out its functions as set out in the Project Agreement.
- b. Supervise and monitor the activities of the PMU and its progress towards achieving physical, financial, and outcome-related targets.
- c. Oversee field operations at DMUs and provide overall implementation guidance.
- d. Operate the PMU's Project account.
- e. Recruit staff required for implementing the Project.
- f. Undertake project procurement.
- g. Ensure that the PMU's Project accounts are audited annually and in accordance with JICA's audit requirements and submitted the same to DOH; and
- h. Ensure that the PMU receives the required level of funding for carrying out the activities.

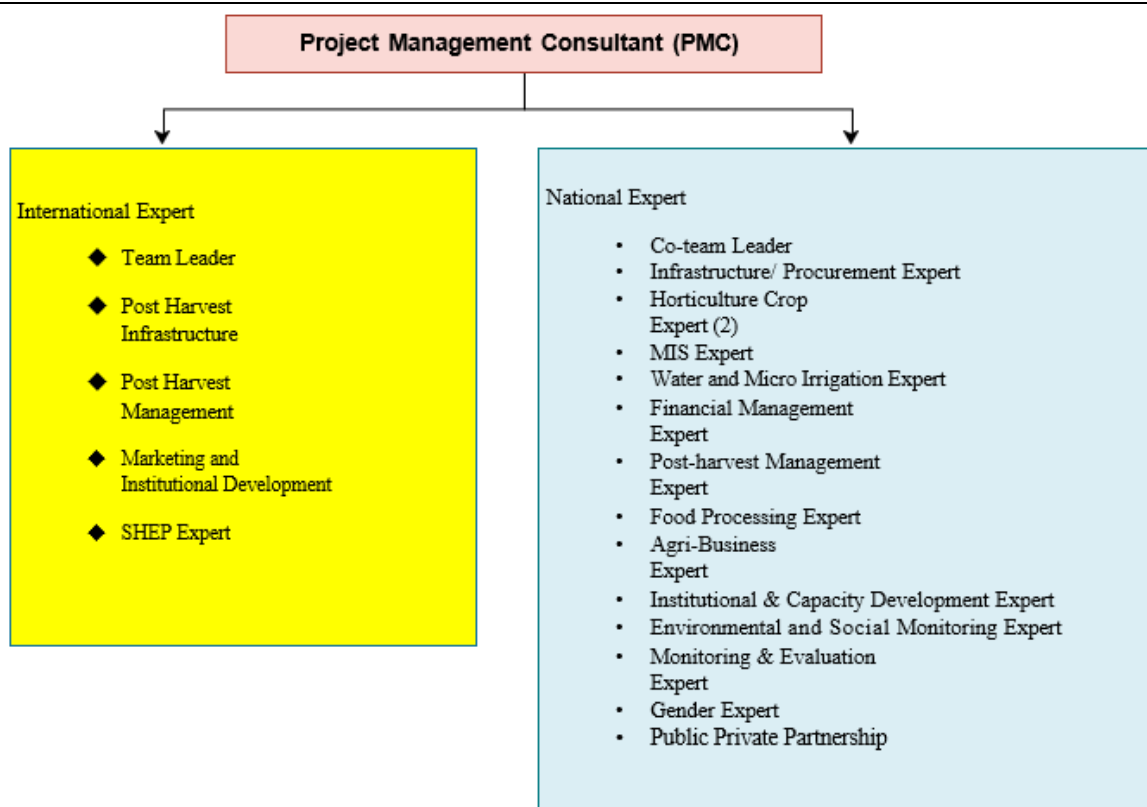
#### **District Project Management Unit (DPMU)**

The PMU will establish a District Project Management Unit (DPMU) at the districts. The Project will engage suitable agencies capable of undertaking all activities related to horticulture and livelihood support at the district level. At each district, technical staff under the guidance of their respective Deputy Project Director will implement the Project. In the Project, the functions of DPMU will include the following:

- a. Establish a district (or other) level office with a multidisciplinary team.
- b. Establish a cluster level office with a Technical Coordinator and a small team.
- c. Develop a plan for the cluster and facilitate the sourcing of funds and support the PGs and group members to implement the plan.
- d. Develop and implement a horticulture supply chain improvement plan for the PGs including irrigation and preventive measures against wild animal attacks.
- e. Ensure flow of funds to the PGs and groups for implementing their plans.
- f. Supervise and monitor implementation of all activities related to project implementation; and
- g. Link up with the service providers including private companies to implement the work plan.

#### **(4) Project Management Consultant (PMC)**

The Project Management Consultant (PMC) will be procured by the PMU utilizing the Japanese ODA loan to reinforce their implementation capacity, particularly to ensure technical and management support for the Project. The PMC will assist the PMU and DPMUs in the improvement of processes and procedures for project implementation at the state, district, and block levels.



Source: JICA Survey Team

**Figure 7.2.3 Organization Structure of PMC**

## **(5) Gender Monitoring**

### **(a) Overview:**

Gender and Nutrition Expert should be responsible for monitoring the gender related activities and indicators in the Gender Action Plan (GAP) for the Project. Gender and Nutrition Expert with assistance of PMC will provide guidance and directions of gender mainstreaming activities and monitoring the progress based on the indicators in the GAP.

### **(b) Task of Expert:**

- Prepare and finalize GAP and conduct periodical monitoring of the actions in accordance with GAP;
- Coordinate the Project's gender initiatives, provide strategic leadership and management, raise awareness, support policy and capacity building, work on resource mobilization, planning, programming and budgeting to ensure that gender equality and the empowerment of women are achieved;
- Provide advice and coordination for systematic orientation and learning of all DOH staff and stakeholders, to improve their capacity to fully integrate gender into policies, programs and projects;

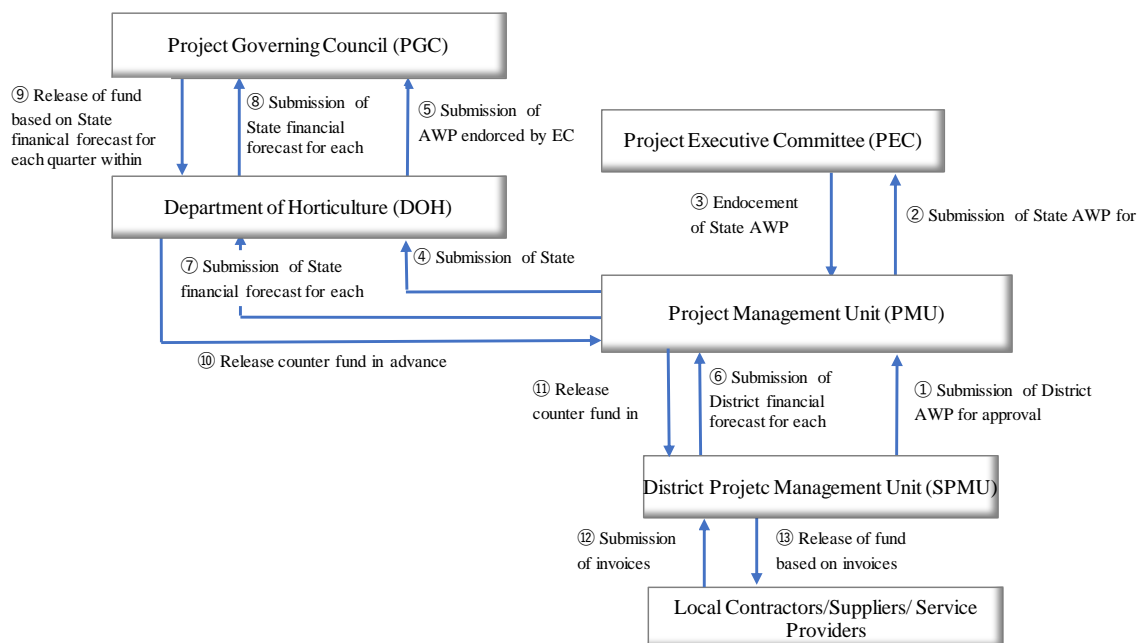
## **(6) Mechanism of Inter-Departmental Coordination and Knowledge Sharing**

The PMU shall arrange a monthly meeting for information exchange/sharing between PMU and HRSHP, in which DPMU shall participate in. In addition, PMU shall take the initiative for conducting project coordination meetings on a quarterly basis among the relevant organizations and stakeholders such as HSAMB, KVK/ University and other institutions etc.

## **7.3 Overall Fund Flow**

The financial year of the Project is from the 1st of April of the year to the 31st of March of the next year. As shown in the following figure, the project funding procedure will start with the submission to and

approval of the annual work plan and the annual budget (AWPB) from the PGC, and the same for the financial forecast for every quarter, and then the funds will be released to the PMU's account in advance.



Source: JICA Survey Team

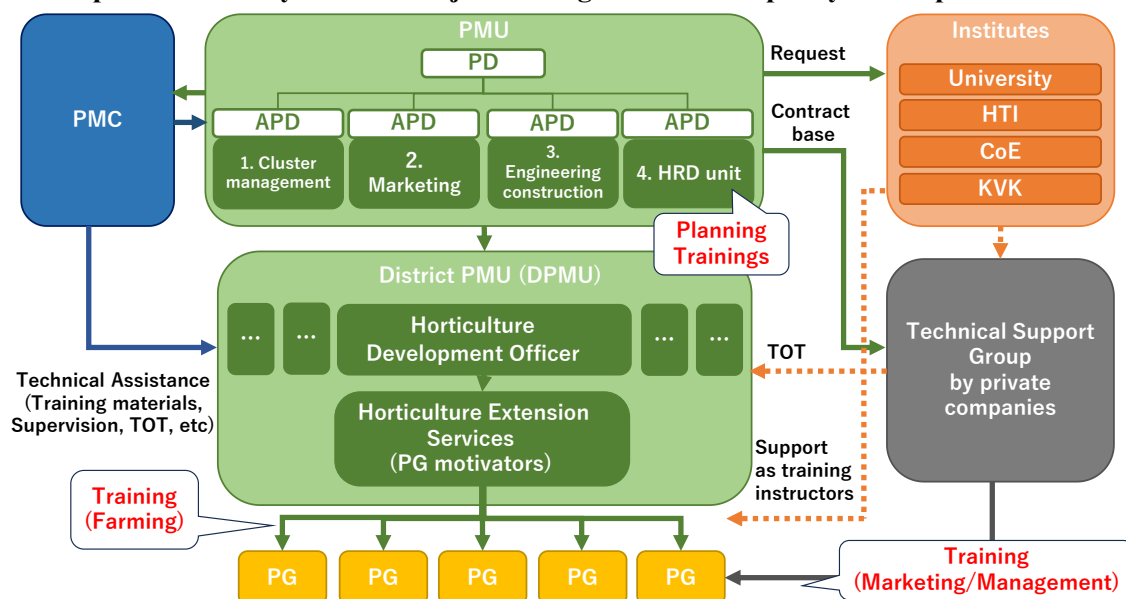
**Figure 7.3.1 Overall Fund Flow**

The maximum subsidy rate for the development of packhouses for this project is 90%. The Haryana government proposed that this subsidy be divided into two parts: a full government subsidy (half of the subsidised amount, up to 45%) and an interest-free loan from the government (half of the subsidised amount, up to 45%), to be repaid by the beneficiaries after a specified number of years.<sup>1</sup> The repayment from the interest-free loan could be considered for reinvestment as additional funds for future packhouse improvements. This is a novel approach to optimize the use of the loan and introduces a "skin in the game" concept, which is proposed to allow PGs to take ownership and ensure that the project's investment can be sustainably leveraged.

<sup>1</sup> This arrangement will not affect JICA's ODA financing.

The interest-free loan will be administered by the government-owned Haryana State Cooperative Apex Bank Limited (HARCO BANK, <https://www.harcobank.org.in/>). The PG receives an interest-bearing loan from a bank for the beneficiary's share and an interest-free loan from the government (HARCO) for half of the subsidy amount; the PG repays the interest-free loan to the government (HARCO) after the interest-bearing loan has been repaid to the bank. The nature of the interest-free loan provided by the Government (HARCO) will be considered on a case-by-case basis.

## 7.4 Implementation System for Project Management and Capacity Development



Source: JICA Survey Team

**Figure 7.4.1 Conceptual Frameworks on Extension Services**

In this Project, As shown in the diagram above, the Project Management Consultant (PMC) will teach farming techniques to Horticulture development officer and Horticulture Extension Services, which is called PG motivators, and Horticulture Extension Services will teach farming techniques to farmers of Producer Groups (PGs) in a cascade approach to farm extension activities. The Horticulture Development Officer and Horticulture Extension Services will teach techniques related to agricultural cultivation, while the Technical Support Group will teach PG farmers about marketing and management. The PMU will request training instructors from cooperating training institutions, as shown in the figure (e.g., University, HTI, CoE, and KVK). The Cooperating Institutions will provide training to the PGs as requested by the PMU, collaborating with a technical support group.

Some rural farmers have difficulty in accessing centres of excellence, resulting in a knowledge gap among farmers. To improve this situation, the Village of Excellence concept will be utilised. Villages of Excellence will act as an extension of the pilot farms of the Centres of Excellence, bringing progress and knowledge to the doorsteps of farmers who have difficulty accessing the central facilities.

It will be planned and managed by Deputy Director Horticulture (DDH) and PGs with DOE jurisdiction, and actual technical guidance will be arranged by instructors, including from the private sector as required.

It is proposed that villages of excellence will be established by utilising producer group leaders and existing facilities. Capital investment will therefore be kept to a minimum and the necessary horticultural tools, machinery and training materials will be provided at the time of establishing the village of excellence. Operational costs, maintenance and repair costs and incentives for producer group leaders will be considered.

In addition, the concept of the JICA-led Small-Scale Horticulture Empowerment Project (SHEP) will be piloted. In the initial phase of each activity, a market survey will be conducted by PG representatives under the guidance of the TSG to determine current agricultural production and market demand in each district/cluster. The results will be shared with farmers belonging to the PGs and further detailed plans will be developed. In the training program for farmers, farmers themselves conduct market surveys to identify market needs and develop business plans (action plans), including cropping patterns, varieties and technologies to be applied.

## 7.5 Procurement Method and Plan

### (1) Procurement Method

The Project plans to procure (a) construction works, (b) supply of goods which include various items such as office equipment and furniture, transportation equipment, farm machinery and inputs, and laboratory equipment, and (c) services provided by PMC, NGOs or universities. The PMU will prepare the plan, design, specifications, special requirement or other description pertaining thereto in advance to the procurement. The description referred to shall be based on international standards, where such exist; otherwise, on national technical standards, regulations, or codes.

The PMU shall prepare description of procurement requirements in conformity with applicable environmental protection legislation. For the purpose of opening tenders or proposals and evaluation of bids, the PMU shall constitute a tender committee comprising a minimum of three members.

Procurement of construction works or goods or services can be made either through (a) international competitive bidding only for PMC, (b) local (national) competitive bidding, (c) quotation method, or (d) direct undertaking.

### (2) State Procurement Rules

For the local competitive bidding, the Haryana Procurement Rules will be used in principle. The rules specify all necessary procedures for the procurement of goods, works and services and for public-private partnership arrangements in infrastructure and service delivery projects and to regulate the matters connected.

### (3) Procurement Plan

The procurement method for the three major components is summarized in Attachment 7.5.1.

## 7.6 Implementation Schedule of the Project

The implementation schedule of the Project is summarized in the table below.

**Table 7.6.1 Brief Implementation Schedule of the Project**

No.	Work Item	Fiscal Year (April to March)										
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
0	Project Preparation Stage											
	Appraisal		▲									
	Pledge		▲									
	Signing of Loan Agreement		▲									
	Establishment and function of PMU/DPMU		■	■	■	■	■	■	■	■	■	■
	Selection of PMC		■	■								
1	Support for crop diversification into horticultural crops and Reinforcement of production support											
	1.1) Formation and strengthening of PGs		■	■	■	■	■	■	■	■	■	■
	1.2) Water-harvesting and Micro irrigation system			■	■	■	■	■	■	■	■	■
	1.3) Horticulture guidance			■	■	■	■	■	■	■	■	■
	1.4) Pilotfarm Establishment and Public-private partnerships		■	■	■	■	■	■	■	■	■	■
2	Support for building value chains and Promotion of private sector partnerships											
	2.1) Infrastructure development for building value chains			■	■	■	■	■	■	■	■	■
	2.2) Building an E-market Place and a information sharing platform				■	■	■	■	■	■	■	■
	2.3) Branding				■	■	■	■	■	■	■	■
3	Institutional development for Project Management											
	3.1) Installation of PMU and DPMU		■	■	■	■	■	■	■	■	■	■
	3.2) Strengthening the capacity of DOH		■	■	■	■	■	■	■	■	■	■
	3.3) Strengthening the capacity of horticulture extension services			■	■	■	■	■	■	■	■	■
	3.4) Baseline Studies and Impact Assessment		■	■	■	■	■	■	■	■	■	■
4	Consulting Services			■	■	■	■	■	■	■	■	■

Source: JICA Survey Team

The detailed schedule is given in Attachment 7.6.1.

## **7.7 Operation and Maintenance (O&M) of Project Facilities**

For proper O&M of project facilities in the long term, each organization responsible for O&M must ensure human resources, education/training, and financial resources. Accordingly, the O&M entity arranges person/s, gives education and training, and provides funds necessary for O&M.

In general, owners of the facilities belong to either government or private entity. Under the Project, the government facilities will be operated and maintained mainly by DOH, of which idea is to manage these on public-private partnership (PPP) mode. As for private facilities, it is broadly divided into four: private company, Federation of PGs, PG, and individual. In any case, the below three important factors shall be carefully examined from the proper O&M aspect of the project facilities.

The following points will be proposed to ensure the O&M of the project facilities under the Project.

### **(1) Handing Over with Trainings**

Service providers must provide O&M training to the users along with O&M manual written in the local language before officially handing over the products. Costs for these activities shall be covered under the contract. In view of O&M, after-sales services including supply system of spare parts are important check points in the bidding.

### **(2) Warranty Services**

Troubles and defects found in initial operation of the project facilities shall be covered by warranty services for equipment and tools and defect rectification services for infrastructures by stipulating the conditions in the contract agreement. The period depends on the products, but it is preferable to set the period to at least one year.

### **(3) Fund Raising**

The O&M of the project facilities is the most crucial issue for O&M entities especially PGs and individuals with limited financial resources. Possible solutions will be fund raising for the O&M.

The summary of O&M of the project facilities is shown in Attachment 7.7.1.



## Chapter 8 Project Cost

### 8.1 Basic Conditions of the Project Cost Estimate

#### 8.1.1 Contents of Cost Estimate

- i) Direct cost for procurement and works
- ii) Consulting services
- iii) Administration expenses during the construction period
- iv) Price escalation and physical contingencies
- v) Tax, interest during construction, and commitment charge

#### 8.1.2 Assumption

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### 8.2 Summary of the Project Cost

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**Table 8.2.1 Summary of the Project Cost**

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Source: JICA Survey Team

### 8.3 Annual Disbursement Schedule

The annual expenditure plan for this project is shown in the table below.

**Table 8.3.1 Summary of Annual Disbursement Schedule**

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Source: JICA Survey Team

#### 8.3.1 Appropriate Bidding Method

Local competitive bidding (LCB) shall be applied to the construction works to select the responsible and capable local construction firms at lower contract prices.

## Chapter 9 Project Evaluation

### 9.1 Economic Evaluation Methodology and Assumptions

#### 9.1.1 Method of Economic Evaluation

Economic evaluation is carried out to assess the economic viability of the Project from a viewpoint of the national economy. In order to evaluate the Project, indicators such as the economic internal rate of return (EIRR), cost-benefit ratio (B/C), and net present value (B-C) are calculated by estimating the cash outflow (costs) and inflow (benefits) on an annual basis over the project life with a certain discount rate. EIRR is a discount rate at which the present value of the in and out cash flows become equal. This rate shows the return expected from the Project as expressed in the following equation:

$$\sum_{t=0}^n C_t / (1+r)^t - \sum_{t=0}^n B_t / (1+r)^t = 0$$

Where,

$C_t$  : Cost

$B_t$  : Benefit

$t$  : Year

$n$  : Project Life(year)

$r$  : Discount Rate (EIRR)

Sensitivity analysis is also carried out to evaluate the viability of the Project against possible adverse changes in the future.

Financial internal rate of return (FIRR) is not calculated because FIRR is an indicator to assess the financial sustainability of the implementation agency with direct return from project activities such as water supply scheme.

#### 9.1.2 Basic Assumption of Economic Evaluation

The abovementioned economic evaluation indicators are estimated under the following conditions and assumptions:

- i) **Project life:** Project life is assumed to be 30 years beginning from fiscal year 2024, The general useful life of a pack house is 20-50 years, but the "useful life" for accounting and depreciation purposes of the asset is considered to be 30 years for both buildings and non-factory buildings, which fall under the category of buildings under the Companies Act, 2013.;
- ii) **Exchange rate:** All prices and costs are expressed in economic prices of Indian rupee. Other currencies are converted to Indian rupee using the exchange rate, September 2023, for the estimation:  
USD 1.00 = JPY 145, INR 1.0 = JPY 1.75, USD 1.00 = INR 82.7
- iii) **Discount rate:** Discount rate of 6.0% is applied for calculation.
- iv) **Financial prices:** Those were converted to economic prices by using the prices and factors as follows: Transfer payment (taxes and subsidies), land acquisition, compensation, price escalation, and interest during construction are excluded from the calculation of economic project cost/benefit.
- v) The prices of traded agricultural materials such as fertilizers/pesticides are calculated by excluding subsidies from the market price without Goods and Services Tax (GST).
- vi) Other goods are regarded as non-traded goods. The financial price was converted to economic price using the standard conversion factor (SCF) of 0.97. The SCF is calculated from available data of the export/import statistical data from 2014 up to 2018 of India, since 2019 data is not yet available as of September 2023.

## 9.2 Project Economic Cost

Based on the financial project cost shown in Chapter 8, project economic costs were calculated using the aforementioned conversion method to economic prices. The project economic cost is approximately 31.0 billion yen, the breakdown of which is shown in Table 9.2.1. Details of the project economic costs are presented in Table 9.2.1.

**Table 9.2.1 Project economic cost**

入札関連情報のため一定期間非公表
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Source: JICA Survey Team

Unit : L/C (million rupee), F/C and Total (million yen)

## 9.3 Operation and Maintenance (O&M) and Replacement Cost

### (1) O&M Cost

Annual operation and maintenance (O&M) cost is estimated as shown in the following table. The annual O&M cost is assumed as the total cost of solar fence and custom hiring unit. The O&M cost will be required every year according to the schedule of infrastructure development. Details of the annual incremental O&M cost are shown in Attachment 9.3.1.

**Table 9.3.1 Economic Annual O&M Cost**

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Source: JICA Survey Team

The following replacement cost is expected to be required every 10 years based on the economic life of infrastructure and equipment along with the infrastructure development schedule. Details of the annual

incremental replacement cost are shown in Attachment 9.3.1.

**Table 9.3.2 Economic Cost of Replacement**

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Source: JICA Survey Team

## 9.4 Project Economic Benefit

### 9.4.1 Benefit from Haryana Sustainable Horticulture Promotion Project

One of the benefits from the Project is the increment of crop production income to be derived mainly from water saving irrigation, quality improvement, reduction of post-harvest loss by shifting crops. Total area for shifting is 10,500 (ha) and it will be from cereal to vegetable (Potato, Tomato, Onion) and fruit (Kinnow, Guava, Mango).

Other benefits include the construction of packhouses, which will add value to crops by reducing post-harvest losses and improving pre-shipment packaging for mass marketing and value addition.

In the benefit calculations for this project, only the benefits from the construction of packhouses are calculated.

### 9.4.2 Crop Budget

In order to calculate the benefits derived from crop transactions, the financial and economic prices of cereals, vegetables and fruit were estimated under the following conditions

- i) Back data of crop budget is basically referenced from the following data:
  - State Statistical Abstract of Haryana 2021-22
  - DOH data (Referred in Interim report Table 3.3.7 and 3.3.13)
  - Value Chaine Report from DOH
  - Value Chain Survey Report of Subletting Contract Survey under the JICA Survey
- ii) Crop budgets are converted to economic prices based on abovementioned financial prices with use of conversion factors.

Details of crop budgets are presented in Attachment 9.3.1.

### 9.4.3 Project Benefit

The Project Benefit is calculated based on the event that post-harvest losses are reduced by value chain infrastructure construction such as packhouse construction, as well as increased revenue growth due to higher value addition by crop diversification and by being able to take advantage of economies of scale to sell. This benefit is also estimated by “without Project” condition and “with Project” condition to monetary value by pack house.

The estimation flow is below (See attachment Att\_9.3.1\_Details of Calculation of EIRR)

The estimation flow is as follows (see Att\_9.3.1).

#### **Benefits from value addition through the use of packhouses**

- i. Calculate the financial and economic price of each crop (see Table 9.4.1).
- ii. Calculate the "average unit price" with project as 25% more than the current economic price. (Assume that the introduction of packhouses will allow for larger units to be sold, thus increasing the unit selling price).
- iii. Calculate the total volume of packed houses to be constructed in the project. (See Table 9.4.2)

- iv. Calculate the volume of vegetables and fruits handled in each of the packhouses, assuming the ratio of vegetables to fruits handled in the packhouses is 6:4.
- v. Calculate the benefit from value-added improvement by utilizing packhouses based on the annual handling volume and unit price of vegetables and fruits, respectively.

**Benefits of using packhouses to reduce post-harvest loss rate**

- i. Calculate the "current average post-harvest loss rate" for vegetables and fruits, respectively, from the average of Haryana's major agricultural products.
- ii. Calculate the increase in handling volume due to the construction of packhouses, assuming that the "average post-harvest loss rate after project implementation" will be reduced by 60% from the current average post-harvest loss rate.
- iii. Calculate the benefits of value-added to reduce the path and harvest loss rate by utilizing packhouses based on the annual handling volume and unit cost of vegetables and fruits, respectively.

**Table 9.4.1 Economic price of vegetable and fruit**

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Source: JICA Survey Team

**Table 9.4.2 Project Benefit (Mitigation of Post-harvest Loss) -Annual**

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Source: JICA Survey Team

**Table 9.4.3 Vegetables and Fruits Handling amount of the Packhouses**

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Source: JICA Survey Team

**Table 9.4.4 Annual Benefit (value addition)**

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Source: JICA Survey Team

**Table 9.4.5 Annual Benefit (reduction of post-harvest loss rate)**

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Source: JICA Survey Team

## 9.5 Results of Economic Evaluation

Based on the assumptions and conditions described so far, the indicators for economic evaluation are calculated as shown in the following table. The cash flow table for the calculation is shown in Attachment 9.3.1.

**Table 9.5.1 Calculation Results of the Indicators for Economic Evaluation**

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Source: JICA Survey Team

A sensitivity analysis is also carried out tentatively to evaluate the soundness against unexpected adverse changes such as cost overrun and decrease of benefit in the future. The result of analysis is shown in the following table.

**Table 9.5.2 Result of Sensitivity Analysis**

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Source: JICA Survey Team

## 9.6 Farm Economic Analysis

The evaluation of the financial capacity of individual farmers in the project will be done by conducting a baseline survey of farmers belonging to the PGs at the time the target PGs are selected and an endline survey at the end of the project.

## 9.7 Intangible Benefits

The following positive effects as intangible benefits shall be envisaged through project activities.

### 1) Increase of Farm Household Income in the Project

Based on farm economic analysis, the Project can be expected to increase farmers' income compared

to the current situation. The income of farmers supported by the project will be improved by adding value to fruits and vegetables in terms of cultivation and marketing methods. In addition, material provision and technical support to the Project can make farmers achieve the yields increment under area expansion and production component.

## 2) Strengthening of Management Capacity of PGs

The supply chain development component will encourage PGs to stand as business entity independently with support of Technical Support Group. General situation of PGs operation in Haryana is not preferable since it is difficult to continue the sustainable management and operation by PG members due to insufficient capacity development. In the Project, Technical Support Group will be instructed by PMU/PMC firstly and after starting of Technical Support Group support for PGs also, PMU and PMC will monitor the progress and assist as necessity so that PGs can conduct business activities. That will lead to accomplish the development of supply chain of horticultural crops in the Project.

## 3) Capacity Development of Government Institutions

The project management component will strengthen the PMU/DPMU capacities through various training programs. The Project will become the first experience for HSHPP to implement a Japanese ODA loan scheme. With support of the PMC, the PMU/DPMU can develop their capacity for project management as well as technical techniques in the component. This can also contribute to their management and monitoring skills for PG activities for the purpose of supply chain development as well.

## 9.8 Operation and Effect Indicators

It is important to monitor and evaluate the project operation and effect indicators periodically, which will suggest the way to the proper operation and maintenance activities. The target year of the indicators is usually set for two years after project completion. It is proposed that the evaluation will be based on the results of a baseline study conducted in the early stages of the project and an endline study conducted at the end of the project.

The operation and effect indicators are set for the Project in consideration of the project outputs as follows:

**Table 9.8.1 Proposed Operation Indicators of the Project**

Operational Indicator		Unit	Current (2021)	Target (2034)
1	Area and Target of development to Horticulture crop (DOH targets for crop diversification into non-crops other than rice, including horticultural crops)	ha	417,000	700,000
	Area and Target of crop diversification from Paddy to Horticulture crop (Total target of DOH) (Estimation)	ha	41,700	70,000
2	Area and Target of crop diversification (Total target of Project)	ha	0	10,500
3	Water consumption reducing (10,500ha)	m <sup>3</sup>	141,750,000	43,785,000
4	Farmer's income	Rp	Collected in Baseline survey	To be set in the baseline survey
5	Reduction in post-harvest losses in horticultural produce (Fruits)		11.60%	4.64%
	Reduction in post-harvest losses in horticultural produce (Vegetable)		9.30%	3.72%
6	Sales performance of horticultural crops		Collected in Baseline survey	To be set in the baseline survey
	PGs Infrastructure Operation Indicators	-	-	-
	<b>(Quantity)</b>			
	1) Transaction amount (throughput)/ day			
	2) Service charge (handling charge)/ kg (income)			
	3) Operation days (assuming 250days/ year)			
	<b>(Quality)</b>			



Operational Indicator		Unit	Current (2021)	Target (2034)
	1) Quality supervisor judge the Grading parameter (quality) standard parameter (a) retail b) wholesale c) processing )			
	Capacity building of PG log frame (capacity building plan)			
	1) pre-harvest (production)			
	2) post-harvest (sorting grading packing pre-cooling, storage, logistic)			
	3) marketing pack house management/ accounting documentation (like ISO)			
7	Percentage of women-focused producer group		Collected in Baseline survey	To be set in the baseline survey

Source: JICA Survey Team

### 9.8.1 Monitoring Method and System for effect Indicators

The operation and effect indicators shall be continuously monitored during and after the Project. It is proposed to have a monitoring method and system for each indicator, including specific data collection methods as shown in the following table.

**Table 9.8.2 Monitoring Method and System for Effect Indicators**

No.	Indicator	Monitoring Target	Responsible Organization	Timing of Data Collection
1	Area and Target of development to Horticulture crop (Total target of DOH)	PMU	PMU	Once a year
2	Area and Target of crop diversification (Total target of Project)	PMU	PMU	Once a year
3	Water consumption reducing (10,500ha)	PMU	PMU	Once a year
4	Farmer's income	PGs	PMU	Once a year
5	Reduction in post-harvest losses in horticultural produce (vegetables and fruit)	PGs	PMU	Once a year
6	Sales performance of horticultural crops	PGs	PMU	Once a year
7	Percentage of women-focused producer group.	PMU	PMU	Once a year

Source: JICA Survey Team

This monitoring method and system will be finalized soon after starting the project activities by PMU. The system will be reviewed and updated with support of the PMC. Required costs are listed as baseline, midline and end line survey in the project management component.

## 9.9 Risk Management

### 9.9.1 Approach to Risk Management

Risk is defined as the possibility that an event will occur and adversely affect the achievement of an objective. According to the concept of risk management, risk is generally classified as the probability of occurrence and the impact (magnitude) of loss when it occurs. Based on the classification, treatments for risks shall be considered: avoidance, reduction (optimize, mitigation), sharing, and retention. The purpose of risk management is to identify potential problems before they occur. In the Project, "loss" is considered to be a "decrease of development effect". Factors to reduce the development effect are called risks, such as decrease of the project benefit, increase of project cost, unachieved development target of the project, project cancellation or suspension, and their multiple occurrences. Treatment for risks is generally classified as follows:

**Table 9.9.1 Treatment for Risks**

Impact	Probability	
	High	Low
High	Avoidance of the risk (to avoid activity itself with the risk)	Sharing of the risk (to transfer the risk to others, e.g., insurance)

Low	Reduction of the risk (to reduce probability and impact of risk before occurrence)	Retention of the risk (not to take action for the risk)
-----	------------------------------------------------------------------------------------------	------------------------------------------------------------

Source: JICA Survey Team

As mentioned above, the concept of risk management aims to treat critical and major risks based on the above categories, considering the costs associated with the treatment of risks. Risk identification and assessment shown below is done based on the concept of risk management.

### 9.9.2 Identification and Assessment of Risk

According to the JICA Risk Management Framework, the risks for the Project are identified and assessed in the following categories. The JICA Risk Management Framework classifies the risks into: 1) stakeholder risk, 2) executing agency risk, and 3) project risk. The identified major risks in each risk category and the assessment results are shown in Attachment 9.9.1

## Chapter 10 Environmental and Social Considerations

### 10.1 Environmental Administrative System in India

The Ministry of Environment, Forest and Climate Change (MoEFCC) and the Central Pollution Control Board (CPCB) are the two major agencies responsible for the Environmental administration and regulation in India. The MoEFCC is the nodal agency responsible for planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programs, whereas CPCB, constituted in 1974 under the water (Prevention and Control of Pollution) Act, 1974 and entrusted power and functions under the Air (Prevention and Control of Pollution) Act, 1981, serves as a field formation and provides technical services to the MoEFCC.

### 10.2 Environmental Laws, Regulations and Policies in India and the State of Haryana

The constitution of India was amended 42<sup>nd</sup> time in 1976 to introduce provisions for protection of environment. The provision contains Article 48-A which states that “the state shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country”.

The other Article 51-A, Clause (g) states that “it is the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers, and wildlife and to have compassion for living creatures.” Further, an Article 253 was added which stated that “the Parliament has the power to make any law for the whole or any part of the country for implementing any treaty, agreement or convection with other country.”

#### 10.2.1 Major National and State Level Laws and Regulations Relevant to Environmental and Social Considerations

The Table 10.2.1 contains key acts, policies, rules and laws relevant to Environment and Social Consideration in India and the State of Haryana.

**Table 10.2.1 National/State Level Legal Framework for Environmental and Social Considerations**

Law/Policy	Description/Outline	Responsible Ministry/ Agency
<b>Acts and Policies – National level</b>		
The Environment (Protection) Act, 1986	It is a major law introduced in the country for the protection of the environment and to ensure sustainable development. The act made it mandatory to get Environmental Clearance before commencing projects. Also, the establishment of the Central Pollution Control Board and State Pollution Control Board takes place under this Act.	Ministry of Environment, Forest and Climate Change
The Air Act, 1981	The act is passed by the Government of India for the protection of the air quality of India. The main objective of the act is to ensure the air quality of India is as per the international standards. The Air Quality Control Boards are also established under this act.	Central Pollution Control Board
The Water Act, 1974	It is an umbrella legislation that covers all the aspects of water management in the country, from surface water and groundwater to international rivers, reservoirs, and water supply. The act gives the Central Government the power to regulate the use, distribution, and conservation of water resources in the country. It also ensures that the rights of all users, including farmers and industrialists, are respected. The Act is also responsible for setting standards and guidelines for water use and pollution prevention.	Central Ground Water Board
The Wildlife Conservation Act, 1972	The act is introduced to ensure the conservation of India’s rich and diverse wildlife. The act includes provisions for the conservation of endangered species, the regulation of hunting and fishing, and the protection of habitats. It also includes provisions for the establishment of protected areas for the conservation of wildlife, and for the regulation of trade in species of wild fauna and flora.	National Board for Wildlife
The National	The main objective of the policy was to ensure the conservation of the country’s	Ministry of

Law/Policy	Description/Outline	Responsible Ministry/ Agency
Forest Policy, 1988	natural resources and biodiversity, meet the needs of the local people, and promote economic development. The policy ensures that the forests are managed in an equitable and socially responsible manner, The policy calls for the protection of forests from over-exploitation, the promotion of afforestation and sustainable use of forests.	Environment, Forest and Climate Change
The Public Liability Insurance Act, 1991	It is an act to provide for public liability insurance and to make provisions for matters connected therewith or incidental thereto. The act aims to ensure the safety of public authority due to any act, omission, or negligence. It requires all public authorities to take out a public liability policy for the protection of the public from any liability or damage arising out of any act of their employees or any other act or omission of theirs. It also lays down the procedure for the settlement of claims arising out of such acts or omissions.	Central Pollution Control Board
The Noise Pollution (Regulation and Control) Rules 2000	The rules are established in India to regulate and control noise pollution in India. The rules are designed to ensure that the noise levels in all areas of the country are kept to a minimum. It also prescribes the permissible sound levels for various activities such as construction, manufacturing, public address systems and loudspeakers. Additionally, the rules make provision for establishment of noise monitoring stations, setting up noise control authorities at the state and district level, and the imposition of penalties for violations of the noise regulations.	State Pollution Control Board in consultation with Central Pollution Control Board.
The Manufacture, Storage, and Import of Hazardous Chemical Rules, 2000	The aim of the rules is to prevent and control the risks associated with hazardous chemicals and protect the environment and public health. The rules apply to all manufacturers, importers, and users of hazardous chemicals and require them to obtain a license for the manufacture, storage, and import of hazardous chemicals. The rules also set out the requirements for proper labeling, packaging, and disposal of hazardous chemicals, and specify the responsibilities for the involved parties.	Central Pollution Control Board
The National Water Policy, 2002	The policy document outlines the need to address water related issues such as water scarcity, water pollution, and water-related disasters, while recognizing the importance of water to economic and social development. The policy also includes the guidelines for the conservation, management, and equitable distribution of water resources, as well as for the promotion of water-related activities such as rainwater harvesting, wastewater treatment, and water reuse.	National Water Resources Council
Biological Diversity Act 2002	It is an Act of the Parliament of India enacted to provide for the conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.	National Biodiversity Authority
The National Environment Policy 2006	The Policy seeks to promote environmental protection, conservation, and improvement by integrating environmental considerations into the planning and decision-making processes of all sectors of the economy. It emphasizes the need for public participation in environmental decision-making and encourages the adoption of green technologies and practices. The policy provides a framework for the development of environmental laws and regulations, as well as for the establishment of environmental monitoring and enforcement mechanisms.	Ministry of Environment, Forest and Climate Change
The Batteries (manufacturing and Handling) Rules 2010	It applies to the manufacture, sale, storage, transport, collection, reprocessing, and recycling of lead-acid batteries. The rules provide for licensing of storage, recovery and recycling facilities, safe handling and storage of used/waste batteries, disposal of hazardous waste generated from used/waste batteries and other relevant matters. The rules aim to prevent the pollution caused by used/waste batteries and to ensure their efficient management and handling.	Ministry of Environment, Forest, and Climate Change
The Coastal Regulation Zone 2011	It aims to protect the coastal environment from activities such as industrialization, construction, and other activities that may cause environmental degradation.	Ministry of Environment, Forest and Climate Change
The Plastic Waste Management Rules 2016	These rules provide a comprehensive framework for managing plastic waste in India, with the aim of reducing its environmental impact. The rules cover a wide range of topics, including a ban on non-recyclable single-use plastic products, the introduction of Extended Producer Responsibility (EPR) schemes, and the promotion of plastic waste recycling.	State Pollution Control Board and Pollution Control Committee

Law/Policy	Description/Outline	Responsible Ministry/ Agency
The Solid Waste Management Rules 2016	The rules focus on the segregation of waste at the source, scientific processing and disposal of waste, and encourage the use of modern technologies for waste management. The rules are applicable to all urban bodies (ULBs) and entities generating, collecting, storing, transporting, treating and disposal of solid waste.	Central Pollution Control Board
The Hazardous Waste Management Rules 2016	The rules provide for the safe collection, storage, transportation, treatment, and disposal of hazardous wastes in a manner that does not pose any adverse impacts to human health or the environment. It also ensures that the hazardous waste is disposed of in an environmentally sound manner.	Central Pollution Control Board
The E-Waste Management Rules 2016	The rules focus on the collection, handling, storage, transportation, treatment, and recycling of e-waste, and set out the roles and responsibilities of producers, consumers, and other stakeholders. The rules also require the establishment of a system for tracking e-waste from producers to recyclers.	Central Pollution Control Board
The Construction and Demolition Waste Management Rules 2016	The rules mandate that all construction and demolition activities should adhere to a set of guidelines and standards to ensure that the waste produced is managed and disposed of safely. The rules also require that the waste is segregated at the source, and that certain materials are recycled or reused wherever possible. The rules also aim to reduce the amount of waste sent to landfill sites and encourage the use of sustainable waste management practices.	Bureau of Indian Standards and Indian Roads Congress
The Biomedical Waste Management Rules, 2016	These rules are applicable to all persons and establishments generating, collecting, receiving, storing, transporting, treating, destroying, or disposing of biomedical waste. The rules aim to ensure the safety of human health and the environment by ensuring the safe and effective management of biomedical waste.	Ministry of Environment, Forest and Climate Change
<b>Acts and Policies of the Haryana State government</b>		
The Insecticide Act, 1968	The act is introduced to regulate the import, manufacture, sale, transport, distribution, and use of insecticides. The objective of the act is to prevent risk to human beings or animals, and for matters connected therewith.	Agriculture Department, Haryana
The Haryana Non-Biodegradable Garbage (Control) Act, 1998	To prevent the throwing and deposition of non-biodegradable garbage in public drains, roads, and places open to public view in the state.	Haryana State Pollution Control Board
The Haryana Forest Policy, 2006	The aim is to ensure the sustainable use of forest resources while protecting biodiversity and ecological balance. One of the major objectives is to increase the forest cover to 20% and for that it is suggested to establish new forests, afforestation programs, and protection regeneration of existing forests.	Haryana Forest Department
The Haryana Preservation of Sub-Soil Water Act, 2009	The act provides prohibition of sowing of nursery of paddy and transplanting the paddy before the dates notified. The act prohibited the farmers from sowing paddy before 15th May of the year and not to transplant the paddy before 15th June of the year.	Irrigation and Water Resources Department, Haryana
The Haryana Water Resource (Conservation, Regulation and Management) Authority Act, 2020	The Act is for the conservation, management and regulatory of the water resources which include groundwater and surface water in the state. The act ensures the judicious, equitable and sustainable utilization, management, regulation and fixes the rate of the water. The authority encourages the inhabitants of the State to adopt self-regulation which include the supply of desired quantity of irrigation water to the crop, to adopt water conservation practices, to encourage for rainwater harvesting and catchment conservations, and to encourage every water user to extract and use the water in an economical and efficient way. The authority shall discourage and prevent activities which lead to potential water logging of land.	Irrigation and Water Resources Department, Haryana
Water Conservation Scheme 2021	The scheme suggested measuring the actual consumption of water by various gadgets in the premises and comparing it with estimate minimum water requirement and suggesting the best ways to optimize the consumption of water. The minimum requirement for households varies between 150 to 200 litre per head per day, for factories it is 30 to 45 litre per head per day while for hospitals 340 to 450 litre per head per day is required.	State Water and Sanitation Mission, Haryana

Law/Policy	Description/Outline	Responsible Ministry/ Agency
Assistance for Environment Compliance Scheme 2021	The scheme suggested carrying out the industrial development and associated growth without damaging the ecology and environment. To implement the “Zero Effect”, a financial assistance provision was made to set up Effluent Treatment Plant and install Air Pollution Control Devices for new micro, small, and medium enterprises of the state.	Haryana State Pollution Control Board

*Source: Compiled by JICA Survey Team from Central Pollution Control Board, Haryana State Pollution Control Board, Haryana Forest Department, Industries and Commerce Department, Law and Legislative Department Haryana.*

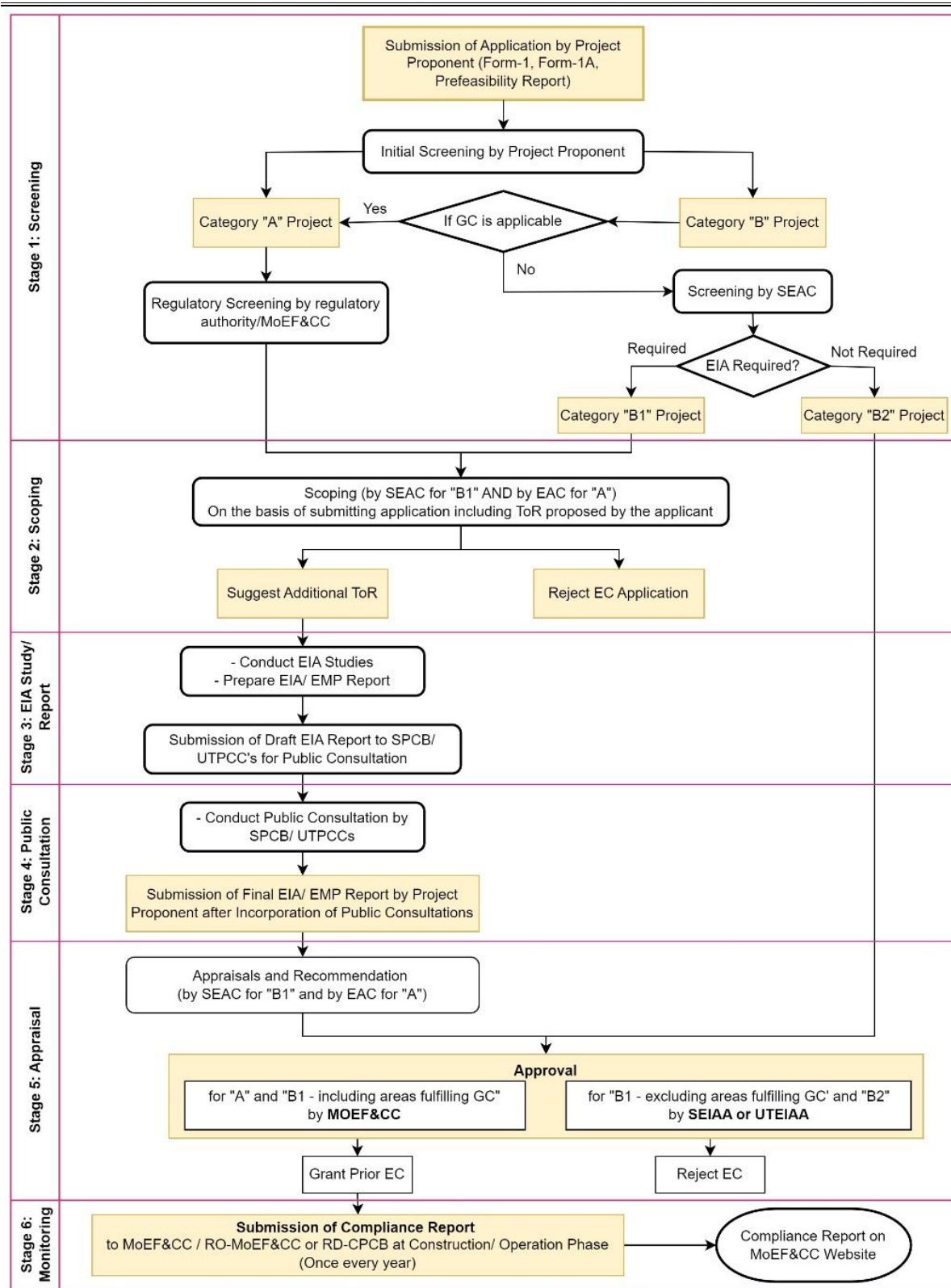
### 10.2.2 Environmental Impact Assessment

Environmental Impact Assessment is conducted to predict the possible impacts of a project on the environment. EIA not only examines the adverse consequences but also investigates beneficial factors. By doing so, the environmental assessment provides protection to environment, optimizes the usage of resources, and saves the time and cost of the project.

EIA in India started in 1976-77, when the Planning Commission asked the then Department of Science and Technology to examine the river-valley projects from the environmental angle. In 1994, the Ministry of Environment and Forest made the EIA mandatory for setting up new projects. Various amendments were made and in 2006, projects like mining, thermal power plant, river valley, infrastructure and industries were made mandatory to get Environment Clearance before starting the project.

In the year 2020, MOEFCC has circulated a draft EIA Notification 2020 for comments from public, NGOs etc. Some of the key proposals of the draft EIA 2020 include: (1) to reduce the notice period for public hearing from 30 days to 20 days considering growth of internet and mobile network, (2) the online public hearing is added along with the physical public hearing, (3) Category B2 projects do not require mandatory Environmental Clearance that also include irrigation projects between 2,000 and 10,000 hectares of command area and specified building construction and area development projects who's built-up area is upto 1,50,000 sq meter, (3) annual submission of compliance reports as against every six months as per 2006 notification, (4) Post-factor clearance – for the projects that started and are operating without prior environmental clearance can apply for environmental clearance and may be regularized, (5) and the EIA process for certain sub-category of projects was streamlined to reduce the time taken for clearance.

For all practical purposes, EIA notification 2006 and its subsequent amendments are officially approved notifications, thus as on date EIA 2006 notification is valid and referred to for this report.



**Note:**  
EAC: Environmental Appraisal Committee  
EIA: Environmental Impact Assessment  
EMP: Environmental Management Plan  
GC: General Conditions  
MoEF&CC: Ministry of Environment and Climate Change  
RO: Regional Office

RD: Regional Directorate  
SPCB: State Pollution Control Board  
SEAC: State Level Expert Appraisal Committee  
SEIAA: State Level Environmental Impact Assessment Authority  
UTEIAA: Union Territory Level Environmental Impact Assessment Authority  
UTPCC: Union Territory Pollution Control Committee

f

Source: Prepared by JICA Survey Team based on EIA Notification 2006 (S. O. 1533 (E)), Ministry of Environment and Forest.

**Figure 10.2.1 Procedure of Environmental Impact Assessment.**

## **(1) EIA System and Requirements**

The key EIA system and requirements as per EIA notification 2006 are described below:

- The project development activities are divided into eight major categories and thirty-nine sub-categories that require Environmental Clearance either from MoEF&CC or State Environmental Impact Assessment Authority (SEIAA).
- There are two major categories of projects: Category A and Category B.
- The Category B is sub-divided into B1 and B2, where B1 category projects that include areas under 'General Condition' shall require prior-EC from MoEF&CC whereas that exclude areas defined under 'General Conditions' shall require prior-EC from SEIAA or UTEIAA. Category B2 projects do not require EIA and fall under the purview of the SEIAA or UTEIAA.
- Category A projects are mandated to conduct EIA studies along with Public Hearing and Environmental Clearance required from MoEF&CC.
- Category B projects have screening under State Expert Appraisal Committee (SEAC) and State Level Environmental Impact Assessment Authority (SEIAA) / Union Territory Level Environmental Impact Assessment Authority (UTEIAA) to decentralize procedure of Environmental Clearance.
  - Category B1 projects that excludes areas defined under General Conditions shall require prior Environmental Clearance from SEIAA or UTEIAA.
  - Category B1 projects that include the area under General Conditions shall require prior Environmental Clearance from MoEF&CC.
  - Category B2 projects do not require EIA. The category B projects shall require prior Environmental Permission (EP) from SEIAA or UTEIAA.

## **(2) Stages and Procedure to Obtain Environmental Clearance**

The environmental clearance for the new projects will comprises of four stages:

- **Stage 1 – Screening:** Only for Category 'B' projects and activities to determine whether the project requires further environmental studies. The project that requires EIA report shall be termed as Category 'B1' and the remaining projects shall be termed Category 'B2'.)
- **Stage 2 – Scoping:** The Expert Appraisal Committee for Category 'A' projects or activities and State level Expert Appraisal Committee for Category 'B1' projects or activities determines detailed and comprehensive Terms of Reference (TOR) addressing all relevant environmental concerns for the preparation of EIA Report.
- **Stage 3 – EIA Study/ Report:** Proponent need to hire services of the specialized authorized EIA Accredited agencies for conducting EIA studies and preparation of EIA/ EMP reports and submit the draft reports to SPCB/ UTPCC for public consultation.
- **Stage 4 – Public Consultation:** The process involved the local affected persons and others who have plausible stake in the environmental impacts of the project or activity. All the Category 'A' and Category 'B' projects or activities shall undertake Public Consultation except the irrigation projects, industrial estate or parks, road and highways expansion, building/ construction projects/ area development projects and Townships, all the Category 'B2' projects, and projects concerning national defence and security.
- **Stage 5 – Appraisal:** The detailed scrutiny by the Expert Appraisal Committee or State Level Expert Appraisal Committee of application and other documents like EIA report, outcome of public consultation, submitted by the application to the regulatory authority concerned for grant of environmental clearance. The appraisal of all the projects or activities which are not required to undergo public consultation, or submit an EIA Report, shall be carried out based on prescribed application Form 1 and Form 1A as applicable.



- **Stage 6 – Monitoring:** After the EC is granted compliance reports need to be submitted to MoEF&CC/ RO-MoEF&CC or RD-CPCB during Construction as well as Operation phase once every year.

### 10.2.3 Agriculture/ Horticulture, Irrigation and associated Infrastructure Development Projects Requiring Prior Environmental Clearance

Considering the indicative list of the proposed project activities under Haryana Sustainable Horticulture Promotion Project (HSHP) the major activity types falls under the components that includes strengthening of Farmers Producers Organizations including infrastructure development, optimization of value chain development, strengthening capacity of the DOH and other Government agencies. The activities under HSHP mostly cover Agriculture/ Horticulture, Irrigation and associated infrastructure development type. As per EIA notification 2006, the related project types, that require prior environment clearance or prior environmental permission are depicted in table Table 10.2.2 below.

**Table 10.2.2 List of Projects Related to Agriculture/Horticulture, Irrigation and associated Infrastructure Development Requiring Prior-Environment Clearance as per EIA Notification 2006**

Project		Category with Threshold Limit		Remarks
		A	B1	
(1)	(2)	(3)	(5)	
1(a)	River Valley Projects	(i) $\geq 50$ MW hydroelectric power generation. (ii) $\geq 10,000$ ha. of culturable command area	(i) $< 50$ MW $\geq 25$ MW hydroelectric power generation. (ii) $< 10,000$ ha. of culturable command area	“General Condition shall apply. Note: Irrigation projects not involving submergence or interstate domain shall be appraised by the SEIAA as Category ‘B’ Projects.”;
5(a)	Chemical Fertilizers	All projects	-	-
5(b)	Pesticides industry and pesticide specific intermediates (excluding formulations)	All units producing technical grade pesticides	-	-
8(a)	Building and Construction projects		$>20,000$ m <sup>2</sup> and $<1,50,000$ m <sup>2</sup> of built-up area#	# (built up area for covered construction; in case of facilities open to sky, it will be the activity area)

Source: Compiled by JICA Survey Team from EIA Notification 2006 (S. O. 1533), Ministry of Environment and Forests.

Under Irrigation, the project activities include granting water-saving irrigation facilities to the sub-projects. The introduction of water saving irrigation facilities like sprinklers and drip irrigation, are environmentally friendly, that helps in conserving/ sustainable usage of valuable groundwater resource and do not pose any threat to the environment. The proposed infrastructure development includes construction of Integrated Pack Houses and distribution centers as well as center of excellence, PMU, and extension of district level DOH offices, the built-up area of each sub-project structure is expected to be well below the threshold limit as per EIA 2006, viz. built-up area  $<20,000$  m<sup>2</sup>, therefore EC will not be required.

### 10.2.4 Land Acquisition, Rehabilitation, and Settlement

It is a piece of legislation that governs the acquisition of land in the state of Haryana. This Act was first introduced in 2012 and has since been amended multiple time in order to update the provision contained in it. The main provision of the Act includes the need to secure the consent of the landowners before any

land can be acquired, the payment of compensation to the land owners, the provision of rehabilitation and resettlement of the affected people, the need to ensure that any acquired land is used for public purpose, and the requirement to undertake an environmental impact assessment before any land is acquired.

The Rehabilitation and Resettlement Policy of Haryana is a comprehensive policy that aims to provide effective rehabilitation and resettlement measures for the affected persons of any developmental projects in the state. The policy is applicable to all the developmental projects with an investment of more than Rs. 10 crore and covers all aspects of rehabilitation and resettlement including compensation, resettlement and rehabilitation of project affected persons.

### 10.3 Environmental and Social Conditions of Haryana

Before discussing the probable impact of the proposed project activities, it is highly important to first develop an understanding about the present status of the social and physical environment in the state. This baseline information is very much important to understand environmental and social issues to consider appropriate mitigation measures under ESAF for the project.

#### 10.3.1 Social Environment

##### (1) Scheduled Castes

Article 46 of the Constitution of India is a directive principle of state policy that directs the government to promote the educational and economic interests of the weaker sections of society, especially the Scheduled Castes and Scheduled Tribes, and protect them from social injustice and all forms of exploitation. The article states that ‘The State shall promote with special care the educational and economic interests of the weaker sections of the people, and, in particular, of the Scheduled Castes and the Scheduled Tribes, and shall protect them from social injustice and all forms of exploitation.’<sup>1</sup>

While Article 46 is not enforceable by any court of law, it is a fundamental principle of governance in India and provides guidance to the government on policies and programs that must be adopted to promote the welfare of the weaker sections of society. The directive principle has been used as a basis for several affirmative action measures and policies, including reservations in education and employment for Scheduled Castes and Scheduled Tribes.

According to the Statistical Abstract of Haryana, the total percentage of Scheduled Caste males was 53.50 % in 2001 which decreased to 52.99% in 2011 while the total percentage of Scheduled Caste females was 46.50% in 2001 and increased to 47.01% in 2011 (refer Table 10.3.1 below). The district wise population of Scheduled Castes show very minor difference as it is in between 52% to 54% for males and 45% to 47% for females.

**Table 10.3.1 Total Scheduled Castes Population of Haryana.**

District Name	Year 2001					Year 2011				
	Total (No.)	Male (No.)	Male (%)	Female (No.)	Female (%)	Total (No.)	Male (No.)	Male (%)	Female (No.)	Female (%)
Ambala	2,54,477	1,35,370	53.00	1,19,107	46.80	2,96,246	1,56,874	52.95	1,39,372	47.05
Bhiwani	2,79,470	1,50,085	53.70	1,29,385	46.30	3,41,162	1,81,475	53.19	1,59,687	46.81
Faridabad	2,91,381	1,57,463	54.04	1,33,918	45.96	2,23,799	1,19,495	53.39	1,04,304	46.61
Fatehabad	2,21,107	1,16,698	52.78	1,04,409	47.22	2,84,357	1,49,111	52.44	1,35,246	47.56
Gurugram	1,28,432	68,349	53.22	60,083	46.78	1,97,937	1,04,332	52.71	93,605	47.29
Hisar	3,38,045	1,81,245	53.62	1,56,800	46.38	4,08,785	2,17,338	53.17	1,91,447	46.83
Jhajjar	1,56,531	84,590	54.04	71,941	45.96	1,70,448	90,856	53.30	79,592	46.70
Jind	2,35,765	1,27,176	53.94	1,08,589	46.06	2,82,351	1,50,940	53.46	1,31,411	46.54
Kaithal	2,03,875	1,10,372	54.14	93,503	45.86	2,47,513	1,31,486	53.12	1,16,027	46.88
Karnal	2,67,424	1,43,455	53.64	1,23,969	46.36	3,39,604	1,79,681	52.91	1,59,923	47.09
Kurukshetra	1,69,394	90,196	53.25	79,198	46.75	2,15,128	1,13,311	52.67	1,01,817	47.33

<sup>1</sup> Chapter XI, Special Representation in Services for SC/ST, Constitutional of India

District Name	Year 2001					Year 2011				
	Total (No.)	Male (No.)	Male (%)	Female (No.)	Female (%)	Total (No.)	Male (No.)	Male (%)	Female (No.)	Female (%)
Mahendergarh	1,32,512	69,176	52.20	63,336	47.80	1,56,314	82,420	52.73	73,894	47.27
Mewat	78,802	42,008	53.31	36,794	46.69	75,251	39,743	52.81	35,508	47.19
Palwal	-	-	-	-	-	2,03,123	1,07,741	53.04	95,382	46.96
Panchkula	72,637	38,790	53.40	33,847	46.60	1,01,830	53,868	52.90	47,962	47.10
Panipat	1,52,803	82,415	53.94	70,388	46.06	2,06,213	1,09,695	53.19	96,518	46.81
Rewari	1,44,452	76,158	52.72	68,294	47.28	1,82,606	95,571	52.34	87,035	47.66
Rohtak	1,79,550	96,751	53.89	82,799	46.11	2,16,889	1,15,573	53.29	1,01,316	46.71
Sirsa	2,97,556	1,56,944	52.74	1,40,612	47.26	3,87,381	2,02,430	52.26	1,84,951	47.74
Sonapat	2,31,347	1,24,648	53.88	1,06,699	46.12	2,69,935	1,44,516	53.54	1,25,419	46.46
Yamunanagar	2,55,550	1,36,696	53.49	1,18,854	46.51	3,06,743	1,63,200	53.20	1,43,543	46.80
Total	40,91,110	21,88,585	53.50	19,02,525	46.50	51,13,615	27,09,656	52.99	24,03,959	47.01

Source: Compiled by JICA Survey Team from Statistical Abstract of Haryana (2001, 2011).

## (2) Below Poverty Line (BPL)

According to the Food Security Act 2013, an adequate amount of food quality is provided at an affordable price to the people to ensure the food and nutrition security in the human cycle. The act considers a major step towards ensuring food security and reducing hunger and malnutrition in the country<sup>2</sup>.

Based on the classification of BPL as per the State level Rural households survey 2007, conducted by Rural Development Department, Haryana, the following families are automatically included in the BPL list, viz, households without shelter, destitute/ living on alms, manual scavengers, primitive Tribal Groups, legally released bonded laborers.

The deprivation indicators<sup>3</sup> considered for the identification of BPL category are listed below:

- Households with only one room with *kucha* walls and *kucha* roof.
- Households with no adult member between age 18 to 59
- Female headed households with no adult male member between age 18 to 59
- Households with disabled member and no able-bodied adult member
- SC/ST households
- Households with no literate adult above 25 years
- Landless households deriving major part of income from manual casual labor.

The district wise number of households classified under State Below Poverty Line to be eligible for various subsidies under government schemes is given in Table 10.3.2 below.

**Table 10.3.2 District-wise list of State Below Poverty Line (SBPL) families in Haryana.**

District	SBPL (No. of Households)
Ambala	36,489
Bhiwani	25,006
Charkhi Dadri	5,557
Faridabad	31,110
Fatehabad	25,536
Gurgaon	14,270
Hisar	18,736
Jhajjar	10,255

<sup>2</sup> The National Food Security Act, 2013, No. 20 of 2013

<sup>3</sup> Number of Rural Households in the State, Survey 2007, Rural Development Department, Haryana

District	SBPL (No. of Households)
Jind	35,677
Kaithal	24,952
Karnal	29,950
Kurukshetra	14,598
Mahendergarh	14,840
Meewat	27,555
Palwal	9,728
Pachkula	4,267
Panipat	15,571
Rewari	20,297
Rohtak	18,219
Sirsa	19,742
Sonipat	26,650
Yamunanagar	22,183
Haryana	451,188

Source: Compiled by JICA Survey Team from National Food Security Portal, Department of Food and Public Distribution, Government of India (2022).

### (3) Forest Dwellers and People/ Communities Recognized by Forest Right Act

As per the Ministry of Tribal Affairs there is no forest dependent community or forest dwellers in the state of Haryana and no communities are recognized under Forest Rights Act.

### (4) Human-Animal Conflicts (Number of cases and Compensation Norms)

The Forest Department of Haryana informed that there are negligible number of cases of human and wildlife conflicts reported in the state and the sporadic instances were compensated by local DC office as and when reported and thus no centralized data is available for the same.

The Compensation Norms for loss/damage to Crops by Wild Animals in Haryana is given in Table 10.3.3 below:

**Table 10.3.3 Compensation Norms for loss/damage to crops by wild animals.**

1	Crop damage by wild animals (where crop loss is 33% and above)	
	a) For agriculture crops, horticulture crops and annual plantation crops	6,800/- per ha. In rainfed areas and restricted to sown areas. 13,500/- per ha. In assured irrigated areas, subject to minimum assistance not less than Rs. 1,000 and restricted to sown areas.
	b) Perennial crops	18,000/- per ha. For all types of perennial crops subject to minimum assistance not less than Rs. 2000/- and restricted to sown areas.
	c) Sericulture	4,800/- per ha. For Eri, Mulberry, Tussar 6,000/- per ha. For Muga
2	Housing	
	a) Fully damaged/ destroyed houses	
	i. Pucca House	95,100/- per house in plain area
	ii. Kutcha House	
	b) Severely damaged	
	i. Pucca House	1,01,900/- per house in hilly areas including Integrated Action Plan (IAP) Districts.
	ii. Kutcha House	
	c) Partially Damaged House	
	i. Pucca (other than huts) where the damage is at least 15%	5,200/- per house
	ii. Kutcha (other than huts) where the damage is atleast 15%	3,200/- per house
	d) Damaged/destroyed huts:	4,100/- per hut (Hut means temporary make shift unit, inferior to Kutcha house made of thatch mud plastic sheets etc. traditionally

		recognized as hut by the State/District Authorities.  Note: The Damaged house should be an authorized construction duly certified by the Competent Authority of the State Government.
	e) Cattle shed attached with house	2,100/- per shed.

Source: Forest and Wildlife Department, Haryana (Memo number 372-Ft-4-2020/1858 date 3/03/2020).

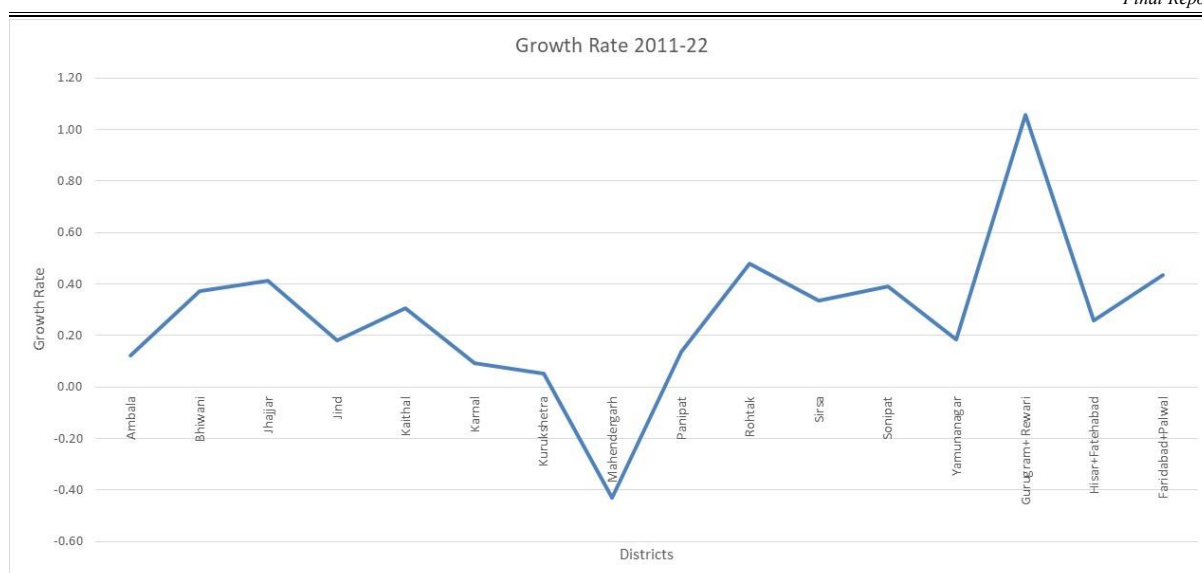
### (5) Electrification in the state

Table 10.3.4 depicts the decadal growth rate of the agricultural electricity connections in Haryana. District Rohtak, Jhajjar, Sonipat, Bhiwani and Sirsa recorded an increase in electricity connection by 48%, 41%, 39%, 37% and 34% respectively. For the year 2011, the data of district Rewari, Fatehabad, and Palwal are included in Gurugram, Hisar, and Faridabad, respectively and thus there is no individual base data available. For ease of understanding the clubbed electricity connection data of Gurugram and Rewari indicates that the percentage growth is 105 %, and of Faridabad and Palwal shows an increase of 43% connections. District Mahendergarh is the only district to record a negative growth.

**Table 10.3.4 District-wise number of agricultural electricity connections in Haryana.**

Year/Circle	2011-12	2021-2022	Growth Rate	For bifurcated Districts 2021-22 (Growth rate)
Ambala	18,906	21,182	0.12	
Bhiwani	32,541	44,651	0.37	
Jhajjar	8,290	11,702	0.41	
Jind	37,181	43,863	0.18	
Kaithal	44,048	57,488	0.31	
Karnal	67,213	73,328	0.09	
Kurukshetra	39,749	41,831	0.05	
Mahendergarh	56,667	32,310	-0.43	
Panipat	29,583	33,602	0.14	
Rohtak	4,502	6,668	0.48	
Sirsa	44,461	59,416	0.34	
Sonipat	24,943	34,691	0.39	
Yamunanagar	38,562	45,713	0.19	
Gurugram		27,703	-	59,126 (1.05)
Rewari	28,740	31,423	-	
Hisar		18,557	-	58,060 (0.26)
Fatehabad	46,079	39,503	-	
Faridabad		8,788	-	27,169 (0.43)
Palwal	18,941	18,381	-	

Source: Compiled by JICA Survey Team from Statistical Abstract of Haryana, 2011-12 and 2021-22.



**Figure 10.3.1 Growth Rate of Agricultural Electricity Connections in Haryana 2011-12 and 2021-22.**

Source: Compiled by JICA Survey Team from Statistical Abstract of Haryana.

### (6) Key social welfare schemes to benefit Vulnerable and Marginalised

There are several social security schemes launched by the central government as well as the state government to benefit the vulnerable and the marginalized. Some of the key social security schemes are listed below Table 10.3.5:

**Table 10.3.5 Key social security schemes**

S. No.	Scheme	Objective	Financial Assistance
<b>Welfare of Scheduled Castes/ Backward Classes</b>			
1	Dr. B. R. Ambedkar Awas Navinikaran Yojana	- A subsidy of 80,000 rupees is provided to the persons of all sections of society living below poverty line for repair of their house.	- An amount of 3,218.50 lakh has been spent on 6,437 beneficiaries during the year 2020-21. - A provision of 5,000 lakh has been made and out of which 3,506.90 lakh has been spent on 5,714 beneficiaries.
2	HSCFDC (Haryana Scheduled Castes Finance and Development Corporation)	- To undertake the tasks of socio-economic upliftment of Scheduled Castes in the State. - Three schemes have been implemented: (i) Bank tie-up schemes (The Corporation provides financial assistance for various bankable income generating schemes costing up to 1.50 lakh, subsidy 0 50% and margin money 0 10% of project cost and balance amount is provided by the bank.) (ii) Scheme in collaboration with National Scheduled Castes Finance & Development Corporation (NSFDC) (The share of the corporation is up to 10% of the approved cost. The Corporation provided subsidy in BPL cases 0 50% of the project cost. The minimum amount of the subsidy is 10,000 rupees.) (iii) Scheme in collaboration with National Safai Karamcharis Finance and Development Corporation (NSKFDC) (The share of the Corporation is up to 10% of the approved unit cost. There is no provision of subsidy under NSKFDC scheme.)	- During the year 2021-22, the Corporation assisted 15,000 families for various income generating schemes by providing them financial assistance of 1, 4927.10 lakh rupees including 1447 lakh rupees as subsidy. - The Corporation has assisted 585.37 lakh rupees including 54.95 lakh as subsidy during 2021-22.
3	Haryana Backward Classes	- To provide loan to the Backward Classes, Minority Communities, and Persons with	- The nigram proposed the target to disburse loan of 25 crore to 5,000

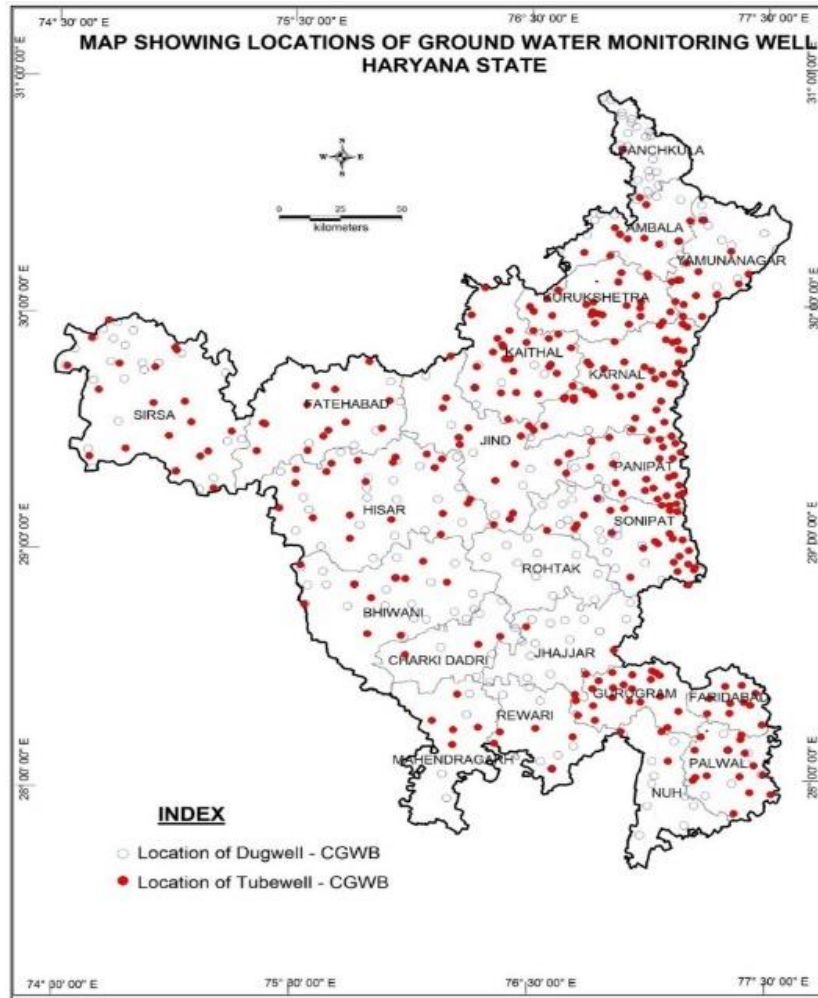
S. No.	Scheme	Objective	Financial Assistance
	& Economically Weaker Sections Kalyan Nigam	Disabilities for self-employment in various income generating schemes with collaboration of National Corporations on low-rate interest.	persons of Minority Communities and 10 crore rupees to 2,000 persons with Disabilities. - The Nigam has disbursed loans amounting 5.99 crore to 755 persons of Backward Classes, 3.74 crore to 402 persons on Minority Communities and 11.11 crore to 1,081 persons with disabilities up to 31.01.2022.
<b>Social Justice and Empowerment</b>			
4	Pension to Widows and Destitute Women Scheme	- Scheme was introduced in 1980-81. - Aim is to provide social security to women who are unable to sustain themselves from their own resources and are in need of financial assistance.	- The rate of pension was 50 rupees per month, at the beginning of scheme which enhanced from time to time and it is 2500 w.e.f. 01.04.2021.
5	Divyang Pension Scheme	- To provide social security to the Disabled persons. - Scheme was introduced in 1981-82.	- The rate of pension was 50 rupees per month was enhanced and it is 2500 per month w.e.f. 01.04.2021.
6	National Family Benefit Scheme	- Centrally sponsored scheme only for BPL families. - Under this scheme, an amount of 20,000 rupees is given as compensation in the death of a "Primary breadwinner" (male or female) has occurred while he or she is in the age group of 18 to 60 years.	- An amount of 9 crore rupees was allocated, out of which 3.26 crore has been spent for the year 2021-22.

Source: Compiled by JICA Survey Team from Economics of Haryana, Department of Economics and Statistical Affairs.

### 10.3.2 Natural Environment

#### (1) Ground water scenario/usage in the state (rate of depletion)

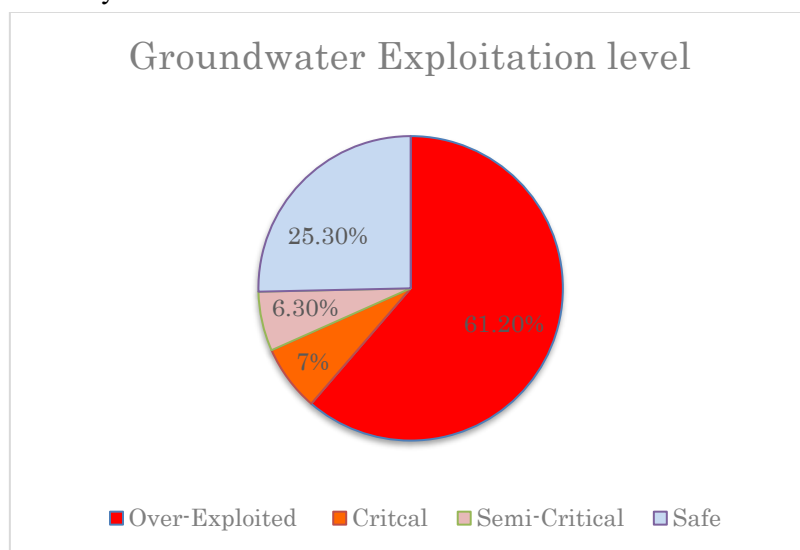
In the state of Haryana ground water is closely monitored by Central Ground Water Board (CGWB) as well as the state agriculture department.



Source: Groundwater Yearbook of Haryana 2021-22

**Figure 10.3.2 Location map of Ground water Monitoring in Haryana state**

The level of groundwater is observed from 142 stations in Haryana. Out of those 142 stations, 87 stations are over-exploited which is 61.2%, 10 are critical, i.e. 7%, 9 are semi-critical that are 6.3% and 36 stations are safe that are 25.3%. The pie chart shows the percentage of different categories of groundwater level in Haryana.



Source: Compiled by JICA Survey Team from Central Ground Water Board.

**Figure 10.3.3 Percentage of groundwater level in Haryana**



**Table 10.3.6 Stage of Ground Water Development and Categorization Of The Blocks As  
On 31.03.2020**

Sr. No.	District	Over-exploited		Critical		Semi-critical		Safe	
1.	Ambala	Barara, Naraingarh, Saha	3	Shahzadpur, Ambala-I	2	Ambala-II		-	
2.	Bhiwani	Behal, Kairu, Loharu, Tosham	4	-		Bhiwani, Bawani Khera		Siwani	
3.	Charkhi Dadri	Badhra, Jhoju	2	-		-		Baund, Ch. Dadri	
4.	Faridabad	Ballabhgarh, Faridabad, Tigaon	3	-		-		-	
5.	Fatehabad	Fatehabad, Ratia, Tohana, Jakhal, Bhattu Kalan, Nagpur	6	Bhuna	1	-		-	
6.	Gurugram	Farukhnagar, Pataudi, Sohna, Gurugram	4						
7.	Hissar	Barwala, Narnaund	2	Agroha, Adampur	2	Hansi, Hisar-I, Hisar-II,		Hansi-II, Uklana	
8.	Jhajjar			-		Badli		Jhajjar, Matanhail, Salhawas, Beri, Bhadurgarh, Machhrauli	
9.	Jind	Alewa, Uchana, Ujhana, Safidon, Jind	5	-		Pillukhera		Julana, Narwana	
10.	Kaithal	Siwan, Gulha, Kaithal, Kalayat, Pundri, Rajaund, Dhand,	7	-		-		-	
11.	Karnal	Assandh, Karnal, Gharaunda, Nilokheri Nissing at Chirao, Munak, Kunjpura	6	-		Indri		-	
12.	Kurukshetra	Ismailabad, Babain, Ladwa, Pehowa, Shahbad, Thanesar, Pipli	7	-		-		-	
13.	M.garh	Kanina, Simha Mahendragarh,	3	Ateli, Nangal	2	Satnali		Narnaul, Nangal, Chaudhary, Nizampur	
14.	Mewat	Tauru	1	Firozpur Jhirkha, Punahna	2	Indri		Nagina, Nuh, Pingwan	
15.	Palwal	Badoli, Prithala	2	Hasanpur	1	Hodal		Hathin	
16.	Panchkula	-		Raipur Rani	1	-		Pinjore, Barwala	
17.	Panipat	Bapoli, Madlauda, Panipat, Israna, Samalkha, Sonali Khurd		-		-		-	

Sr. No.	District	Over-exploited		Critical		Semi-critical		Safe	
18.	Rewari	Khol, Nahar, Jatusana, Bawal	Rewari, Dharuhera,	Dahina	1	-		-	
19.	Rohtak			-		-		Lakhan Majra, Meham, Kalanaur, Sampla, Rohtak	
20.	Sirsa	Rania, Nathusari, Odhan, Ellenabad	Sirsa, Chopta, Dabwali,	-		Baraguda,		-	
21.	Sonepat	Ganaur, Rai, Mudlana	Sonepat, Murthal,	-		-		Gohana, Kathura, Kharkhoda	
22.	Yamunanagar	Chachrauli, Jagadhri, Mustafabad, Khizrabad, Bilashpur	Radour,	Sadaura	1	-		-	
	State Total	85		12		14		30	

Source: Compiled by JICA survey team based on data from Haryana Water Resource Authority

## (2) Type of Irrigation (Canal/ Ground water (Tube well or Pumping), Rainfed)

The irrigation practices followed in Haryana include Canal System, Groundwater System and rainfed. There are four types of major irrigation systems which include all four canals of Haryana while the micro irrigation systems include Sprinkler system and Drip Irrigation System (Table 10.3.7). According to the Working Group Report on Rainfed Development in Haryana (2014), about 21% area in Haryana is rainfed.

**Table 10.3.7 Types of Irrigation System in Haryana.**

Irrigation System	Types of System	Description
Major Irrigation System	1. Western Yamuna Canal System	The WYC provide water to Kurukshetra, Karnal, Panipat, Sonipat, Jind, Rohtak, and Jhajjar districts.
	2. Bhakhra Canal System	The Bhakhra Canal supply water to Ambala, Kaithal, Hisar, Fatehabad, and Sirsa districts.
	3. Lift Irrigation System	This system receive water from Ravi-Beas. It feeds the district Rohtak, Bhiwani, Mahendergarh, and Rewari.
	4. Agra Canal and Gurgaon Canal System	The Agra and Gurgaon Canal supply water to Faridabad, Gurgaon, and Mewat.
Micro Irrigation System	1. Sprinkler System	The water is supplied to the crops in a similar way to rainfall. The pumps are used to distribute the water with the help of pipes and the sprinklers provide efficient amount of water to the crop.
	2. Drip Irrigation System	The drippers are used to supply water directly and slowly to the soil. This method is more efficient as the water is directly applied where it is needed and also, the water is soaked by the soil before its evaporation.

Source: Compiled by JICA Survey Team from Aspects of Irrigation System in Haryana: An Overview.

Further, the groundwater is pumped out for irrigation with the help of pumping sets and the table below includes the number of tube wells and pumping sets in Haryana.

**Table 10.3.8 Number of tube wells and pumping sets in Haryana.**

Year	Diesel Sets	Electric Sets
1966-67	--	--
1970-71	17,903	86,455
1980-81	1,09,353	2,22,674

Year	Diesel Sets	Electric Sets
1990-91	1,55,842	3,41,729
2000-01	2,55,302	3,34,171
2010-11	2,31,146	4,92,311
2017-18	2,97,616	5,50,134
2018-19	2,75,211	5,46,188
2019-20	2,64,472	5,26,401

Source: Compiled by JICA Survey Team from Statistical Abstract of Haryana.

### (3) Water Quality

The quality of the water is observed separately for ground water and surface water. The surface water quality is measured at several stations which includes the seven stations of river Yamuna, ten stations of medium and minor rivers in Haryana, four stations of Lakes, one station for Pond, one station for Drain, and fourteen stations for Canals.

Table 10.3.9 contains the standards of water quality.

**Table 10.3.9 Designated Best Use Water Quality Criteria.**

Designated Best Use	Class of Water	Criteria
Drinking Water source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20 C 2mg/l or less
Outdoor bathing (Organized)	B	Total Coliform Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less
Propagation of Wildlife and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen Demand 4mg/l or more Free Ammonia (as N) 1.2mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25C micro mhos/cm Max. 2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l

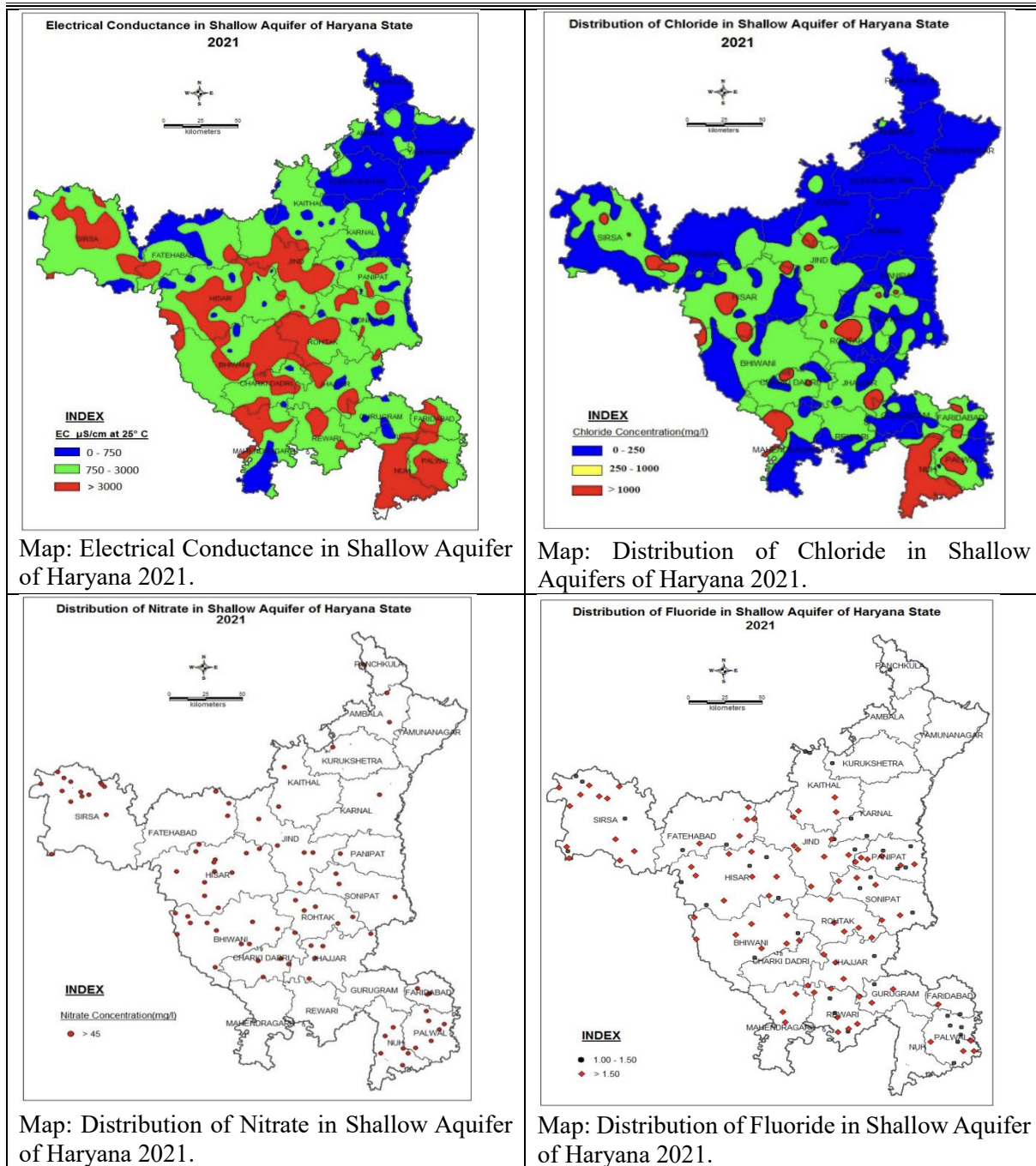
Source: Compiled by JICA Survey Team from Central Pollution Control Board.

For the groundwater quality measurement, there are 28 observatories set up in Haryana. These observatories are in district Rohtak, Sonipat, Bhiwani, Palwal, Faridabad, Gurugram, and Panipat. The parameters like temperature, biochemical oxygen demand (BOD), Nitrate, Conductivity, Fecal Coliform, Total Dissolved Solids, and Fluoride are measured.

**Table 10.3.10 District-wise Groundwater Quality Problem**

Contaminants	Districts affected (in part)
Salinity (EC > 3000 $\mu$ S/cm at 25° C)	Sirsa, Fatehabad, Hisar, Jind, Jhajjar, Bhiwani, Mewat, Mahendergarh, Rewari, Gurugram, Kaithal, Karnal, Palwal, Panipat, Rohtak, Sonipat and Faridabad
Fluoride (>1.5 mg/l)	Ambala, Bhiwani, Fatehabad, Faridabad, Hisar, Jhajjar, Jind, Kaithal, Karnal, Mahendergarh, Mewat, Palwal, Panipat, Rewari, Rohtak, Sirsa.
Chloride (>1000 mg/l)	Rohtak, Bhiwani, Sirsa, Hisar, Mahendergarh, Mewat, and Jhajjar.
Nitrate (>45 mg/l)	Bhiwani, Faridabad, Fatehabad, Gurgaon, Hisar, Jhajjar, Jind, Kaithal, Karnal, Kurukshetra, Mahendergarh, Panchkula, Rewari, Rohtak, Sirsa, Sonipat, Mewat, Palwal, Panipat

Source: Compiled by JICA Survey Team from Ground Water Year Book of Haryana (2021-22).



Map: Electrical Conductance in Shallow Aquifer of Haryana 2021.

Map: Distribution of Chloride in Shallow Aquifers of Haryana 2021.

Map: Distribution of Nitrate in Shallow Aquifer of Haryana 2021.

Map: Distribution of Fluoride in Shallow Aquifer of Haryana 2021.

Source: Compiled by JICA Survey Team from Ground Water Year Book of Haryana (2021-22).

**Figure 10.3.4 Groundwater Quality Problem with map**

**(4) Use of chemical Pesticide/ chemical fertilizers/ insecticides**

The use of fertilizers in Haryana is increasing continuously. After the Green Revolution, the use of pesticides, fertilizers, and high-yield variety seeds leads to the high production of grains in the country (Kumar, 2017)<sup>4</sup>. To improve the soil fertility and increase the crop production, fertilizers are used (Jeetendra Prakash Aryal, 2021)<sup>5</sup>.

4 Kumar, D. S. (2017). Growth and Pattern of Fertilizer Consumption in Haryana. International Journal of Research in Economics and Social Sciences , 138-148.

5 Jeetendra Prakash Aryal, T. B. (2021). Factors affecting farmers' use of organic and inorganic fertilizers in South Asia. Environmental Science and Pollution Research , 51480-51496.

According to the Statistical Abstract of Haryana, there was a significant increase in the consumption of fertilizers from year 1966 to 2021. The total use of fertilizers was 13,347 tonnes in 1966-67 which increased to 17,73,490 tonnes in 2020-21. In the 1970s, the consumption of fertilizers reportedly climbed to 70,060 tonnes as an effect of the green revolution. There was a steady increase in the use of fertilizers till 2017. In 2018, fertilizer use decreased to 7,44,946 tonnes from 13,57,622. According to the article published by Times of India<sup>7</sup>, in 2017, the government of India decided to reduce the size of the Urea bags to 45 kg from 50 kg has brought down the consumption of fertilizers or nitrogen by 8%. But the rise in fertilizer consumption continued to increase from 2019 to till date.

**Table 10.3.11 Year-wise chemical fertilizer consumption in Haryana (1966-67 to 2020-21).**

Year	Consumption (Tonnes)				Percentage		
	N	P	K	Total	N	P	K
1966-67	12,626	574	147	13,347	95	4	1
1970-71	60,972	6,860	2,228	70,060	87	10	3
1980-81	1,87,385	31,340	12,098	2,30,823	81	14	5
1990-91	4,43,245	1,38,005	5,042	5,86,292	76	24	1
2000-01	7,14,308	2,06,319	9,668	9,30,295	77	22	1
2010-11	9,74,045	3,35,950	47,627	13,57,622	72	25	4
2018-19	5,83,618	1,47,909	13,419	7,44,946	78	20	2
2019-20	10,49,069	3,17,002	42,206	14,08,277	74	23	3
2020-21 (P)	10,02,500	1,36,890	6,34,100	17,73,490	57	8	36

Source: Compiled by JICA Survey Team from Statistical Abstract of Haryana.

Note: For the year 1974-75 to 1980-81 fertilizer year has been taken as February to January. (P) is Provisional.  
N = Nitrogenous, P = Phosphate, K = Potash

In terms of NPK, nitrogenous fertilizers were used in large amount as compared to phosphates and potash. Out of all the districts, Faridabad uses fewer amounts of fertilizers while district Sirsa consumes most amounts of the fertilizers (Table 10.3.12).

The excessive use of fertilizers can cause many problems which include water eutrophication, soil acidification, degradation, and nitrogen pollution (Jeetendra Prakash Aryal, 2021).

**Table 10.3.12 District-wise consumption of chemical fertilizers in Haryana (2021-22).**

Districts	Consumption (Tonnes)				Percentage		
	N	P	K	Total	N	P	K
Ambala	40,540	4,490	25,580	70,610	57	6	36
Bhiwani	53,850	13,000	33,830	1,00,680	53	13	34
Faridabad	6,050	1,490	2,920	10,460	58	14	28
Fatehabad	77,180	11,490	48,630	1,37,300	56	8	35
Gurugram	8,790	2,650	4,780	16,220	54	16	29
Hisar	72,910	5,610	46,080	1,24,600	59	5	37
Jhajjar	22,500	1,550	13,500	37,550	60	4	36
Jind	88,380	4,320	55,240	1,47,940	60	3	37
Kaithal	73,720	2,350	39,470	1,15,540	64	2	34
Karnal	86,350	6,550	86,350	1,79,250	48	4	48
Kurukshetra	68,270	10,680	41,500	1,20,450	57	9	34
Mahendergarh	23,430	3,910	13,990	41,330	57	9	34
Nuh	13,920	2,890	7,140	23,950	58	12	30

<sup>6</sup> Statistical Abstract of Haryana 2020-21. Panchkula: Department of Economic and Statistical Analysis.

<sup>7</sup> <https://timesofindia.indiatimes.com/india/reducing-urea-bag-size-has-brought-down-fertilizer-consumption-report/articleshow/96836756.cms>

Districts	Consumption (Tonnes)				Percentage		
	N	P	K	Total	N	P	K
Palwal	33,280	6,710	18,170	58,160	57	12	31
Panchkula	6,470	550	3,720	10,740	60	5	35
Panipat	35,380	4,010	21,200	60,590	58	7	35
Rewari	25,160	4,550	12,810	42,520	59	11	30
Rohtak	35,550	6,470	19,060	61,080	58	11	31
Sirsa	1,10,940	24,930	68,020	2,03,890	54	12	33
Sonipat	58,620	7,030	35,630	1,01,280	58	7	35
Yamunanagar	61,210	11,660	36,480	1,09,350	56	11	33

Source: Compiled by JICA Survey Team from Statistical Abstract of Haryana 2021-22.

Note: Total may not tally due to rounding off. Figures of Charkhi Dadri districts included in Bhiwani.

N = Nitrogenous, P = Phosphate, K = Potash

Haryana is among the highest pesticide-using states in the country<sup>8</sup>. According to the Statistical Abstract of Haryana, the consumption of pesticides has increased with respect to the area covered. The consumption of pesticides is almost similar over a decadal period throughout the state. Only minor increase and decrease can be observed in the consumption percentage (refer Table 10.3.13 below).

**Table 10.3.13 District-wise consumption of chemical pesticides (Technical Grade) in Haryana (Tonnes)**

District	Consumption of Pesticides (Tonnes)		Percentage	
	2010-11	2020-21 (P)	2010-11	2020-21
Ambala & Panchkula	310	305	7.64	7.26
Bhiwani & Charkhi Dadri	299	305	7.36	7.26
Faridabad & Palwal	209	204	5.15	4.86
Fatehabad	110	125	2.71	2.98
Gurugram & Nuh	43	43	1.06	1.02
Hisar	420	460	10.34	10.95
Jhajjar	67	69	1.65	1.64
Jind	180	195	4.43	4.64
Kaithal	304	315	7.49	7.50
Karnal	462	505	11.38	12.02
Kurukshetra	240	250	5.91	5.95
Mahendergarh	33	40	0.81	0.95
Panipat	398	390	9.80	9.29
Rewari	7	13	0.17	0.31
Rohtak	48	48	1.18	1.14
Sirsa	360	355	8.87	8.45
Sonipat	280	283	6.90	6.74
Yamunanagar	290	295	7.14	7.02
Haryana State	4,060.00	4,200.00	100	100

Source: Compiled by JICA Survey Team from Statistical Abstract of Haryana.

<sup>8</sup> Rukshan V. Mehta, M. S. (2020). A mixed-methods study of pesticide exposures in Breastmilk and Community and lactating Women,s perspectives from Haryana, India. . *BMC Public Health* .

## (5) Ambient Air Quality

The ambient air quality is observed in 30 stations in 22 districts of Haryana. All the districts have at least one observatory except Faridabad and Gurugram who have four observatories each. There are four Continuous Ambient Air Quality Monitoring Stations installed by the State Pollution Control Board at Faridabad, Gurugram, Rohtak and Panchkula and the data monitored at these stations is being displayed on prominent public places.

The National Ambient Air Quality Standards are set for Industrial, Residential, and Ecologically Sensitive Area. The permissible limit for SO<sub>2</sub> annually is 50 µg/m<sup>3</sup> in industrial and residential area and 20 µg/m<sup>3</sup> in ecologically sensitive area, similarly it is 40 µg/m<sup>3</sup> for industrial and residential area and 30 µg/m<sup>3</sup> for ecologically sensitive area for NO<sub>2</sub>. Further, the standards set for PM<sub>10</sub> and PM<sub>2.5</sub> are 60 µg/m<sup>3</sup> and 40 µg/m<sup>3</sup> for all areas.

In 2021, the air quality is measured in all the districts (refer Table 10.3.14). The NO<sub>2</sub> value of Rohtak was higher than the standard value and the PM<sub>2.5</sub> and PM<sub>10</sub> values were above the standard values in all the districts.

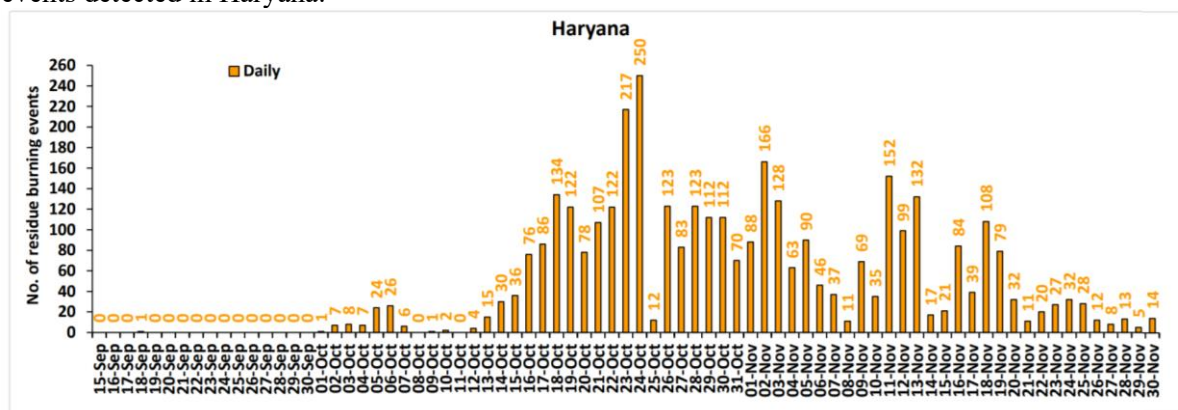
**Table 10.3.14 Annual average ambient air quality of Haryana in 2021.**

District	Annual Average in µg/m <sup>3</sup>			
	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
Amabala	9	21	122	62
Bahadurgarh	13	28		91
Ballabgarh	9	35	165	82
Bhiwani	13	23	135	50
Charkhi Dadri	5	28	156	79
Dharuhera	18	26	187	77
Faridabad	10	35	230	98
Fatehabad	10	22	153	61
Gurgaon	6	20	174	93
Hissar	12	30	162	92
Jind	10	24	145	88
Kaithal	21	17	144	58
Karnal	26	20	119	60
Kurukshetra	10	29	142	69
Mandikhera	15	21	92	52
Manesar	8	9	164	96
Narnaul	7	25	175	69
Palwal	10	11	127	37
Panchkula Urban Estate	10	23		49
Panipat	39	15	196	61
Rohtak	10	70		90
Sirsa	15	26	129	57
Sonepat	9	24	319	55
Yamunanagar	7	24	166	79

Source: Compiled by JICA Survey Team from Central Pollution Control Board.

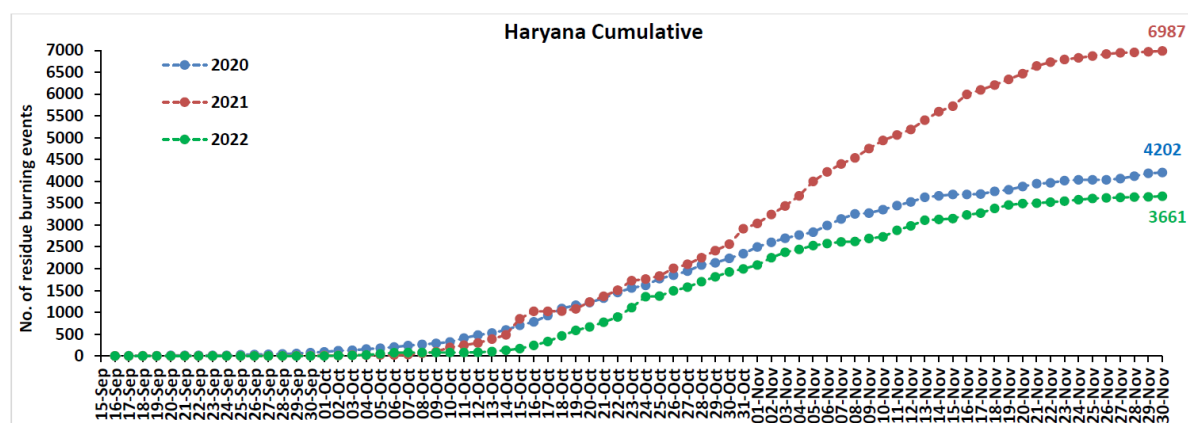
The active fire events due to rice residue burning are regularly being monitored using satellite remote sensing, following the "Standard Protocol for Estimation of Crop Residue Burning Fire Events using Satellite Data". In the state of Haryana, in total 3,661 stubble burning events were detected between 15-Sept-2022 and 30-Nov-2022. On the other hand, 49,922 stubble burning events were detected in

the state of Punjab during the same period, which was 1300 times more than the stubble burning events detected in Haryana.



Source: Division of Agricultural Physics, ICAR – Indian Agricultural Research Institute

**Figure 10.3.5** Number of Crop Residue burning events between 1-Sept to 30-Nov 2022



Source: Division of Agricultural Physics, ICAR – Indian Agricultural Research Institute

**Figure 10.3.6** Comparison of annual cumulative crop residue burning events – 2020, 2021, 2022

### (6) Ambient Noise Level

As per the Haryana State Pollution Control Board, the department only measure the ambient noise level during the Diwali festival. The table contains the standards for Noise level.

**Table 10.3.15** The Noise level Standards.

Specific Environment	Time Base (Hours)	Standard limit as per WHO guidelines	
		LAeq (dB)	LMax, fast (dB)
Outdoor living area	16	50-55	-
Dwelling, indoor, inside bedrooms	16	35	-
	8	30	45
Outside Bedrooms	8	45	60
School class rooms and pre-schools, indoor	During class	35	-
Pre-school bedrooms, indoor	Sleeping time	30	45
School, playground outdoor	During day	55	-
Hospital, ward rooms, indoor	8	30	40
	16	30	-
Hospitals, treatment rooms, indoor	-	As low as possible	-

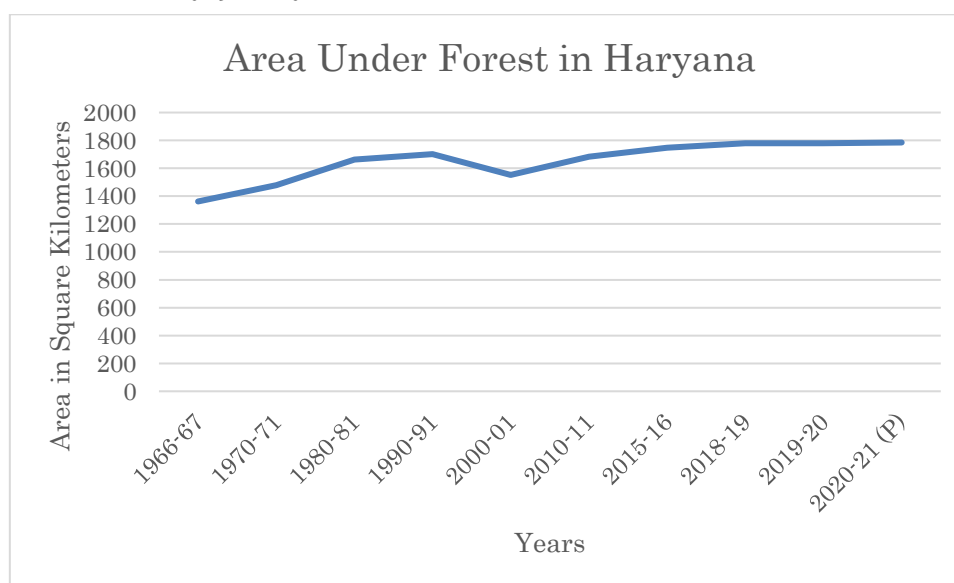


Specific Environment	Time Base (Hours)	Standard limit as per WHO guidelines	
		LAeq (dB)	LAm <sub>ax</sub> , fast (dB)
Industrial, commercial, shopping and traffic areas, indoor and outdoor	24	70	110
Ceremonies, festivals and entertainment events	4	100	110
Public addresses, indoors and outdoors	1	85	110
Music through headphones/earphones	1	85	110
Impulse sounds from toys, fireworks and firearms	-	-	120-140 (peak sound pressure (not L <sub>am</sub> <sub>ax</sub> , fast), measured 100 mm from the ear)
Outdoors in parks and conservation area	-	Existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low.	-

Source: Compiled by JICA Survey Team from Central Pollution Control Board.

### (7) Protected Areas

It is observed that forest cover in Haryana has increased between 1966 to 1991 but then a slight drop in the forest cover was observed in 2001. After 2001, the forest cover started increasing again and it is constant since 2019 to 2021.



Source: Compiled by JICA Survey Team from Statistical Abstract of Haryana.

**Figure 10.3.7 Area under Forest Cover in Haryana since 1966-2021.**

Table 10.3.16 shows the categories of forest which include State Forest which further have three parts, Reserved, Protected and Un-classed Forests and other category is Private Forests that are closed under two Acts, Indian Forests Act and Land Preservation Act.

**Table 10.3.16 Area under Forest Cover in Haryana**

District	State Forests (sqkm)			Private Forests (sqkm)		Total (sqkm)	Percentage of State Forests to total Forests
	Reserved	Protected	Un-classed	Closed under Indian Forests Act	Closed under Land Preservation Act		
Ambala	2	35	0	0	16	53	69.81
Bhiwani	1	60	1	2	1	65	95.38
Charkhi Dadri	1	27	1	1	0	30	96.67
Faridabad	2	13	0	0	55	70	21.43
Fatehabad	0	55	1	0	0	56	100
Gurugram	2	16	0	0	69	87	20.69
Hisar	0	63	0	0	0	63	100
Jhajjar	0	37	1	0	2	40	95
Jind	4	63	2	0	0	69	100
Kaithal	37	35	0	0	0	72	100
Karnal	4	72	0	1	0	77	98.7
Kurukshetra	18	27	0	0	0	45	100
Mahendgarh	17	24	0	5	11	57	71.93
Nuh	0	12	1	2	64	79	16.46
Palwal	1	27	1	0	0	29	100
Panchkula	86	253	0	0	43	382	88.74
Panipat	0	41	0	3	0	44	93.18
Rewari	6	33	0	1	10	50	78
Rohtak	0	40	4	0	2	46	95.65
Sirsa	0	48	0	1	0	49	97.96
Sonipat	0	74	0	1	19	94	78.72
Yamunanagar	69	133	1	0	25	228	89.04

Source: Compiled by JICA Survey Team from Statistical Abstract of Haryana  
P: Provisional.

There are two National Parks in Haryana. The Sultanpur National Park was established in 1991 and it is located in Gurugram in 352.17 acres while the Kalesar National Park was established in 2003 and it is present in 11570 acres in Yamuna Nagar district of Haryana.

**Table 10.3.17 National Park of Haryana**

S. no.	National Park	District	Area in Acre	Date of Establishment
1	Sultanpur National Park	Gurugram	352.17	05.07.1991
2	Kalesar National Park	Yamuna Nagar	11,570	08.12.2003
	<b>Total</b>		<b>4824.84</b>	

Source: Compiled by JICA Survey Team from Haryana Forest Department

Wildlife Sanctuaries are made to protect the fauna and there are seven Wildlife Sanctuaries in Haryana. The table shows the name of the Wildlife Sanctuaries along with the area and date of establishment.

**Table 10.3.18 Wildlife Sanctuaries in Haryana**

S. No.	Wildlife Sanctuaries	District	Area in Acre	Date of Establishment
1	Kalesar Wildlife Sanctuary	Yamuna Nagar	13,209	13.12.1996
2	Bir Shikargah Wildlife Sanctuary	Panchkula	1,896	29.05.1987
3	Chhilchhila Wildlife Sanctuary	Kurukshetra	71.45	28.11.1986

S. No.	Wildlife Sanctuaries	District	Area in Acre	Date of Establishment
4	Nahar Wildlife Sanctuary	Rewari	522.25	30.01.1987
5	Bhindawas Wildlife Sanctuary	Jhajjar	1,016.94	07.05.1986
6	Khapparwas Wildlife Sanctuary	Jhajjar	204.36	27.03.1991
7	Khol Hi-Raitan Wildlife Sanctuary	Panchkula	5,501.88	10.12.2004
<b>Total Area of Wildlife Sanctuaries</b>			<b>23441.17</b>	

Source: Compiled by JICA Survey Team from Haryana Forest Department.

The wetland is a land area covered with water. There are two wetlands in Haryana which were declared as wetlands in 2021. The table contains information about the wetlands in Haryana.

**Table 10.3.19 Wetland in Haryana**

S. No.	Wetland	District	Area	Date of Declaration
1	Bhindawas Wildlife Sanctuary	Jhajjar	4.12	25.05.2021
2	Sultanour National Park	Gurugram	1.43	25.05.2021

Source: Compiled by JICA Survey Team from ENVIS Center on Wildlife and Protected Areas.

**Table 10.3.20 Conservation Reserves in Haryana**

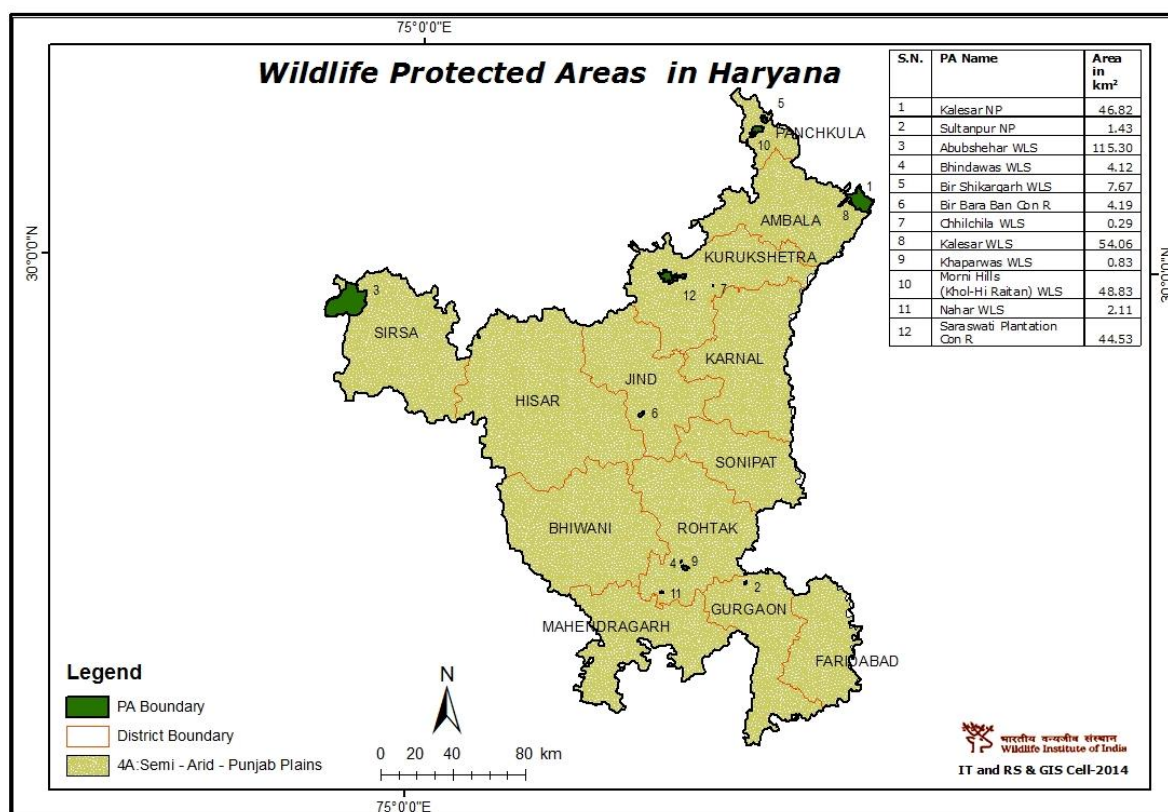
S.No.	Name	District	Area in Acre	Date of Establishment
1	Saraswati	Kaithal	11,003	11.10.2007
2	Bir Bara Ban	Jind	1,036	11.10.2007

Source: Compiled by JICA Survey Team from Haryana Forest Department

**Table 10.3.21 Community Reserve in Haryana**

S.No.	Name	District	Area in acre	Date of Establishment
1	Abubshehar	Sirsa	28,492	14.03.2018
2	Golden Jubilee Brahm Sarovar	Kurukshetra	89.36	19.07.2017

Source: Compiled by JICA Survey Team from Haryana Forest Department.



Source: ENVIS Center on Wildlife and Protected Areas.

**Figure 10.3.8 Wildlife Protected area in Haryana.**

### (8) Environment and Climate change schemes

The table contains information about the schemes related to environment and climate change.

Table: Environment and Climate Change Schemes.

S. No.	Scheme	Description	Beneficiaries
1	Mukhya Mantri Pragatisheel Kisan Samman Yojana	To motivate farmers for water saving, crop residue management, sustainable agriculture, organic farming, and integrated farming system practices. Under this scheme, selected farmers will be facilitated by providing cash prize/awards for their outstanding work.	First prize 5,00,000 rupees is given to 1 person, second prize of 3,00,000 rupees is given to 2 people, third prize of 1,00,000 rupees is given to 5 people, and consolation Prize of 50,000 is given to 88 people. Total amount of 60,00,000 rupees is spent on this scheme every year.
2	Land Reclamation Scheme	To motivate farmers for construction and operation of horizontal subsurface/vertical drainage system, environmentally sound disposal of saline drainage effluent in SSD project area, and the preservation of productivity of land once land is reclaimed.	The farmers are requested to show their willingness for reclamation of their lands and have to pay 20% share of the total cost of the reclamation of waterlogged and saline soils which is Rs. 9000/- per acre in case of Sub Surface Drainage and Rs. 7000/- per acre in case of Vertical Drainage Technology.
3	Promotion of Agricultural Mechanization for In-situ Management of Crop Residue in the States of Punjab,	Farmers are trained for crop residue management and operation and maintenance of agricultural machines along with providing demonstration of agricultural machines at farmers' field.	This scheme is 100% sponsored by Govt. of India. Till date a total of 72777 in situ management machines has been provided to the farmers at 50% to 80% subsidy.

S. No.	Scheme	Description	Beneficiaries
	Haryana, Uttar Pradesh and NCT of Delhi		
4	National Food Security Mission	Main objectives of the Mission are to increase production of wheat and pulses through area expansion and productivity enhancement in a sustainable manner in the identified districts of the state.	The Govt. of India has approved the Action Plan of Rs. 4012.724 Lakh of the year 2021-22 to achieve the objectives of the Mission following interventions have been envisaged in the scheme.
5	Crop Diversification Programme – Mera Pani Meri Virasat	The purpose of crop diversification is to promote the latest technology along with sustainable agriculture and to enable the farmers to choose alternative crops for increasing the productivity and income of the farmers.	In the year 2020-21, under the crop diversification scheme, farmers were given a grant of 7000 / - per acre with the aim of reducing the area of paddy in the state and promoting maize, cotton, Kharif Oilseed, Kharif Pulses, Kharif onion, Fodder crops, Horticulture/ vegetable crops, even in case of fallow land.
6	Sprinkler Irrigation System	This water saving device is found most suitable for sandy soil with undulating topography. The General Category Farmers, SC Farmers, small and marginal farmers are given assistance of @85% in entire State.	So far, 1,90,177 nos. of Sprinkler set have been installed with an expenditure of 292.24/- crore as subsidy in the State.
7	Underground Pipeline (UGPL) System	Due to the intensive cropping system in some districts of Haryana, the ground-water table declined by 9.3 meter in between 1999 to 2016. To increase the crop production, the transporting of irrigation water by UGPL is best method.	So far, an area of 2,23,695 hectare had been brought under the system by utilizing an amount of 358.21/- crore. The pattern of assistance under UGPL is @50% of cost of system limited to 25,000/- per hectare with maximum of 60,000/- per beneficiary.
8	Drip Irrigation System	The system is use in cotton and sugarcane crops.	So far, an area of 4,819 hectare has been covered under this system by providing subsidy amount of 29.43/- crore in the state.

Source: Compiled by JICA Survey Team from Department of Agriculture and Farmer Welfare, Haryana and Economic of Haryana, Department of Economics and Statistical Affairs.

## **Chapter 11 Recommendations**

### **11.1 Activities to be implemented immediately by HSHPP**

It is the understanding of the HSHPP that the following activities should be conducted before the PMC procurement process.

- Establishment of the implementation and monitoring system (Formation of the Project Executive Committee, contact with the Project Governing Council, etc.)
- Appointment of staff of PMU/DPMUs and procurement of office equipment
- Comprehensive market survey at accessible large markets (refer to Section 11.2)
- Survey of existing PGs

### **11.2 Development of PGs**

It is understood that the main component of the Project, value chain development, is linked to the agricultural policy, which aims to develop and strengthen PGs that operate in production clusters based on development blocks for creating a system to benefit their member producers economically. In this Project, keeping the focus with the existing farmer groups, other new farmers are also encouraged to participate. The Project shall anticipate that it will take time to confirm with them the PG concept in the Project, build consensus among the PG members, or to mobilise more number of farmers in the surrounding area. Therefore, the Project shall be recommended to engage Technical Support Groups with proven track records in implementing the PG development.

### **11.3 Strengthening of Horticulture Extension (including SHEP Approach)**

There are several issues and problems to solve or improve for strengthening of Horticulture Extension as mentioned in Chapter 3, 3.3.8 Challenges for Horticulture.

#### **Water-saving irrigation facilities**

There are water-saving facilities in Haryana. However, those use, or have management that is not so skillful. To learn efficient use of the facilities, DOH extensionists should visit advanced area in India as well as abroad.

One of the candidate States is Rajasthan. Because Rajasthan has been suffering from groundwater depletion and soil degradation for some time, and small-scale irrigation using artificial reservoirs and solar pumps, and rainwater harvesting irrigation are being utilized.

#### **Deterioration of soil condition**

This is also a good opportunity to visit advanced areas. In Rajasthan, farmers face more serious water problem not only quantity but also quality. Desertification has depleted rivers, and salinity accumulation occurs when ground moisture evaporates as a characteristic of desert soils. Application of drip irrigation and solar pump are very common for horticultural crops. Salinization is more severe therefore they survey on salinity-tolerant crops including Date Palm.

In Japan, one big Tsunami hit the Tohoku area in 2011. Tohoku was originally the biggest paddy production area. Because of Tsunami, from Iwate prefecture to Chiba prefecture, around 23,600ha of farmland was inundated by sea water. To remove salt from the inundated soil, Tokyo Agriculture University took scientific approach such as use of slug (by-product of iron manufacturing) to control pH and sowing of green manures to improve soil structure. Joint-research activities between DOH and Tokyo Agriculture University is one of the options to tackle this issue.

The introduction of digital tools has also been instrumental in advancing soil health management. These include soil sensing technologies that provide real-time data on soil moisture, pH, temperature and nutrient content. Geographic Information Systems (GIS) and remote sensing technologies are used for comprehensive soil mapping and analysis to facilitate informed decision-making on crop rotation and soil conservation. Mobile applications provide farmers with easy access to soil health insights and

recommendations based on soil test data. Artificial intelligence-based predictive models use historical data to forecast soil health trends and issues, enabling proactive management. Together, these digital tools have transformed the landscape of soil health management, leading to more sustainable and productive agricultural outcomes.

### **Access to quality inputs (Quality seeds and planting materials)**

There are high potential to produce high quality horticultural products in Haryana benefitting from the climate and proximity to big cities. Presently, good vegetable seeds are available from seed companies and government recommended seeds from certified seed producers.

However, high quality planting materials for fruit trees are not so easily available. For instance, seedless Kinnow has become popular and highly evaluated in the market. Actually, the number of nurseries for seedless kinnow is very limited in Haryana. Less seed number hybrid variety of kinnow was developed by Punjab agriculture university. To compete with Pakistan seedless kinnow, collaboration among producing states such as Rajasthan (Center of excellence, Kota), Punjab (Punjab university), Haryana, Himachal Pradesh are indispensable. Originally, seedless kinnow of India was developed in ICAR Central Citrus Research Institute. Scions were provided in this center and grafted to other citrus.

In the same way, development of flower varieties, introduction of grafting techniques for flowers are necessary. There are good markets nearby. However, many flowers come from other states also such as Tamil Nado, Kerala and Andhra Pradesh in the south, West Bengal in the East, Maharashtra in the West and Rajasthan, Delhi and Haryana in the North.

Midicinal plants and spices are also potential crops. India has become one of big producers of these crops. At present, only small area covered by these crops and export to other states or other countries. For export, processing is essential. There are good models like Rajasthan and Gujarat. In Rajasthan, food parks have important role in terms of processing. Arrangement of matching between producers and processars (private sector) should be done by DOH for strengthening the production.

Not only inside of India but also outside of India, there is a chance to collaborate for production of quality seeds suitable to Haryana. According to DOH, seeds from Taiwan (Known you seed) gave good results. Known you seed company has a branch in India. For production of high-quality seeds, joint research and development between university or institute in Haryana and Taiwan seed company or Agriculture University in Taiwan can be a trigger for strengthening capacity of high-quality seed production.

### **11.4 Promotion of plant factory**

A plant factory is a facility to stably produce crops without being affected by the weather by artificially creating the optimum conditions required to grow plants. In addition to contributing to stable food supply, the factories enable cultivation of farm crops in areas and environments unsuitable for agriculture. Usually, this type of cultivation is conducted in urban area to fill the basket of fast-food restaurants such as MacDonald, Kentucky fried chicken, Pizza hut, etc. Mostly leaf lettuces and sprouts are main crops cultivated in a plant factory. There are big business chance in Haryana. DOH need to promote these facilities in soil deteriorated area and matching the facilities with fast-food chains. Japan Plant Factory Association can guide DOH.

### **11.5 Measures for Climate Change Impact**

The conversion of rice to other crops is also covered by the project. Rice cultivation is a major source of methane emissions due to the use of paddy fields. Conversion to field crops reduces methane emissions from paddy fields and can contribute to the reduction of greenhouse gas emissions. Carbon credits may be considered for this initiative.

### **11.6 Formation of Production Centers and Branding Strategy**

Consideration can also be given to eco-labelling and sustainability certification, highlighting environmentally friendly cultivation methods and sustainable production processes, such as micro-irrigation. In the future, a market could be created where produce produced by environmentally friendly agriculture could be sold as environmentally friendly vegetables.

## 11.7 Involvement of the Private Sector

### 11.7.1 Pilot farm Establishment under Centre of Excellence

A post-harvest Centre of Excellence may not be required under this Project since the University of Birmingham (United Kingdom) has already established one, and the existing facility are sufficient for the training purposes. Instead, a pilotfarm shall be established as a Vegetable Center of Excellence's facility.

To establish the pilot farm, it is assumed the components of Capex (Capital Expenditure) and Opex (Operational Expenditure) as below.

**Table 11.7.1 Component of Capex of a Pilotfarm**

Component	Description
Land Preparation	Soil testing, leveling, plowing, and other preparatory activities to make the land suitable for cultivation.
Training and Demonstration Area	A shaded structure for hosting training sessions, workshops, and demonstrations for farmers and extension workers.
Irrigation System	Introduction and setup of drip irrigation systems, sprinklers, and water storage facilities.
Research and Storage Facility	A dedicated space for conducting research, storing harvested crops, seeds, and equipment.
Greenhouse or Polyhouse	Controlled environment structures for testing and growing crops under specific conditions.
Basic Amenities	Essential facilities like sanitation, drinking water supply, and resting areas for the staff and visitors.
Equipment and Materials	Purchase of necessary horticultural tools, machinery, and training materials.

Source : JICA Survey Team

**Table 11.7.2 Component of Opex of a Pilotfarm**

Component	Description
Maintenance and Repairs	Routine upkeep and repairs for infrastructure, tools, and equipment.
Salaries	Wages for the staff, including trainers, maintenance personnel, and researchers.
Utilities	Ongoing costs associated with water, electricity, and other essential utilities required for farm operations.
Equipment and Supplies Renewal	Periodic replacement of worn-out tools, purchasing of additional supplies, and updating the existing equipment.

Source :Prepared by JICA Survey Team

### 11.7.2 Village of Excellence

Some farmers in rural areas have difficulty to access to Center of Excellence and it creates gaps of knowledge among farmers. To improve the situation, the concept of "Village of Excellence" is proposed. Village of Excellence serves as a localized hub in rural areas, acting as an extension of the pilotfarm and bringing the advancements and knowledge right to the doorsteps of farmers who might find it challenging to access centralized facilities. By leveraging the expertise and leadership of producer group leaders, this model focuses on peer-to-peer learning, ensuring that knowledge dissemination is effective and relatable.

225 Village of Excellence are proposed to established with utilizing producer group leaders' exiting facilities. Hence, capex can be minimized and only necessary horticultural tools, machinery, and training materials shall be prepared upon the establishment of Village of Excellence. As an operation costs, maintenance and repairs cost and incentives for producer group leaders shall be considered.

### 11.7.3 Acceleration Plans for Public-private Partnerships

Public-Private Partnerships (PPPs) play a crucial role in bridging the gap between innovative technologies, capital, expertise, and the grassroots level implementation in projects like the pilotfarm and the Village of Excellence. To accelerate these partnerships, a blend of online and offline events, along with other innovative strategies, can be employed as described below.

**Table 11.7.3 Acceleration Plans for Public-Private Partnerships**

Category	Component	Description
Online Initiatives	Webinars & Virtual Workshops	Host topic-specific sessions where both public and private entities present their viewpoints, solutions, and requirements. These can be recorded for future reference and shared widely.



Category	Component	Description
Online Initiatives	Online Networking Platforms	Develop platforms specifically designed for stakeholders in the pilotfarm and Village of Excellence project to connect, discuss, and collaborate.
Online Initiatives	Online Hackathons	Organize events where tech experts, agri-professionals, and businesses collaborate to solve specific challenges faced by the pilotfarm or Village of Excellence.
Offline Initiatives	Stakeholder Workshops	Organize events where representatives from the public sector, businesses, and the farming community come together to discuss, plan, and strategize.
Offline Initiatives	Field Days	Arrange specific days where private entities can visit the pilotfarm and Village of Excellence, witness demonstrations, and interact with the community.
Offline Initiatives	Trade Fairs & Expos	Rent stalls in agricultural fairs to showcase technologies, methods, and achievements, attracting potential private partners.
Offline Initiatives	Investor Meets	Host exclusive meetings with potential investors or business incubators where detailed presentations about the potential and requirements of the Project are showcased.
Other Program	Mentorship Programs	Engage industry experts to mentor producer group leaders or Village of Excellence representatives, enhancing their skills and network.
Other Program	Collaborative Research	Facilitate partnerships between private companies, research institutions, and the pilotfarm for mutual benefit.
Other Program	Reward Programs	Encourage businesses to offer rewards for the farming community under the initiative, fostering goodwill and deeper collaboration.
Other Program	Media Partnerships	Collaborate with media for stories, interviews, and updates to increase visibility.

Source: JICA survey team

## 11.8 Gender and Nutrition improvement

While women play important roles in rural agricultural economy, their ownership of and access to socioeconomic resources including training opportunities and control power on decision-making are limited. Concerned actors including officers of DOH seem not to be very sensitized for gender mainstreaming. Considering these situations, measures are proposed in the Project to i) facilitate women membership of PGs and activate them; ii) form women PGs; iii) facilitate women to participate in activities and trainings of PGs, and other services; iv) provide farming instruments for reducing workload; v) set different types of feeding packhouses and those with food processing women PGs could easily apply for; and vi) facilitate gender sensitization of concerned actors including officers of DOH. Their details are described in “Gender Mainstreaming Strategy and Action Plan” as Attachment 11.8.1.

As far as nutrition is concerned, in order to address the lack of knowledge about nutrition, it is advisable to include information and techniques for improving nutrition in the training programs related to horticulture development for PGs. Additionally, to combat micronutrient deficiencies, promoting the establishment of home gardens within the Project is recommended. Moreover, it is suggested that nutritional information be displayed through wall paintings on easily visible surfaces, such as village buildings, school gardens, and other community spaces, to disseminate knowledge about nutrition.

## 11.9 Convergence

As part of strengthening transparency and accountability, it is advisable to consider increasing transparency and accountability through regular reporting and evaluation by all stakeholders. This may include the introduction of a project management system, and the use of online dashboards and other systems to track project progress and the performance of individual sub-projects may be considered.

## 11.10 Digital Transformation

The following considerations should be made at the start of the Project

A basic study level survey should be conducted for future requirements, and such specifications should be prepared based on these studies. In addition, since a system cannot be realized without a vendor who

can respond to the high ideals, it is necessary to conduct interviews (RFI: Request for Information) with the target developers and investigate the possibilities as well.

#### **11.10.1 Items related to basic design**

The following items are necessary to examine requirements specifications.

(i) Preparation of requirements specifications

First, it is necessary to clarify the client's intention for the system. The necessary requirement specifications are compiled. The requirements specification defines the following two functions. Creation of functional specifications (definition of necessary functions, user interface definition, data definition, etc.) and creation of non-functional specifications (requirements other than functions: processing volume, response speed, information security, etc.).

Information security is important, and IPA (Information-technology Promotion Agency, Japan) recommends the following specifications<sup>1</sup>.

In addition to the above, network design, hardware design, server room and operation room design, etc. need to be considered.

(ii) Implementation of RFI<sup>2</sup>

Based on the above basic design, RFIs are conducted with multiple developers to

Confirmation of the applicability of the required specifications and discussion of specification changes to make them applicable.

Identification of initial construction costs and discussion on cost reduction

Discussions on understanding maintenance and management costs and cost reductions

#### **11.10.2 Contracts**

(i) Preparation of procurement specifications

Procurement specifications will be prepared based on what has been done in the basic design. The procurement specifications will be the revised requirements and items related to the contract.

In particular, it is essential to clarify and describe the date and time of service-in of the system, how long this service will be continued, and what actions should be taken when the system is updated (migration to the next system).

(ii) Bidding

In bidding, it is important to ensure fairness and the confidentiality of information proposed by responsive bidders.

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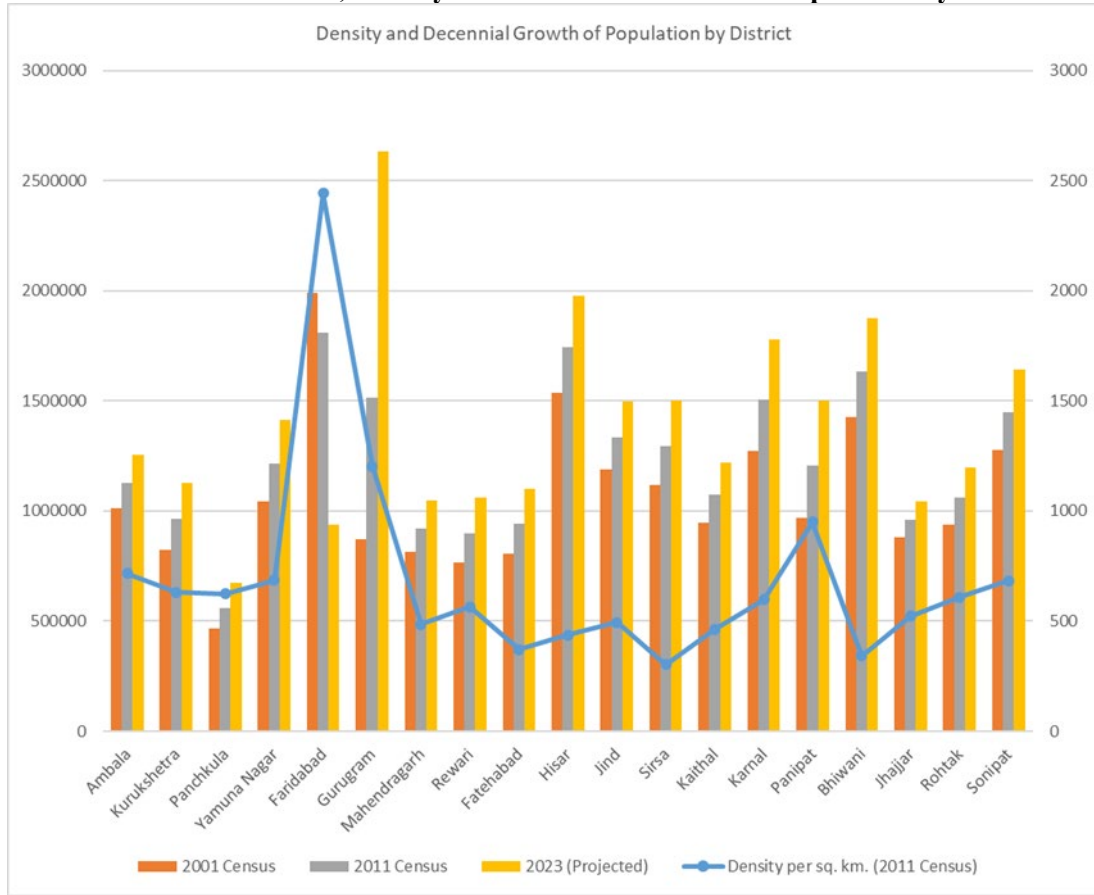
<sup>1</sup> How to write procurement specifications | Information Security | IPA Information-technology Promotion Agency, Japan, <https://www.ipa.go.jp/security/jisec/about/knowledge/shiyousho.html>

<sup>2</sup> The purpose of an RFI is to gather detailed information on available options, technologies, products, etc. and use this information to prepare a more specific Request for Proposal (RFP). The purpose of an RFI is to gather detailed information on available options, technologies, products, etc. and to use this information to prepare a more specific Request for Proposal (RFP).

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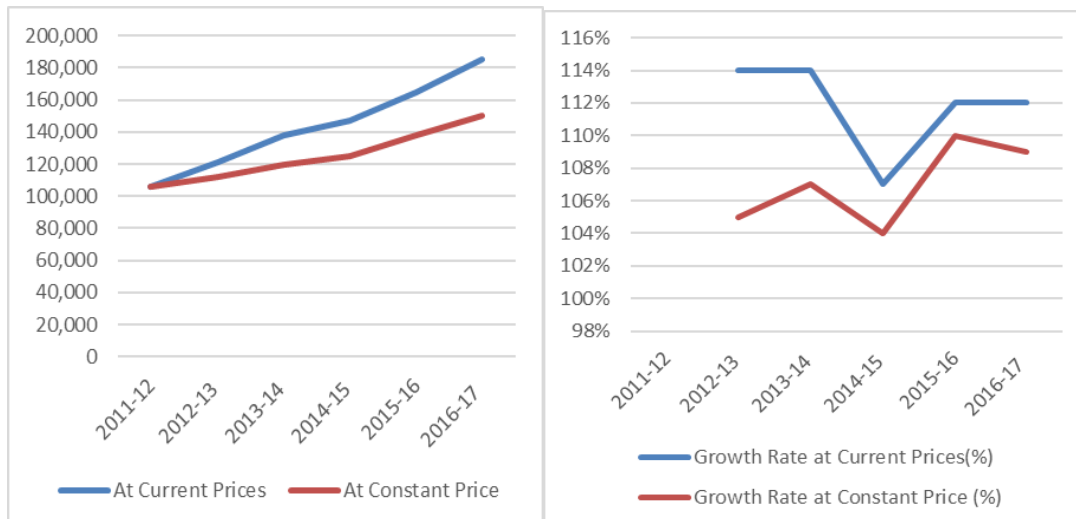
*Attachment*

**Attachment 2.1.1 Area, Density and Decennial Growth of Population by District**



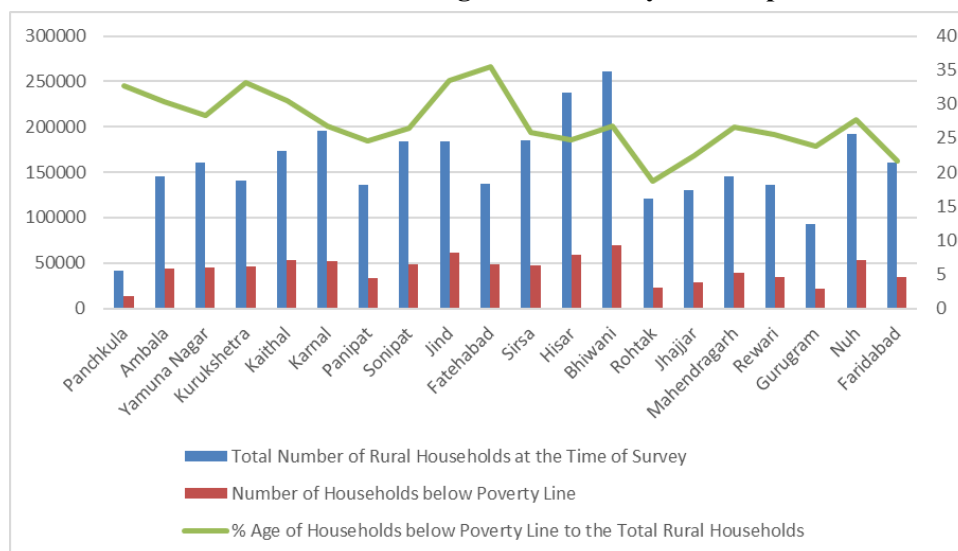
Source: JICA Survey Team based on the data in Office of the Registrar General & Census Commissioner, India 2001, 2011 Census (<https://censusIndia.gov.in/>)

**Attachment 2.1.2 Per Capita Net State Domestic Product/Per Capita income**



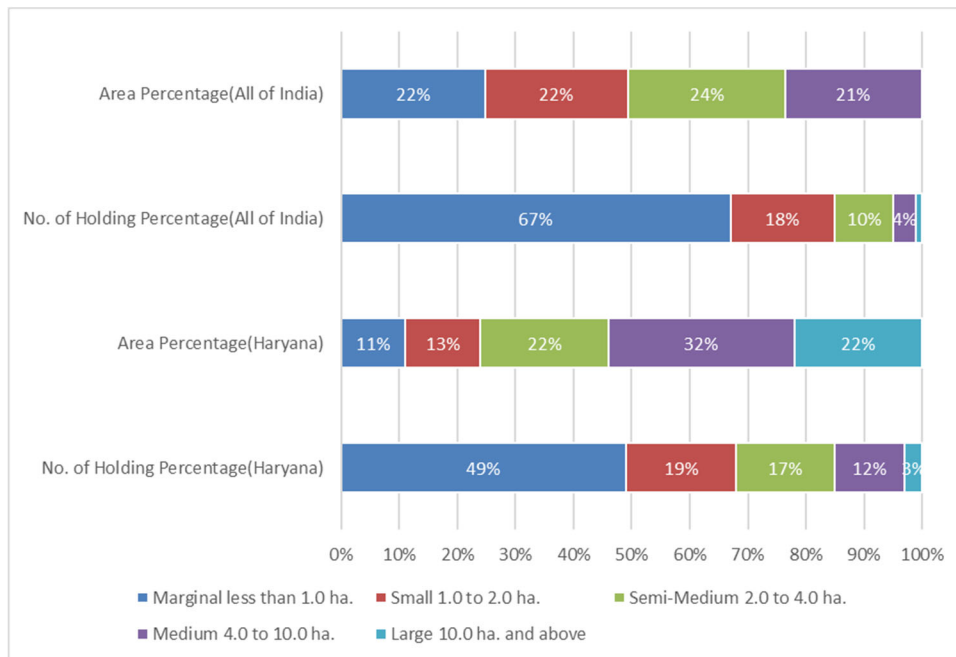
Source: JICA Survey Team based on Census of India 2011-IndiaStateDistSbDistVill

**Attachment 2.1.3 Rural Families Living Below Poverty Line as per 2002-07 Survey**



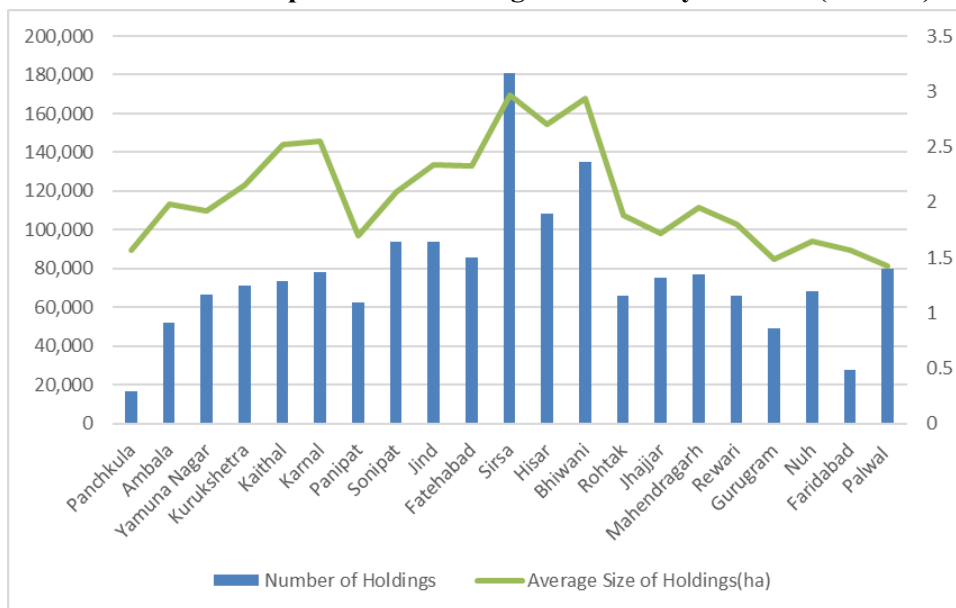
Source: JICA Survey Team based on the data in RURAL DEVELOPMENT DEPARTMENT, HARYANA No. of Rural BPL Households in the State along with Definition of Rural Poverty

**Attachment 2.1.4 Number of Operational Holdings and Area Operated by Size Class of Holdings in the Haryana State and All over India (2010-11)**



Source: JICA Survey Team based on the data in STATISTICAL ABSTRACT OF HARYANA 2021-22

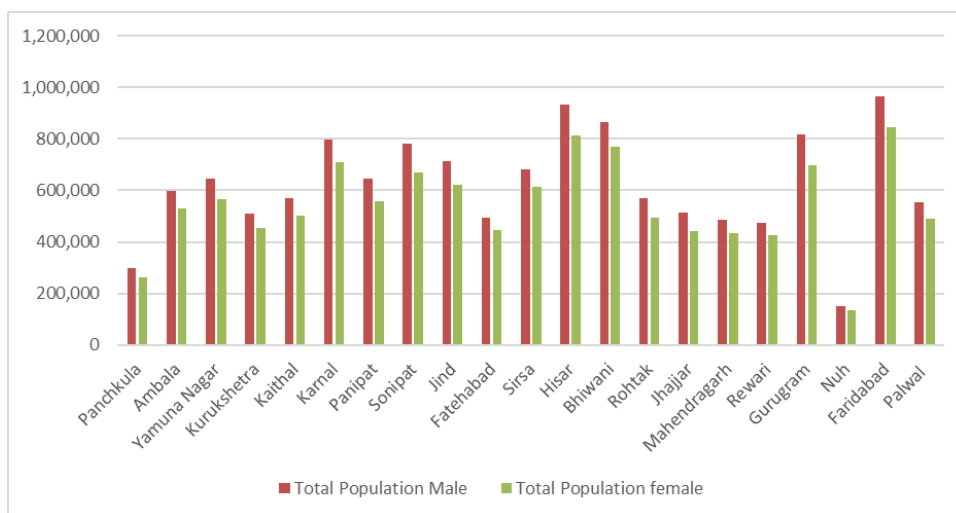
**Attachment 2.1.5 Operational Holdings and Area by Districts (2010-11)**



Source: JICA Survey Team based on the data in STATISTICAL ABSTRACT OF HARYANA 2021-22

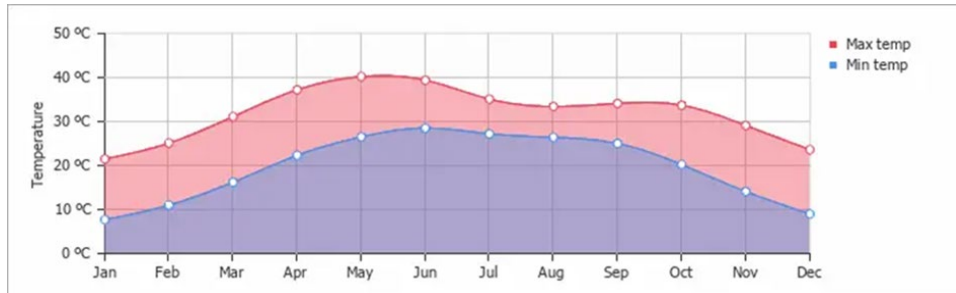


**Attachment 2.1.6 Sex-wise Literacy Rate Among Total Population, Scheduled Castes – 2011 Census**

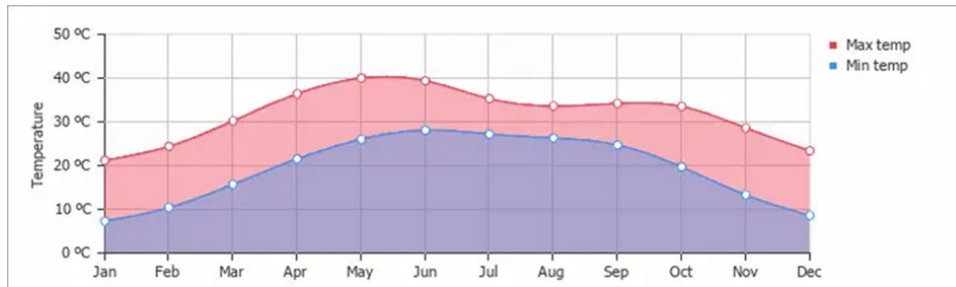


Source: JICA Survey Team based on the data in Statistical Abstract of Haryana 2021-22, STATISTICAL ABSTRACT OF HARYANA 2021-22

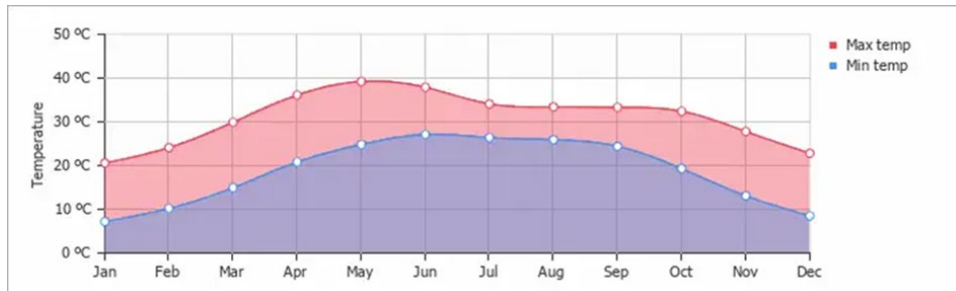
**Attachment 2.3.1 Line graph of min and max temperature in each city, 2022**



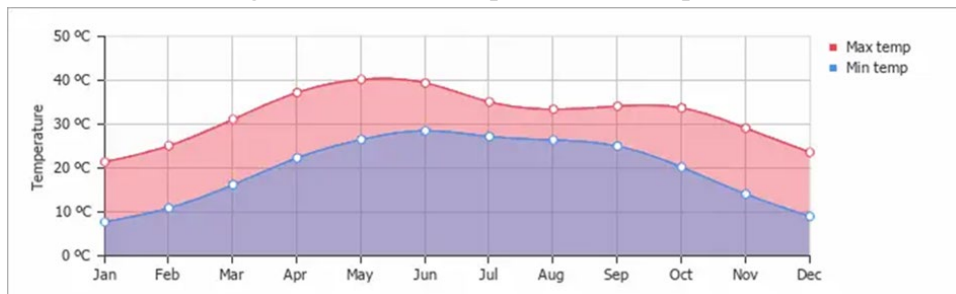
**Average min and max temperatures in Bhiwadi, India**



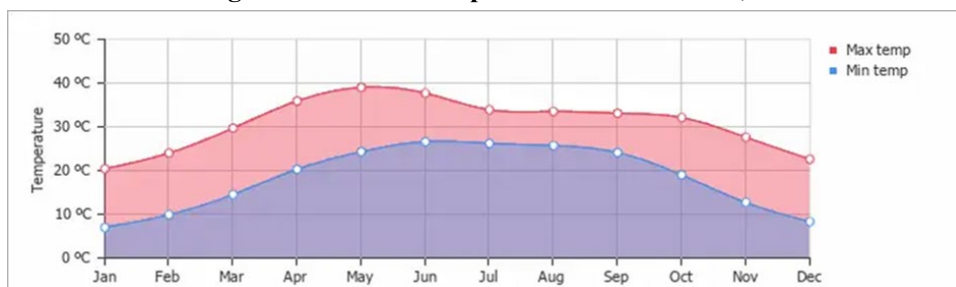
**Average min and max temperatures in Hisar, India**



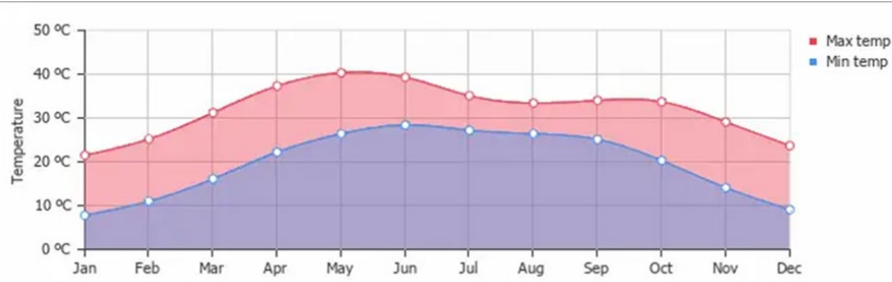
**Average min and max temperatures in Panipat, India**



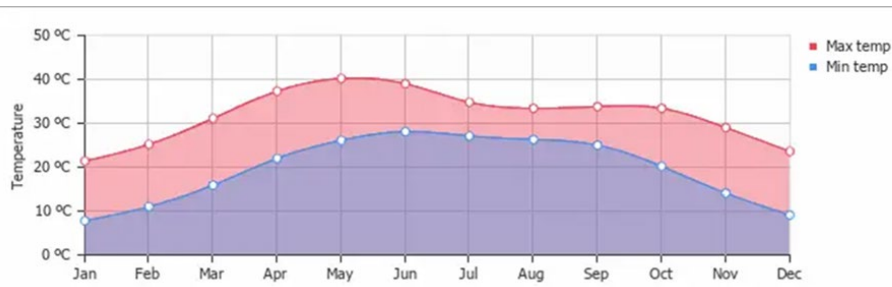
**Average min and max temperatures in Dharuhera, India**



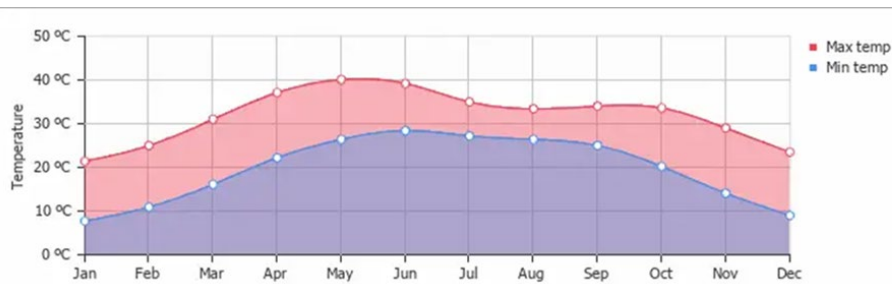
**Average min and max temperatures in Karnal, India**



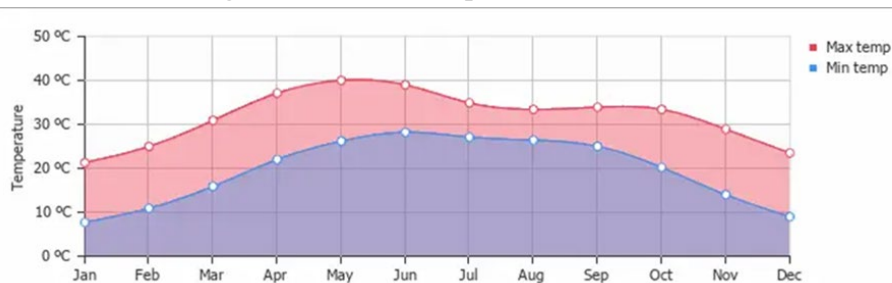
**Average min and max temperatures in Sohna, India**



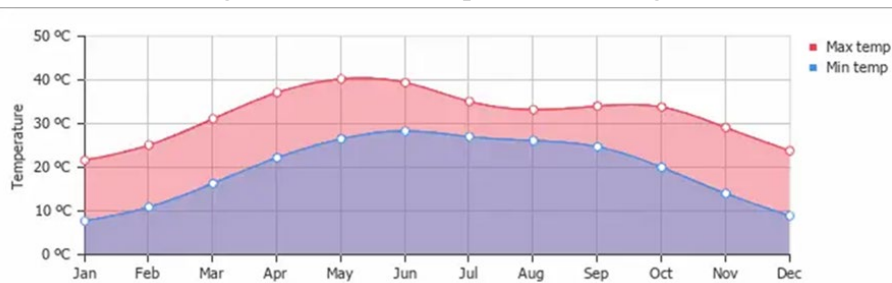
**Average min and max temperatures in Faridabad, India**



**Average min and max temperatures in Manesar, India**



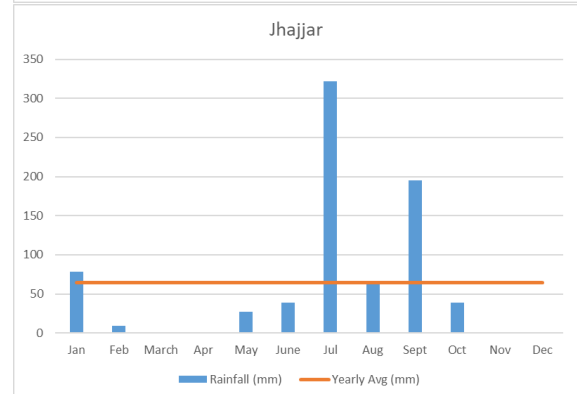
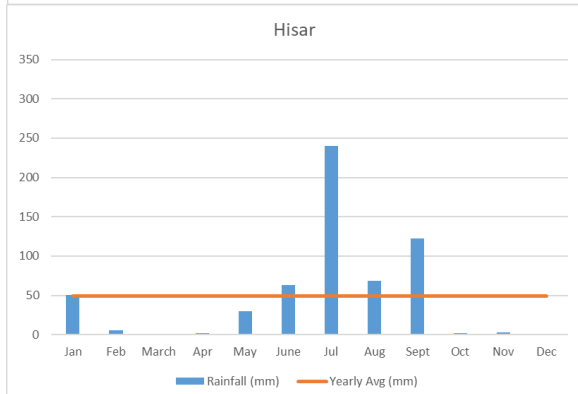
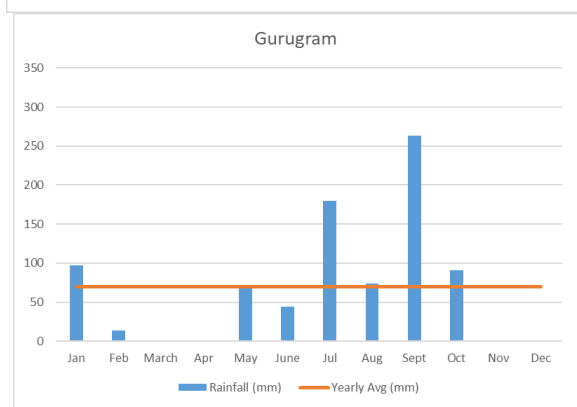
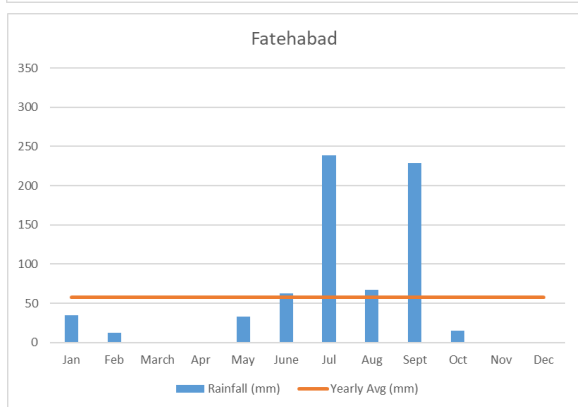
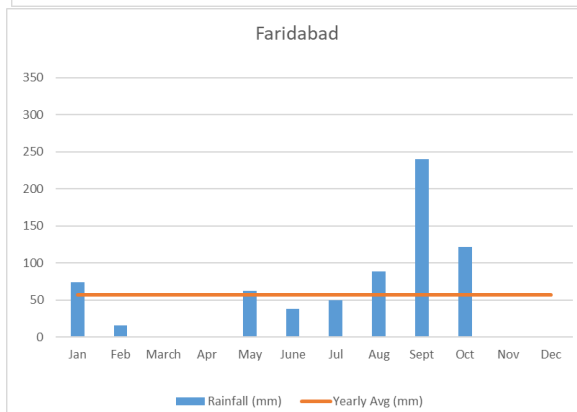
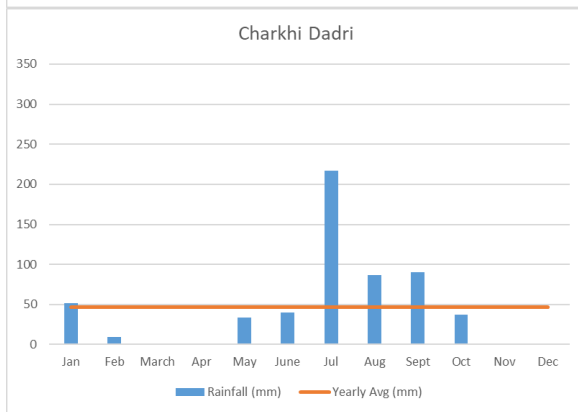
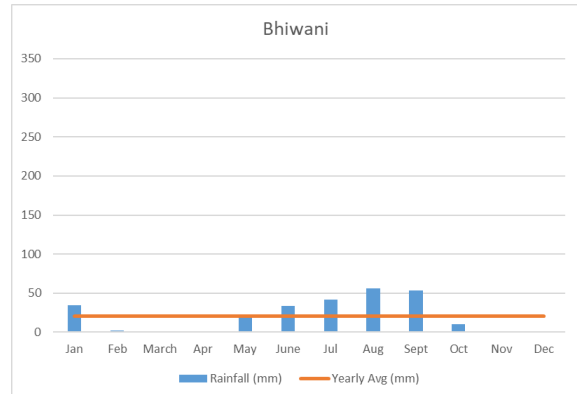
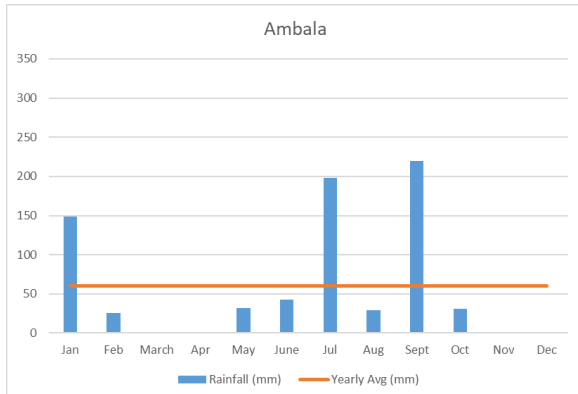
**Average min and max temperatures in Gurgaon, India**

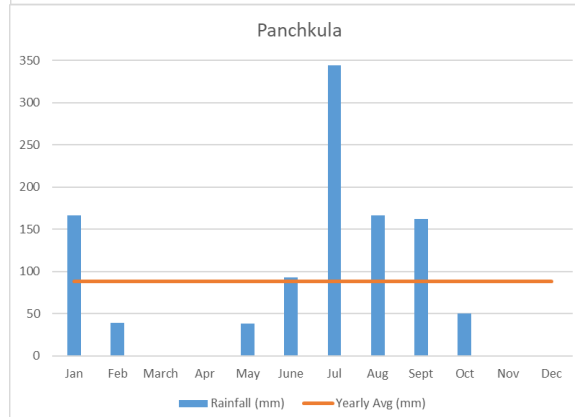
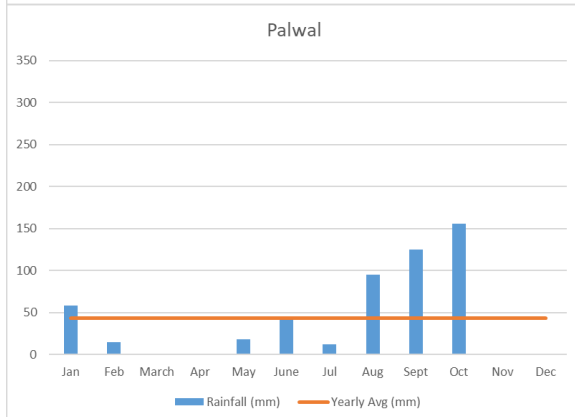
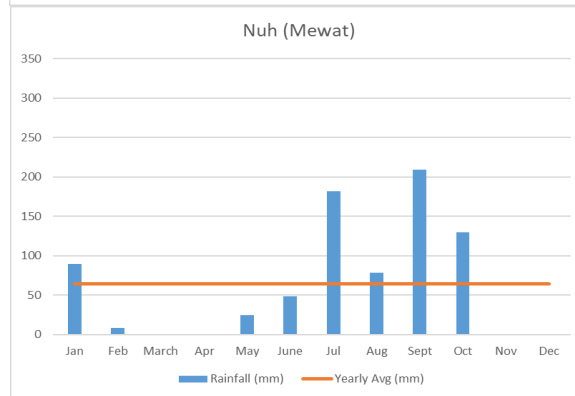
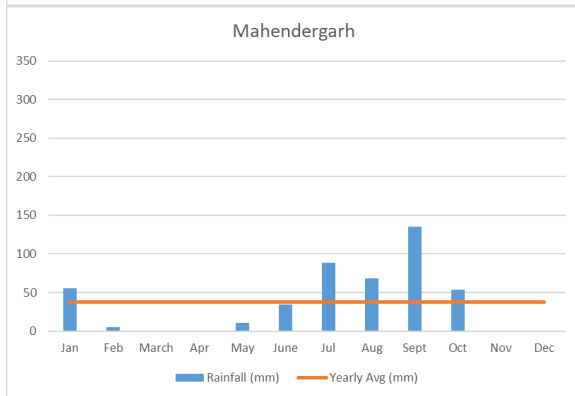
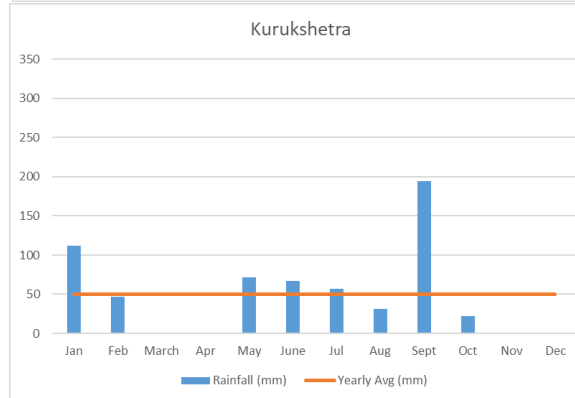
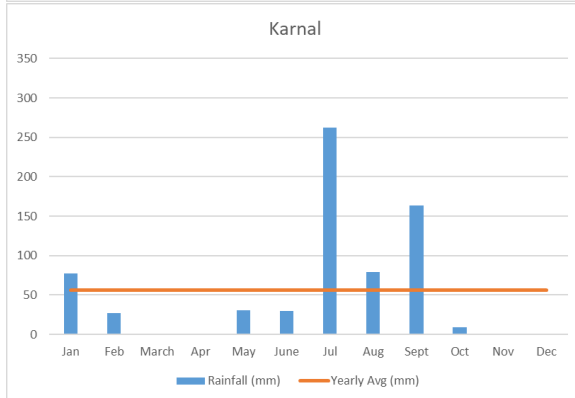
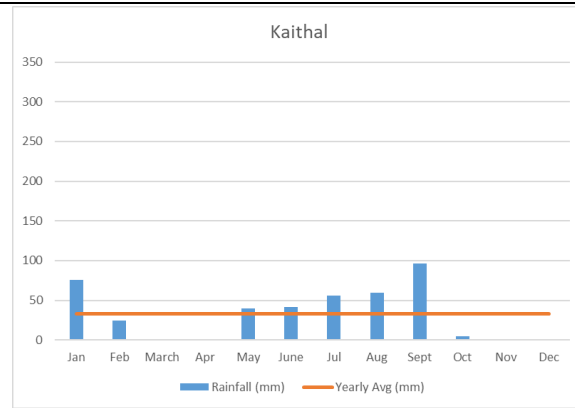
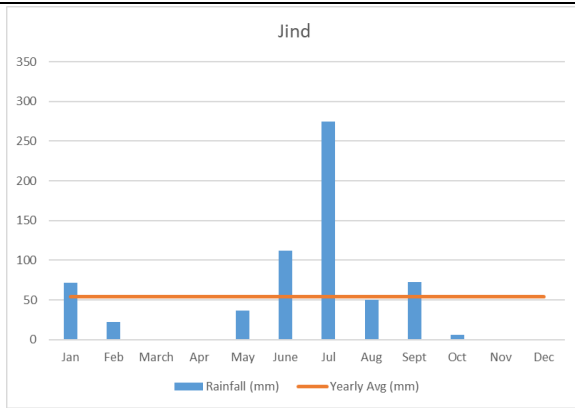


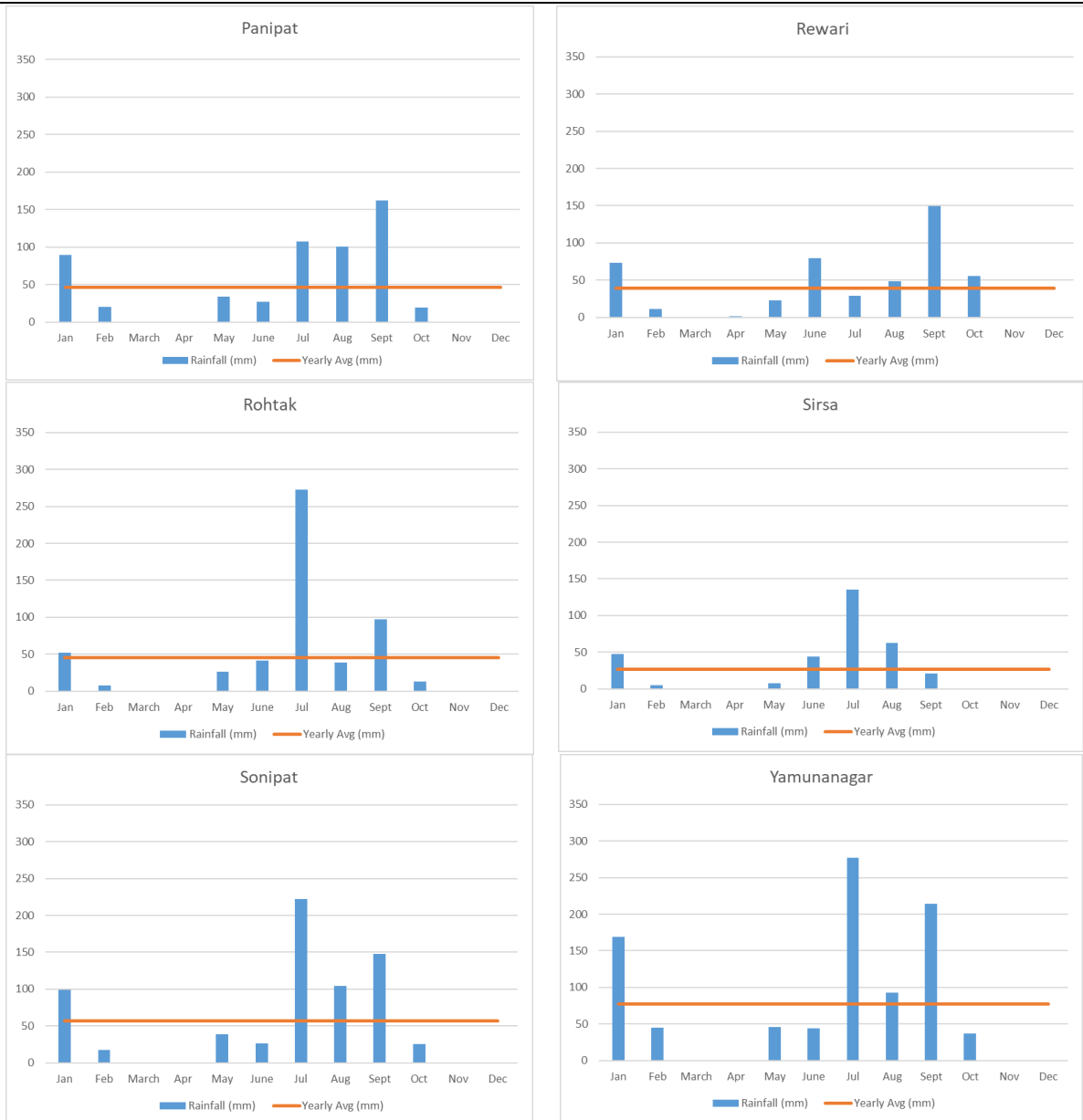
**Average min and max temperatures in Neemrana, India**

Source: Places in Haryana, India (weather-and-climate.com)

### Attachment 2.3.2 District-wise rainfall, 2022







Source: DOH

### Attachment 3.2.1 Role and responsibility of Major Staff

Designation	Work Allotted	Duties
Director General	<p>Director General is the overall in charge of the department and has the following functions and duties:</p> <ul style="list-style-type: none"> <li>• To form the policies of the department.</li> <li>• To get implemented the programmes in tandem with the defined objectives and targets according to the plans. To review and monitor the programmes and issue the instructions accordingly.</li> <li>• To oversee the welfare of the department.</li> <li>• To attend the meetings at Govt. levels and with other institutions.</li> </ul>	
Joint Director of Horticulture General	<ul style="list-style-type: none"> <li>• Accounts</li> <li>• Budget</li> <li>• National Horticulture Mission Micro Irrigation</li> <li>• Small Farmers“ Agribusiness Consortium Plan and Non Plan Schemes</li> </ul>	
Chief Vigilance Officer		<ul style="list-style-type: none"> <li>• To assist DGH day to day to working and policy formulation of the department.</li> <li>• To oversee the matters related to accounts and budget and put up the matters before DGH for his concurrence and approval.</li> <li>• To get prepared the Annual Action Plans of NHM, MI, NMM, SFACH and Plan &amp; Non-Plan schemes and appraisal to DGH for his final concurrence and approval.</li> <li>• To oversee the implementation and providing of information under RTI Act-2005.</li> </ul>
Joint Director Horticulture (NHM)	<ul style="list-style-type: none"> <li>• National Horticulture Mission</li> <li>• National Mission on Medicinal Plants Plan and Non Plan Schemes</li> </ul>	<ul style="list-style-type: none"> <li>• To assist DGH day to day working and policy formulation of the department.</li> <li>• To oversee the matters related to NHM, NMM and plan and non-plan schemes and put up the matters before the Director General for his concurrence and approval.</li> <li>• To get implemented the approved Action Plans of NHM, NMM and Plan and Non-plan schemes.</li> <li>• To review the physical and financial progress of NHM, NMM, Plan and Non-Plan Schemes and apprise to DGH for further implementation strategy and action.</li> <li>• To assist JDGH/G for preparation of Annual Action Plans of NHM, NMM and Plan &amp; Non-Plan Schemes. To attend meetings in absence of DGH.</li> </ul>

Designation	Work Allotted	Duties
Deputy Director (MI)	<ul style="list-style-type: none"> <li>Centrally Sponsored Micro Irrigation Scheme. National Mission on Indo Israel Projects.</li> <li>Protected Cultivation Components of NHM Scheme. Sanctions of Community Tanks under NHM Inquiries &amp; Inspections</li> <li>Floriculture Projects and Floriculture Scheme.</li> </ul>	<ul style="list-style-type: none"> <li>Formulation, implementation through DHO's and monitoring of centrally sponsored, Micro Irrigation Scheme in supervisory capacity. To examine community tank cases under NHM and to submit to JDH for further submission to DGH for approval and concurrence. Implementation of Indo Israel Projects.</li> <li>Implementation of protected cultivation components through DHOs and its monitoring. Enquiries and inspection of subordinate staff as and when assigned.</li> </ul>
Deputy Director (NHM)	<ul style="list-style-type: none"> <li>Centrally Sponsored National Horticulture Mission Scheme.</li> <li>Centrally Sponsored Small Farmers Agribusiness Consortium Scheme. Plan &amp; Non Plan Scheme, Budget and Account.</li> </ul>	<ul style="list-style-type: none"> <li>Formulation of schemes and implementation through DHO's the work assigned.</li> <li>To examine &amp; to submit the cases to JDH for further submission to DGH for approval and concurrence. To prepare Annual Action Plan of all CSS and State Plan Scheme.</li> <li>To review the monthly and quarterly report of above schemes. Enquiries and inspection of subordinate staff as and when assigned. To examine &amp; submit the budget and account matters to JDH(G).</li> <li>Preparation of meeting proceedings related to above schemes. Approval of tour programmes.</li> <li>Transaction of bills (medical/budget etc.). Audit Paras, P.A.C/C.A.G. Reports.</li> </ul>
Deputy Director Horticulture / Vegetable	<ul style="list-style-type: none"> <li>Formulation and implementation through DHO's the work assigned.</li> <li>To examine &amp; to submit the cases to JDH for further submission to DGH for approval &amp; concurrence. Vegetable, Spices, Mushroom-Extension and Production.</li> <li>RKVY (Rastriya Krishi Vikas Yojna).</li> <li>MDA (Mewat Development Authority) schemes.</li> <li>DRDA (District Rural Development Authority) Schemes. Shivalik Development Scheme.</li> <li>Shows, Seminars and Field Days.</li> <li>IPM</li> <li>Plant Health Clinics.</li> <li>Centrally Sponsored National Horticulture Mission on Medicinal Plants.</li> </ul>	<ul style="list-style-type: none"> <li>Vegetable Seed Licensing Seed Samplings.</li> <li>Vegetable Seed Production Programme.</li> <li>State Seed Sub Committee and Central Seed Sub Committee for Variety Release. Assesment of loss due to weather vagaries i.e., drought, flood, hot &amp; cold etc.</li> <li>To prepare action plan related to work assigned.</li> <li>To formulate extension strategy for work assigned and identification of sources. Coordination with HSDC, HAIC.</li> <li>To assist in scheme preparation &amp; its implementation.</li> <li>To conduct departmental enquiries relating to vegetable section. To conduct and co-ordinate shows, seminars, field days in the State. To review/prepare reports related to work assigned.</li> </ul>
Deputy Director of Horticulture /Fruits	<ul style="list-style-type: none"> <li>Fruits. Govt. Garden &amp; Nurseries and Private Nurseries in the State. Show-Mango Mela.</li> <li>Biotechnology-Tissue Culture.</li> </ul>	<ul style="list-style-type: none"> <li>Formulation and implementation through DHO's the work assigned.</li> <li>To examine &amp; to submit the cases to JDH(N) for further submission to DGH for approval &amp; monitoring. Fruit Planting Material Production Programme.</li> </ul>



Designation	Work Allotted	Duties
		<ul style="list-style-type: none"> <li>• Vegetable Seed Production Programme at GGNs &amp; HSDC.</li> <li>• To assist scheme preparation and its implementation related to fruits. Licensing authority of nurseries related to fruits under Fruit &amp; Nursery Act. To review progress reports related to work assigned.</li> <li>• Enquiries and inspection of subordinate staff as &amp; when assigned.</li> <li>• To submit the cases to JDH(N) and cases related to Biotechnology and Tissue Culture. To co-ordinate with NHB, HSDC and other related department concerning fruit matters.</li> </ul>
Vegetable Specialist	<ul style="list-style-type: none"> <li>• Vegetable, Spices, Extension and Production. RKVY (Rastriya Krishi Vikas Yojna).</li> <li>• MDA (Mewat Development Authority) Scheme.</li> <li>• DRDA (District Rural Development Authority) Scheme. Shivalik Development Scheme.</li> <li>• Trainings, Shows, Seminars, Visit, Fair etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Examination of technical aspects of work assigned, analysis of these reports and put up the matters to higher authority for approval. Vegetable Seed Licensing</li> <li>• Seed Samplings.</li> <li>• Vegetable Seed Production Programme.</li> <li>• State Seed Sub Committee for Variety Release.</li> <li>• Compilation of reports relating to Vegetable Section.</li> <li>• Coordination with HSDC, HAIC, CADA, MDA, DRDA, Shivalik Development Board. Preparation of reply for reports/letters submission to Government related to Vegetable section. Assist in preparation of guidelines related to assigned work.</li> </ul>
Fruit Specialist	<ul style="list-style-type: none"> <li>• Govt. Garden &amp; Nurseries and Private Nurseries in the State. All related works. Show-Mango Mela.</li> <li>• Biotechnology-Tissue Culture. Potato and Fruits. HAU Workshop</li> </ul>	<ul style="list-style-type: none"> <li>• To examine &amp; submit the cases related to nurseries and NHM, GGNs or Private nurseries to higher authorities for approval. 2nd and 3rd years maintenance rejuvenation.</li> <li>• Examination of license under Nursery Act-Cases regarding. Fruit Planting Material Production Programme at GGN"s.</li> <li>• Vegetable Seed Production Programme at GGNs &amp; HSDC. Potato &amp; Fruits.</li> <li>• Assist in identification of sources for planting material.</li> <li>• Submit the cases for approval of GGNs auction and cropping plan.</li> <li>• Preparation of annual strategy for biotechnology including tissue culture plants for production &amp; supply from HBC, Uchani. Assist in preparation of guidelines related to assigned work.</li> </ul>
Plasticulture Specialist	<ul style="list-style-type: none"> <li>• Micro Irrigation Scheme.</li> <li>• Protected cultivation-poly green houses, shade net houses, plastic tunnels, low tunnels, mulching etc, Indo Israel Projects.</li> </ul>	<ul style="list-style-type: none"> <li>• Examination of technical aspects of the scheme, analysis of these aspects for approval and put up the matter to higher officers. Regulation of scheme including analysis of documents of firms, registration of firms etc.</li> <li>• Assist the higher officers in implementation of assigned schemes/projects. Preparation of instructions, guidelines where necessary.</li> <li>• Preparation of material for creating awareness among the farmers to popularize the scheme.</li> <li>• To assist higher officers in implementation of components of Protected Cultivation/Precision Farming in the State. Monitoring of evolution.</li> </ul>

Designation	Work Allotted	Duties
State Sericulture Officer		<ul style="list-style-type: none"> <li>To look after the work of Sericulture Nature of Duties.</li> <li>Examination of sericulture work assigned &amp; put up for approval of higher authority.</li> </ul>
Post-harvest Management Specialist	<ul style="list-style-type: none"> <li>Post Harvest Management (NHM and others scheme) Processing Unit.</li> <li>Project related to PHM.</li> </ul>	<ul style="list-style-type: none"> <li>Examination of NHM projects for Post Harvest Management to higher authorities' plastic crops and packing materials arrangements put up to higher authorities.</li> <li>Food processing and training related to PHN put up to higher authorities.</li> </ul>
Floriculture	<ul style="list-style-type: none"> <li>Floriculture. Fruits and Schemes.</li> <li>Food Processing. Community Tanks under NHM.</li> <li>Organic Farming.</li> <li>Medicinal &amp; Aromatic Plants (MAP)</li> <li>Work related to North Zone Council, Banker etc. Work related to SMS Sewa, Horticulture Problems. Work related to North zone council, Baulur etc.</li> </ul>	<ul style="list-style-type: none"> <li>Examination of technical aspects of the work assigned &amp; put up for approval of higher authority.</li> <li>To assist the senior officers in project and scheme formulation, regulation and monitoring of field work. Preparation of progress reports &amp; to update the same related to work assigned.</li> <li>Preparation of reply for reports/letters for submission to Government.</li> </ul>
Plant Protection Officer	<ul style="list-style-type: none"> <li>NHM Projects.</li> <li>IPM</li> </ul>	<ul style="list-style-type: none"> <li>Examination of technical aspects of work assigned analysis of projects &amp; put up the cases to higher authorities for approval. Compilation of reports related to work assigned.</li> <li>To assist the officers in inspection &amp; monitoring of work assigned. Preparation of agendas &amp; minutes of Small Farmers Agribusiness Consortium. Assessment of loss due to weather vagaries i.e. drought, flood, hot &amp; cold etc.</li> </ul>
Organic Specialist	<ul style="list-style-type: none"> <li>Organic Farming.</li> <li>International trainings under NHM/Projects. Trainings and courses.</li> </ul>	<ul style="list-style-type: none"> <li>Examination of technical and financial aspects of cases related to assigned work and put up to higher authorities for approval. Preparation of reports, agendas for the work assigned.</li> <li>To assist the higher officers in inspection &amp; monitoring of scheme proposals.</li> </ul>
Horticulture Information Officer	<ul style="list-style-type: none"> <li>Staff Meetings</li> <li>National Horticulture Mission. Progress and annual action programme.</li> </ul>	<ul style="list-style-type: none"> <li>Examination of technical and financial aspects of cases related to assigned work and put up to higher authorities for approval. Assist in preparation of reply related to work assigned.</li> <li>Compilation of Annual Action Plan of NHM.</li> <li>Compilation of NHM reports &amp; online assistance in reports. Preparation of agendas &amp; minutes of monthly &amp; other staff meetings</li> </ul>

Source: Department of Horticulture 2023

**Attachment 3.2.2 Updated Technical Staff Position in DDH Offices of DOH**

Sr. No.	Designation	DDH CoE (Hort.)	DDH CoE (Fruits)	DDH GDCd	DDH CoE (IBDC)	DDH CoE (CSTF)	DDH HBC	DDH CoE (Veg.)	DDH CoE (Flower)	SFACH	HSHDA	Total
1	Principal, IITI, Uchani (Karnal)	0	0	0	0	0	0	0	0	0	0	0
2	Deputy Director Horticulture	0	0	1	1	0	0	1	0	0	0	3
3	District Horticulture Officer	0	0	0	0	0	0	0	0	0	0	0
4	State Sericulture Officer	0	0	0	0	0	0	0	0	0	0	0
5	Trainer	0	0	0	0	0	0	0	0	0	0	0
6	Subject Matter Specialist	0	6	3	0	6	2	10	0	0	0	27
7	Food Technologist	0	0	0	0	0	0	0	0	0	0	0
8	Entomologist, Bee Breeder	0	0	0	1	0	0	0	0	0	0	1
9	Technical Officer Tissue Culture Specialist	0	0	0	0	0	0	0	0	0	0	0
10	Technical Officer (DNA Fingerprinting Specialist)	0	0	0	0	0	0	0	0	0	0	0
11	Technical Officer Virology Specialist	0	0	0	0	0	0	0	0	0	0	0
12	Scientific Officer	0	0	0	0	0	0	0	0	0	0	0
13	TA (Technical Assistant)	0	0	0	0	0	0	0	0	0	0	0
14	APO	0	0	0	0	0	0	0	0	0	0	0
15	HDO (Horticulture Development Officer)	0	0	1	1	0	0	0	0	0	0	2
16	Demonstrator	0	0	0	0	0	0	0	0	0	0	0
17	Technical Assistant (Leminar/ Auto clave/ Green house)	0	0	0	0	0	0	0	0	0	0	0
18	Horticulture Supervisor	0	0	0	0	0	0	0	0	0	0	0
	Total	0	6	5	3	6	2	11	0	0	0	33

Source: DOH, 2022

**Attachment 3.2.3 Updated Technical Staff Position for Agricultural Sector in DHO Offices of DOH**

Sr. No.	Designation	Ambala	Bhiwani	Charkhi Dadri	Faridabad	Fatehabad	Gurugram	Hisar	Jhajjar	Jind	Kaithal	Karnal	Kurukshetra
1	Principal, HTI, Uchani (Karnal)	0	0	0	0	0	0	0	0	0	0	1	0
2	Deputy Director Horticulture	0	1	0	0	0	0	0	0	0	0	0	0
3	District Horticulture Officer	1	1	1	1	1	1	1	1	1	1	1	1
4	State Sericulture Officer	0	0	0	0	0	0	0	0	0	0	0	0
5	Trainer	0	0	0	0	0	0	0	0	0	0	5	0
6	Subject Matter Specialist	0	3	0	0	0	2	0	0	0	0	0	0
7	Food Technologist	0	0	0	0	0	0	0	0	0	0	0	0
8	Entomologist, Bee Breeder	0	0	0	0	0	0	0	0	0	0	0	0
9	Technical Officer Tissue Culture Specialist	0	0	0	0	0	0	0	0	0	0	0	0
10	Technical Officer (DNA Fingerprinting Specialist)	0	0	0	0	0	0	0	0	0	0	0	0
11	Technical Officer Virology Specialist	0	0	0	0	0	0	0	0	0	0	0	0
12	Scientific Officer	0	0	0	0	0	0	0	0	0	0	0	0
13	TA (Technical Assistant)	0	1	0	0	0	0	1	0	0	1	1	0
14	APO	0	0	0	0	0	0	0	0	0	0	0	0
15	HDO (Horticulture Development Officer)	3	3	3	1	4	2	6	2	6	2	3	2
16	Demonstrator	0	0	0	0	0	0	0	0	0	0	0	0
17	Technical Assistant (Leminar/ Auto clave/ Green house)	0	0	0	0	0	0	0	0	0	0	0	0
18	Horticulture Supervisor	0	0	0	0	0	0	1	0	0	0	0	0
Total		4	9	4	2	5	5	9	3	7	4	11	3

Sr. No.	Designation	Mahendragarh	Mewat	Palwal	Panchkula	Panipat	Rewari	Rohtak	Sirsa	Sonapat	Yamuna Nagar	Food Technology Lab.	Total
1	Principal, HTI, Uchani (Karnal)	0	0	0	0	0	0	0	0	0	0	0	1
2	Deputy Director Horticulture	0	0	0	0	0	0	1	0	0	0	0	2
3	District Horticulture Officer	1	1	1	1	1	1	1	1	1	1	1	22
4	State Sericulture Officer	0	0	0	1	0	0	0	0	0	0	0	1
5	Trainer	0	0	0	0	0	0	0	0	0	0	0	5
6	Subject Matter Specialist	0	0	0	2	0	0	1	0	0	0	0	8
7	Food Technologist	0	0	0	0	0	0	0	0	0	0	1	1
8	Entomologist, Bee Breeder	0	0	0	0	0	0	0	0	0	0	0	0
9	Technical Officer Tissue Culture Specialist	0	0	0	0	0	0	0	0	0	0	0	0
10	Technical Officer (DNA Fingerprinting Specialist)	0	0	0	0	0	0	0	0	0	0	0	0
11	Technical Officer Virology Specialist	0	0	0	0	0	0	0	0	0	0	0	0
12	Scientific Officer	0	0	0	0	0	0	0	1	0	0	0	2
13	TA (Technical Assistant)	0	0	0	0	0	0	0	0	1	0	0	5
14	APO	0	0	0	0	0	0	0	1	0	0	0	1
15	HDO (Horticulture Development Officer)	3	2	0	4	3	3	4	2	3	2	0	63
16	Demonstrator	0	0	0	0	0	0	0	0	0	0	0	0
17	Technical Assistant (Leminar/ Auto clave/ Green house)	0	0	0	0	0	0	0	0	0	0	0	0
18	Horticulture Supervisor	1	0	1	0	0	0	0	0	1	0	0	4
Total		5	3	2	8	4	4	7	5	6	3	2	115

Source: DOH, 2022

**Attachment 3.2.4 Function of Haryana Agricultural University (HAU Hisar)**

Function	Contents
Teaching function	The University has the following constituent colleges. 1. College of Agricultural Engineering and Technology, Hisar 2. College of Agriculture, Hisar 3. College of Agriculture, Kaul 4. College of Fisheries Sciences, Bawal 5. College of Basic Sciences & Humanities, Hisar 6. Indira Chakravarty College of Home Science. It offers academic courses not only B.Sc. and B.Tech but also M.Sc., M.Tech., M.B.A program and Ph.D. It also has seven Research stations, situated at Bawal, Karnal, Kaul, Sirsa, Rohtak, Buria, and Balsamand Agriculture Research stations.
Research function	The University has a well-developed experimental farm of 9.94 sq. km at main campus, Hisar along with ten experimental farms, one with each Regional Research Station covering an area of 5.68 sq. km. In these experimental farms, Kaithal has undertaken Seed Production Programme with Haryana Seed Development Corporation since 2001-02. It also has seed processing plant within university. CCS HAU has released 265 crop varieties/hybrids in 56 different crops as of March 2021.
Extension function	Besides academic education and research activities, extension education is one of the three major functions of the CCS Haryana Agricultural University, Hisar. Its main aim is to transfer the well proven/tested technology to the farmers (males and females), livestock owners, rural youth, field staff of State Govt. and other personnel engaged in developmental and professional agencies in the sphere of agriculture, animal husbandry, horticulture, home agencies and other allied areas through its well planned, skill-oriented and need based programmes. A collaboration/linkage is maintained with the Haryana State Govt. Department of Agriculture, Horticulture, Animal Husbandry, Social Welfare (Woman and Child Development) etc., and non-Government organization so that technologies may reach to the beneficiaries at their doorsteps. The Directorate of Extension Education acts as bridge between the research scientist and the farmers and other beneficiaries to provide feedback, therefore, the role of the directorate is two fold, i.e., transfer of technologies from scientists to the ultimate clients through field functionaries and finding out the field problems to be passed on to various research departments for working on a solution to the problem. It has farm advisory services. Farm Advisory Services (FAS) is the major wing and field arm of the Directorate of Extension Education covering the entire state through its Krishi Vigyan Kendra (KVKs) located in each district of the State. There is one Associate Director (AD), who looks after the farm advisory services and assists the Director of Extension Education to achieve the goals of the directorate.
Sources of Transfer of Technology	<ul style="list-style-type: none"> <li>i) <b>Krishi Vigyan Kendras (KVKs) at district Level</b> The Krishi Vigyan Kendras are located at district headquarters in each district of the State and are working under the supervision of the Directorate of Extension Education, CCS HAU, Hisar.</li> <li>ii) <b>Saina Nehwal Institute of Agricultural Technology, Training and Education (SNIATTE)</b> Saina Nehwal Institute of Agricultural Technology, Training &amp; Education (IATTE), CCSHAU, Hisar is situated at Gate No. 3 of the University imparts training to farmers/farm women and rural youths to update their knowledge &amp; skill and to start their entrepreneurs. SNIATTE is also an affiliated centre of Agricultural Skill Council of India (ASCI) for 19 Skill Oriented courses on various disciplines/areas.</li> <li>iii) <b>Farmers Information and Communication Service (FICS) Wing</b> The FICS wing is situated at the first floor of the Directorate of Extension Education. FICS conducts Krishi Melas (Rabi &amp; Kharif) in both the seasons with the objectives to disseminate the activities of the University and the Directorate to the rural masses and to bring the farmers' problems to the attention of the scientists. The University exhibition and Haryana rural antique museum are also maintained and supervised by this wing under the umbrella of the Directorate of extension education.</li> <li>iv) <b>Agricultural Technology Information Centre (ATIC)</b> The Agricultural Technology Information Centre which is situated at Gate No. 4 of CCSHAU, Hisar to provide a single window delivery system for the products and species available in the institution to the farmers, to facilitate direct access to the farmers to the institutional resources available in terms of technology, advice, technology products etc, for reducing technology dissemination losses and to provide feedback from the users to the institute.</li> <li>v) <b>Publication Wing</b> Publication wing is also situated in the Directorate of Extension Education with the objectives to print and publish Haryana Kheti (Monthly Magazine), to print Krishi Vigyan</li> </ul>

Function	Contents
	<p>Patrika for KVKs (Quarterly Magazine), Preparation and publication of annual Reports of the University and any other printing works needed by the university authority and various departments under the supervision of the Directorate of Extension Education.</p> <p>vi) Extension Education Institute, Nilokheri (Karnal)</p> <p>The Extension Education Institute, Nilokheri was established in 1959 as a trainers' training Institute to provide training in extension teaching methods and communication media. It is one of the pioneer and premier training institutes of the country which carries the responsibility of organizing in-service training courses for middle level extension personnel engaged in broad based agricultural extension system.</p> <p>A Kisan Mela (Farmers' Fair) is organized every year in March to promote the spread of agricultural technology among farmers. The Directorate Extension Education also runs a weather and crop advisory service for the farmers called eMausam.</p>

*Source: JICA survey team*

**Attachment 3.2.5 Maharana Pratap Horticulture University, Karnal**

Function	Contents
Teaching function	It covers B.Sc. in Horticulture, M.Sc. and Ph.D. in Fruit science, Vegetable science and Floriculture and Landscape Architecture.
Research function	<p>Research farm has approximately 28.73 ha (71 acres) of area under possession in two blocks. The Research farm has three protected structures viz, high-Tech Green House (1728 m<sup>2</sup>), shade net house (1008 m<sup>2</sup>) and retractable poly house (1024 m<sup>2</sup>) to raise the quality nursery and demonstration of protected cultivation of horticultural crops.</p> <p>The demonstration of production technology of vegetable crops (coriander, spinach, radish, tomato, cauliflower, etc. has been done. The plantation work of fruit crops gradually started with jamun, guava, grape etc. Various trainings have been organized at Research Farm and in village Anjanthali. Quality Nursery Production in Hi-Tech Poly House, Training on Fruit Production for Enhancing Farmer Income, Diversification through Horticulture, Udhyana Diwas (Horticulture Day), Training on Vegetable Production Technology, Plantation drive on Har Ghar Tiranga Event, World Soil Day and Van Mahotsav.</p>
Extension function	<p>Objectives of the directorate of Extension Education are follows:</p> <ol style="list-style-type: none"> <li>i) To promote recent advancements of Horticultural crops among Haryana farmers for taking maximum production, profit &amp; productivity per unit area.</li> <li>i) To encourage farmers to adopt vertical farming system or Precision Farming System/ (protected cultivation of vegetable crops) for all the year-round production of high value horticultural produce with excellent quality for better marketing.</li> <li>ii) To impart efficient training programs on various aspects of Horticultural crop production technology to raise farm income and farmer's economy with better lifestyle.</li> <li>iii) To promote organic farming cum natural farming in Horticultural crops with balanced use of F.Y.M., nutrients for sustainable soil fertility, efficient use of major, secondary and micro-nutrients by using bio-fertilizers, for quality improvement, water harvest technology and promoting use of soil amendments.</li> <li>iv) To create awareness among farmers about use of biological control agents against various insects- pests, diseases, root-knot nematodes, and viral attacks.</li> <li>v) To advise farmers to adopt post- harvest management practices for better shelf life, storability and disposal at maximum price in the market.</li> <li>vi) To undertake hybrid seed production of commercial vegetable and flower crops for maximizing productivity in Haryana.</li> <li>vii) To inculcate farmers to adopt processing of fruits and vegetables on commercial scale to avoid glut in the market.</li> <li>viii) To promote and extend agri-drone facilities among farmers &amp; to undertake production of virus free potato seed tubers.</li> <li>ix) To develop package of practices of horticultural crops for Haryana farmers.</li> <li>x) To showcase MHU's activities on many occasions e.g., Kisan Mela Agri. Expo and other public sector Govt. instructions.</li> </ol>

Source: JICA survey team



**Attachment 3.3.1 District-wise agro-ecological zones and their features**

Sr. No.	Name of district	AEZ	Rainfall per year (mm)	Soil condition	Cultivated crops	Constraints
1	Panchkula	14.2	1109.2	Loamy sand soils (100%)	Rainfed farming is the traditional practice in this area. The common crops are wheat, millet, maize, and rice. Sugarcane is common in Ambala and Yamuna Nagar. Oilseeds are common in Panchkula. The biggest mango production is from Yamuna Nagar.	Occasional saline and sodic phase.
2	Ambala	14.2	834.5	Sandy loam soils (78%), Loamy sand soils (22%)		
3	Yamuna Nagar	14.2	952.2	Sandy loam (75%), Loamy sand (25%)		
4	Kurukshetra	4.1 & 9.1	645.7	Loamy soils (Alluvial) (46%), Sandy loam soils (37.5%)	In AEZ-9, traditionally the rainfed and irrigated agriculture is common. The crops grown are rice, maize, barley, pigeon pea and jute in Kharif season, and wheat, mustard, and lentil in Rabi season. Sugarcane and cotton are grown at places under irrigated conditions. Guava, citrus, and ber are produced relatively.	An injudicious use of irrigation water may lead to waterlogging and salinity hazards.
5	Karnal	4.1 & 9.1	759.5	Loamy soils (64%), Sandy loam soils (36%)		
6	Kaithal	4.1	551.3	Sandy loam soils (19%), Loamy soils (74.6%)	Northern plain, the droughty climate is overcome by introducing tube well irrigation and the area is intensively cultivated for both Kharif and Rabi crops. Sugarcane, groundnut, maize and paddy, etc. are major and chilies, bajra, jowar, pulses and vegetables are minor Kharif crops. Wheat, barley, gram, mustard, and pulses are major Rabi crops. In Hisar and Jind, guava is largely produced.	Coarser soil texture and low plant available water capacity (AWC). Over-exploitation of groundwater, resulting in lowering of groundwater table in some areas. Imperfect drainage caused surface and subsurface soil salinity.
7	Jind	4.1	487.4	Sandy loam soils (100%)		
8	Panipat	4.1	534.7	Sandy loam soils (100%)		
9	Sonipat	4.1	616.5	Sandy loam soils (100%)		
10	Rohtak	4.1	576.3	Sandy loam soils (100%)		
11	Jhajjar	4.1	591.9	Sandy loam soils (41.2%), Loamy sand soils (40.3%), Sandy soils (18.5%)		
12	Faridabad	4.1	595.6	Sandy loam soils (34.9%)		
13	Gurugram	4.1	732.5	Loamy sand soils (84.2%)		
14	Palwal	4.1	595.6	Sandy loam soils (34.9%)		
15	Fatehabad	4.1	346.6	Sandy loam soils (100%)		
16	Nuh (Mewat)	4.1	732.5	Loamy sand (84.2%)		
17	Rewari	2.3 & 4.1	569.6	Loamy sand (Alluvial soils) (66%), Sandy soils (34%)	In the sandy soil (AEZ-2.3), the resistant and short duration rainy season crops, such as pearl millet, chari (fodder), and pulses are grown in non-saline areas. In areas favoured by availability of irrigation water, cotton, sugarcane, mustard, gram and wheat are grown. Citrus, Guava and Ber are produced.	In AEZ-2.3., erratic and scanty rainfall leads to a high-water deficit. Soil salinity leads to frequent physiological

Sr. No.	Name of district	AEZ	Rainfall per year (mm)	Soil condition	Cultivated crops	Constraints
18	Sirsa	2.3	391.1	Sandy loam (56%), Loamy sand (44%)	In the sandy soil (AEZ-2.3), the resistant and short duration rainy season crops, such as pearl millet, chari (fodder), and pulses are grown in non-saline areas. North-western regions support temperate fruits and vegetables. Especially, citrus largely cultivated in Sirsa and Bhiwani.  Bajara & Cotton in Kharif and Wheat & Sarson in Rabi. In Charkhi Dadri, guava, citrus, and ber are produced.  Pearl millet, chari (fodder), and pulses. Citrus, guava and ber are produced.	droughts. Nutrient imbalance, especially for N, P, Zn, and Fe.
19	Hisar	2.3	455.1	Sandy loam soils (80.9%)		
20	Bhiwani	2.3	410.8	Sandy loam soils (29.8%), Loamy sand soils (35.8%), Sandy soils (20.0%)		
21	Charkhi Dadri	2.3	483	Sandy loam soils (29.8%), Loamy sand soils (35.8%), Sandy soils (20.0%)		
22	Mahendragarh	2.3	430.7	Sandy loam (23%), Loamy sand (77%)		

Source: JICA survey team

**Attachment 3.3.2 District-wise Yield of Major Vegetables (2021-22) (1/3)**

Sr. No.	DISTT.	Potato		Onion		Tomato		Radish		Carrot		Cabbage		Cauliflower	
		Area(ha)	Prod. (Mt)	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
1	Panchkula	858	23202	323	850	143	62	62	693	22	155	62	352	152	659
2	Ambala	3470	75928	2900	57574	1650	0	0	29468	1182	34670	0	0	2140	41064
3	Yamuna Nagar	5575	147500	3380	70650	2170	715	715	48858	15	200	715	15940	3680	66280
4	Kurukshetra	9680	276250	922	23100	1100	460	460	11390	520	4810	460	4880	1089	14685
5	Kaithal	540	14260	790	18160	420	490	490	9690	510	9600	490	10200	560	12690
6	Karnal	3150	87020	402	7250	855	152	152	14680	340	7340	152	3270	1360	37850
7	Panipat	1210	30000	1510	30210	1450	4500	4500	65000	6800	82000	4500	109400	7800	196650
8	Sonapat	800	24900	180	1800	748	335	335	4050	230	2050	335	5500	590	7590
9	Rohtak	225	7000	210	3960	120	100	100	24000	340	7000	100	2400	150	4800
10	Jhajjar	228	5807	542	2928	526	286	286	2219	450	5001	286	3308	288	5562
11	Faridabad	94	2750	35	550	195	205	205	7560	674	15240	205	6576	190	6720
12	Mahendragarh	35	1120	420	3190	600	125	125	16870	813	17660	125	2615	80	2215
13	Rewari	19	130	590	9416	650	390	390	24522	590	11457	390	6063	804	8230
14	Gurugram	90	1183	161	3209	1220	302	302	17550	839	16725	302	6161	1440	30007
15	Bhiwani	340	8097	1058	33553	1572	555	555	13980	764	6965	555	6150	988	14820
16	Hissar	510	10020	305	6655	305	1224	1224	15247	1047	29320	1224	6019	1925	14790
17	Fatehabad	540	14200	105	2650	138	150	150	4950	1227	15050	150	870	2695	33070
18	Sirsa	740	17444	240	10967	526	470	470	6190	399	11115	470	12729	563	18429
19	Jind	1060	24370	922	7663	1325	823	823	19904	1250	23724	823	32035	1043	34219
20	Nuh	8	112	9355	184239	4381	655	655	87591	1915	47839	655	14086	798	22246
21	Palwal	305	9162	359	7082	617	232	232	15645	235	5937	232	5800	402	10586
22	Charkhi Dadri	65	1050	162	3800	180	20	20	1205	170	790	20	111	115	450
	<b>State</b>	<b>29543</b>	<b>781505</b>	<b>24871</b>	<b>489456</b>	<b>20891</b>	<b>12251</b>	<b>12251</b>	<b>441262</b>	<b>20332</b>	<b>354648</b>	<b>12251</b>	<b>254465</b>	<b>28852</b>	<b>583612</b>

Source: DOH

**Attachment 3.3.2 District-wise Yield of Major Vegetables (2021-22) (2/3)**

Sr. No.	DISTT.	Chilies		Okra		Brinjal		Cucurbits		Leafy Veggies		Peas		Others	
		Area(ha)	Prod. (Mt)	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
1	Panchkula	118	379	138	286	103	440	409	1281	266	955	25	452	394	1157
2	Ambala	374	2166	128	1852	220	2932	1235	23496	3532	61404	646	8066	2702	40133
3	Yamuna Nagar	945	7620	1220	14030	590	17052	4498	69438	3830	42180	245	6650	2457	35805
4	Kurukshetra	75	3565	400	7645	412	4700	2623	41400	1867	15625	1330	26220	1475	8490
5	Kaithal	480	3430	410	3980	380	6810	1250	12770	780	10840	510	7710	370	3110
6	Karnal	140	1805	500	2770	221	3280	5793	34271	1840	24360	230	2260	1000	10770
7	Panipat	2000	21084	2415	35860	1567	35725	5490	98365	4380	65700	790	19950	12812	178063
8	Sonapat	200	1565	295	815	415	3440	1416	5800	480	2035	134	120	420	1470
9	Rohtak	130	1945	565	2310	50	300	1894	12520	5600	40000	210	1350	4600	34267
10	Jhajjar	261	3604	175	2167	90	964	2973	22638	1226	7613	175	2377	1458	15341
11	Faridabad	152	1461	426	3647	160	5462	1492	16117	1390	15343	135	1200	894	13744
12	Mahendragarh	930	6670	256	1425	255	805	368	9003	935	4290	1050	6830	1671	3460
13	Rewari	544	2568	390	2727	368	2984	1874	13952	1083	6889	706	3365	596	3912
14	Gurugram	170	1700	240	3120	41	650	2645	40395	1143	14000	160	2600	185	3309
15	Bhiwani	1010	6153	550	5937	556	9007	2757	22445	2640	16980	375	3275	1168	11260
16	Hissar	441	5410	265	825	165	1280	1490	1485	1281	7140	150	3880	50	125
17	Fatehabad	305	1575	482	3905	200	967	919	5558	680	2490	70	1515	133	305
18	Sirsa	227	1028	334	1245	152	2237	834	6424	857	10010	151	3716	1625	14390
19	Jind	1382	17536	397	2798	314	2866	1211	10221	1309	17222	192	4872	546	5309
20	Nuh	380	14247	1275	17244	1704	34569	3751	72961	2828	67125	240	7197	721	23145
21	Palwal	690	7043	555	4008	622	9511	3907	26311	1420	18486	450	4564	1350	20121
22	Charkhi Dadri	102	1903	212	715	45	172	623	3971	63	400	175	770	125	450
	<b>State</b>	<b>11056</b>	<b>114457</b>	<b>11628</b>	<b>119311</b>	<b>8630</b>	<b>146153</b>	<b>49452</b>	<b>550822</b>	<b>39430</b>	<b>451087</b>	<b>8149</b>	<b>118939</b>	<b>36752</b>	<b>428136</b>

Source: DOH

### Attachment 3.3.3 Potential of clustered vegetables

Sr. No.	Crop name	Potential (Demand & supply status and Price competitiveness)	Potential to improve productivity and yield through technology transfer and equipment introduction	Cost-effectiveness such as improvement of added value and cost reduction
1	Potato	It ranks eighth in India in terms of production volume. Haryana is the central state of the potato belt, and exports to other states are being actively carried out. However, in major markets such as Azadpur, Chandigarh and Ludhiana, Uttar Pradesh, Punjab and Himachal Pradesh supply more than Haryana. Main supply sources are Uttar Pradesh 65%, Punjab 28% at Azadpur market, Punjab 80%, Himachal 15% at Chandigarh market and Punjab 80%. Himachal Pradesh 20% at Ludhiana market.	The introduction of mulch cultivation is expected to reduce weeding and earthing-up work, prevent greening of potatoes, and increase yields.	There is room for the introduction of new varieties for salads, increased production of potato chips and French fries, and improved added value.
2	Tomato	It ranks 13th in India in production volume, but consumption can be expected to grow in proportion to population growth. At present, share in Azadpur market is 14%. Main supply sources are Madhya Pradesh 26%, Gujarat 15% at Azadpur market, Himachal Pradesh 35%, Gujarat 25%, Maharashtra 20% at Chandigarh market and Punjab 40%, Maharashtra 18%, Himachal Pradesh 18% at Ludhiana market.	Introduction of cuttings and grafting techniques, water-saving agriculture, mulch/drip irrigation, and tunnel cultivation to protect against rain in summer	By introducing the technology on the left, high sugar content and high nutrition are possible. In addition, it is possible to reduce labour for irrigation, fertilization, and weeding.
3	Onion	Ranked 10th in India by production volume. Along with tomatoes, it is a basic ingredient in Indian cuisine, and demand will continue to increase as the population continues to grow. Main supply sources are Rajasthan 46%, Maharashtra 24% at Azadpur market, Maharashtra 35%, Punjab 30%, Rajasthan 15% at Chandigarh market and Maharashtra 48%, Gujarat 30%, Rajasthan 20% at Ludhiana market.	Uniform onion production is possible by introducing perforated mulch	By introducing mulch, it is possible to improve quality and reduce labour for watering and weeding.
4	Cauliflower	Ranked 5th in India in terms of production volume. Indispensable ingredients for Indian cuisine Sabji (vegetable stir-fry) Haryana has share of 40% supply and Himachal Pradesh has 23% share, Rajasthan has 12% at Azadpur market. Though supply share from Punjab is 70%, Himachal Pradesh 30% at Chandigarh market and Punjab share at Ludhiana market is 85%, Himachal Pradesh share is 15% at Ludhiana market.	The introduction of multi-cultivation is expected to lead to uniform quality, earlier and more uniform harvesting, and higher yields.	The technology on the left can be expected to improve quality and achieve differentiation. In addition, it is possible to reduce the labour of weeding and earthing-up work.
5	Radish	Number 1 in India in terms of production volume. An important ingredient in green salads and garden salads. Supply sources are Haryana 38%, Delhi 53% at Azadpur market. Supply sources are Punjab 90% at Chandigarh market and Punjab 90%, Himachal Pradesh 10% at Ludhiana market.	Introduction of new varieties is possible. Introduction of new technology such as multi is possible for higher quality.	It is currently used for salads and paranthas, but it can be processed into achar and dried radish.
6	Leafy vegetables	In the case of spinach, it ranks below 10th in India.	It is possible to introduce new varieties. Swiss chard can be substituted, especially in the summer. It has already replaced most spinach in summer.	Because it is easy to wither, it is limited to consumption within the region, and although consumption growth can be expected as the population increases, there is not much possibility for quality

Sr. No.	Crop name	Potential (Demand & supply status and Price competitiveness)	Potential to improve productivity and yield through technology transfer and equipment introduction	Cost-effectiveness such as improvement of added value and cost reduction
				improvement.
7	Carrot	Number 1 domestic production volume. As a root vegetable, it can be preserved better than radish, and it is a vegetable that can be exported, so growth can still be expected. Data of supply sources are not available.	There is a possibility of introducing new varieties, but there is no specific means to improve yield and quality.	Quality improvement cannot be expected because there are no materials and equipment that can be invested.
8	Cabbage	9th place in domestic production volume. The production volume of the whole country is slightly increasing. In the case of cabbage, supply sources are Uttar Pradesh 65% at Azadpur market, Punjab 50% at Chandigarh market and Punjab 90% at Ludhiana market.	Compared to other leafy vegetables, it can be exported because it can be preserved longer period. However, there is no particular point where technology transfer can be expected.	With the increasing number of nuclear families, consumer preferences are shifting to small cabbages, so it is not expected quantitative growth in demand.
9	Brinjal	14th place in India in terms of production volume. Slight increase in production volume. Supply sources are Uttar Pradesh 37%, Gujarat 23%, Rajasthan 20% at Azadpur market, Punjab 30%, Uttar Pradesh 30% at Chandigarh market and Punjab 90%, Uttar Pradesh 10% at Ludhiana market.	Technology transfer such as grafting and pruning is possible. This makes it possible to switch to long-term cultivation.	Although it is a traditional vegetable, consumption growth is slow, probably because it is the vegetable most hated by children in India. Possibility of popularization of salad eggplants by quality improvement is one of the solutions.
10	Peas	Green peas rank within the top 10 in terms of production volume in India. India is the second largest producer in the world. Supply sources are Punjab 26%, Himachal Pradesh 23%, Rajasthan 22% at Azadpur marker, Punjab 50%, Himachal Pradesh 25%, Uttar Pradesh 25% at Chandigarh market and Punjab 30%, Himachal Pradesh 28% at Ludhiana market.	Yields can be increased by introducing new varieties, pruning, and training techniques, etc.	Growth in exports of fresh, frozen, and canned products is expected.
11	Chilies	Ranked 23rd in India in terms of production volume. No. 1 producer in the world. Solid domestic consumption and exports. Supply sources are Uttar Pradesh 37%, Maharashtra 34% at Azadpur market, Punjab 40%, Himachal Pradesh 30% at Chandigarh market and Punjab 50%, West Bengal 20%, Uttar Pradesh 20% at Ludhiana market.	It is possible to increase production by introducing mulch and drip irrigation in the open field.	Reduction of labour for weeding and irrigation, increase in yield (2-3 times) can be expected.
12	Garlic	8th place in domestic production volume. India ranks first in the world in both production and export volumes. Supply sources are Rajasthan 40%, Madhya Pradesh 34% at Azadpur market, Haryana 50%, Himachal Pradesh 25% at Chandigarh market and Punjab 60%, Madhya Pradesh 28% at Ludhiana market.	It is possible to introduce large new varieties that are easy to cook.	However, the issue is whether the larger size will meet the preferences of consumers. Growth can be expected in the food service industry such as hotels and restaurants.
13	Capsicum	3rd place in domestic production volume. 4th in the world in terms of production volume. The largest export destination in the world is the United States. Supply sources are Maharashtra 25%, Chhattisgarh 25% at Azadpur market, Himachal Pradesh 40% at Chandigarh market and Punjab 50%, Himachal Pradesh 15% at Ludhiana market.	Technology transfer such as mulching, drip irrigation, grafting and pruning is possible. Net house cultivation in summer is also possible.	Higher quality, homogenization of size, and increased yield can be expected.
14	Ginger	Ranked 24th in India in terms of production volume. The world's number one producer and exporter. The largest export destination is the United States. Azadpur marker, Assam 60%, Uttar Pradesh 20% at Chandigarh	Mulch and drip irrigation technique can be introduced.	By introducing the technology on the left, it is possible to reduce labour for weeding and irrigation and increase production.

Sr. No.	Crop name	Potential (Demand & supply status and Price competitiveness)	Potential to improve productivity and yield through technology transfer and equipment introduction	Cost-effectiveness such as improvement of added value and cost reduction
		market and Assam 35%, West Bengal 25%, Uttar Khand 20% at Ludhiana market.		
15	Cucurbits	India is the origin place of cucumbers, and cucumbers and gherkins (cucumbers for pickles) are actively cultivated, and gherkins are exported in large quantities as pickles. It ranks 27th in the world for cucumber production and 1st for gherkin exports. Export destinations are USA, Russia, Canada, France and Spain. In the case of cucumber, supply sources are Uttar Pradesh 32%, West Bengal 22%, Haryana 18% at Azadpur market, Punjab 60%, Himachal Pradesh 25% at Chandigarh market and Punjab 90%, Himachal Pradesh 10% at Ludhiana market.	Technology transfer of grafting, pruning and trimming is possible.	Cucumbers tend to prefer small varieties due to the increase of nuclear family, and it is difficult to expect quantitative growth. However, exports of gherkins can be expected to increase in the future.
16	Okra	11th place in India for production volume. No. 1 in the world for both production volume and export volume. Mainly exported to the Middle East. Supply sources are Gujarat 45%, Haryana 42% at Azadpur market, Punjab 60%, Uttar Pradesh 20% at Chandigarh market and Punjab 80%, Gujarat 10% at Ludhiana market.	New variety introduction, pruning, freeze-drying, and technology transfer of freezing are possible.	Not only fresh, but also freeze-dried and frozen can be processed, and growth in consumption can be expected.
17	Flower	Haryana is one of the top 10 producers in the country. India ranks second in cut flower production in the world. The top 3 producer states are Tamil Nadu, Karnataka and West Bengal.	It is possible to introduce techniques such as cuttings, grafting, and rain-shed tunnels.	As the middle class becomes wealthier, an increase in consumption of flowers as a luxury item can be expected. An increase in exports as cut flowers can also be expected.
18	Baby corn	There is no cultivar dedicated to baby corn, and immature corn is harvested as baby corn. However, the export volume is number one in the world followed by Thailand and Vietnam. In spite of high importance in local as well as national market, information on marketing expenses, marketing channels and their efficiencies are not available at regional or national level. The baby corns are produced in regions including Western Uttar Pradesh, Punjab, Gujarat, Andhra Pradesh, Maharashtra, and Meghalaya.	It is a vegetable that is harvested early, and there is not much introduction technology. There is a need to breed dedicated varieties.	Westernization of cuisine and growth in demand in Chinese dishes are expected, and growth in canning industry is also expected.
19	Sweet corn	India is the 7th largest maize producer in the world. Main export destinations are the United Arab Emirates, the United States, and Russia. After Karnataka and Madhya Pradesh, Bihar is the highest maize producer. Andhra Pradesh is having the highest state productivity.	Introduction of new varieties is possible. In addition, quality can be maintained by changing the transportation method (pre-cooling or cold chain).	Sweet corn loses its flavour quickly, so if it's fresh, it needs to be pre-cooled or cold-chained. Processing such as canning is possible.
20	Exotic vegetables	Production is still limited to limited areas, but demand is expected to grow due to food diversification and health consciousness. There are very few regions in India where these vegetables are grown, such as Pune, Nasik, Mahabaleshwar, Bangalore, Uttarakhand, Ooty, Himachal, and Jammu Kashmir. The exotic vegetable market is growing at 15 to 20 % per annum. India imports more than 85% of exotic vegetables. (2022)	Many varieties prefer cool climates, so winter cultivation and temperature control in summer are important. In the summer, we can provide cultivation techniques using net houses and shade net.	It has the advantage of being able to make trade areas in the big cities of Delhi and Chandigarh, and there are many restaurants and hotels where exotic vegetables are used.

Sr. No.	Crop name	Potential (Demand & supply status and Price competitiveness)	Potential to improve productivity and yield through technology transfer and equipment introduction	Cost-effectiveness such as improvement of added value and cost reduction
21	Green peas (seed)	<p>India is the 6th largest seed producer in the world. It is said that there is still room for growth, and it has grown rapidly from 46 trillion rupees in 2010 to 287 trillion rupees in 2018. The export volume of green pea seeds is also on the rise, although it is not among the top three in the world.</p> <p>Major Green Peas Production States in India: - Karnataka , Madhya Pradesh , Rajasthan, West Bengal, Punjab, Assam, Haryana, Uttar Pradesh, Uttarakhand, Himachal Pradesh, Bihar and Orissa. Uttar Pradesh is the major field pea growing state. It alone produces about 49% of pea produced in India.</p>	Introduction of breeding technology	F1 seeds are becoming popular instead of OP varieties, and we have to deal with it

Source: Compiled by the survey team, 2023

Source: <https://www.agrifarming.in/exotic-vegetable-farming-in-india-check-how-this-growing-guide-helps-beginners>



**Attachment 3.3.4 District-wise Average Yields of Major Fruits (2021-22) (1/2)**

Sr. No.	DISTT.	Mango		Guava		Citrus		Ber		Grapes		Aonla		Chiku	
		Area(ha)	Prod. (Mt)	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
1	Panchkula	704	8477	234	4015	125	2688	6	96	0	0	116	1726	266	3663
2	Ambala	1254	10118	508	8548	27	732	3	25	0	0	7	290	209	744
3	Yamuna Nagar	6006	71890	1110	17110	233	1095	2	5	0	0	155	650	935	14530
4	Kurukshetra	572	6764	461	9850	29	545	19	320	4	32	42	837	145	1310
5	Kaithal	11	138	251	6126	39	650	35	620	0	0	54	1050	2	20
6	Karnal	554	6325	827	19498	259	796	60	778	2	0	180	1481	230	1375
7	Panipat	205	2587	540	11065	50	493	166	2370	0	0	46	366	1	2
8	Sonipat	157	1024	1031	19840	47	662	432	8620	0	0	37	536	6	60
9	Rohtak	20	172	658	5800	239	6686	202	5120	0	0	50	522	0	0
10	Jhajjar	10	65	856	10989	392	5808	333	8867	0	0	48	480	4	56
11	Faridabad	8	30	359	2258	177	4583	104	1120	0	0	49	54	7	63
12	Mahendragarh	0	0	199	5937	1428	40796	275	1990	0	0	101	2070	0	0
13	Rewari	0.13	0	182	4151	191	5104	173	1188	0	0	80	227	0	0
14	Gurugram	2	25	582	7610	370	8590	88	153	0	0	76	826	0	0
15	Bhiwani	12	149	567	4274	2377	40816	308	2976	1	0	290	3135	1	0
16	Hissar	44	170	2008	26852	2254	29760	367	2190	7	180	116	337	0	0
17	Fatehabad	7	71	866	18132	2767	81972	161	1727	0	0	59	901	0	0
18	Sirsa	8	112	1173	16838	12098	328497	270	2781	26	168	221	132	1	0
19	Jind	33	367	795	20939	268	8033	266	3942	2	6	34	792	1	5
20	Nuh	17	34	1153	494	485	321	785	410	0	0	257	210	0	0
21	Palwal	22	252	1177	17240	392	2171	366	1450	0	0	143	470	0	0
22	Charkhi Dadri	1	0	57	948	151	85	12	205	0	0	14	0	2	0
	<b>State</b>	<b>9647</b>	<b>108770</b>	<b>15594</b>	<b>238514</b>	<b>24398</b>	<b>570883</b>	<b>4433</b>	<b>46953</b>	<b>42</b>	<b>386</b>	<b>2175</b>	<b>17092</b>	<b>1810</b>	<b>21828</b>

**Attachment 3.3.3 District-wise Average Yields of Major Fruits (2021-22) (2/2)**

Sr. No.	DISTT.	Litchi		Peach, Pear, Plum		Others	
		Area(ha)	Prod. (Mt)	Area	Prod.	Area	Prod.
1	Panchkula	18	400	45	825	394	645
2	Ambala	12	202	52	795	2702	1559
3	Yamuna Nagar	197	2550	220	3165	2457	1560
4	Kurukshetra	10	55	142	3717	1475	790
5	Kaithal	0	0	10	237	370	1519
6	Karnal	21	50	71	1367	1000	5654
7	Panipat	6	60	29	477	12812	7546
8	Sonipat	2	0	33	165	420	5572
9	Rohtak	0	0	12	220	4600	1552
10	Jhajjar	0	0	0	0	1458	2716
11	Faridabad	0	0	0	0	894	5668
12	Mahendragarh	0	0	0	0	1671	1700
13	Rewari	0	0	0	0	596	1280
14	Gurugram	0	0	0	0	185	250
15	Bhiwani	0	0	0	0	1168.4	7228
16	Hissar	0	0	29	62	50	676
17	Fatehabad	0	0	15	53	133	3141
18	Sirsa	0	0	0	0	1625	5451
19	Jind	0	0	14	79	546	2344
20	Nuh	0	0	0	0	721	720
21	Palwal	0	0	5	10	1350	2985
22	Charkhi Dadri	0	0	0	0	125	0
	<b>State</b>	<b>266</b>	<b>3317</b>	<b>677</b>	<b>11172</b>	<b>36752.4</b>	<b>60556</b>

### Attachment 3.3.5 Potential of the clustered fruits

Sr. No	Crop name	Potential (Demand & Supply status and Price competitiveness)	Potential to improve productivity and yield through technology transfer and equipment introduction	Cost-effectiveness such as improvement of added value and cost reduction
1	Kinnow	Ranked 20th or below in terms of production volume in India. In recent years, along with Punjab and Rajasthan, mandarin oranges have been diverted to this area. If cultivated in a desert climate area close to Rajasthan, the sugar content will be high due to water stress and diurnal temperature range, and there is a future potential.	Currently, the shape of the tree is not appropriate, and if we can improve that point, and improve the problem of nematodes and the decrease in the absorption capacity of the main fertilizer due to excessive micro nutrients, it is possible to increase the yield. It is possible to introduce seedless varieties, non-woven mats, and drip irrigation.	The introduction of seedless varieties is expected, but the production of seedlings is limited, and the introduction tends to be delayed. By introducing non-woven mats and drip irrigation, it is possible to improve quality and reduce laborers for watering and weeding.
2	Guava	5th place in domestic production volume. Consumption is growing steadily. Punjab and Haryana are growing large fruits	The introduction of new varieties is already progressing, and the possibility of introducing technology transfer is limited to grafting.	Consumer preference for fresh fruit is moving toward large fruit and seedless, and consumption growth can still be expected. The processing of puree for juice is also growing.
3	Mango	17th place in India in terms of production volume. India's production volume is number one in the world. Exported in pulp as well as fresh.	Possibility of introduction of high-grade varieties and transfer of grafting techniques.	Production of high-quality, uniform fruit is possible. Can be processed into purees, pulps and juices.
4	Watermelon	8th place in domestic production volume. 4th largest producer and 1st exporter in the world. Production in arid regions is of high quality, and exports to other states in India are also popular.	Technology transfer of grafting and pruning is possible. Early harvesting is possible by using non-woven sheets.	It is possible to produce watermelons that are highly resistant to pests by using grafting techniques. Pruning also enables uniform fruit production. Higher quality is also possible depending on climate conditions.
5	Musk melon	Ranked 5th or below in terms of production volume in India. India is the third largest producer in the world. World No. 1 exporter of seeds.	The use of pruning and mulching is essential for high quality. Early cultivation and prevention of pests can be expected by using non-woven fabric (floating cover).	Since high quality is not necessarily expected in India, the issue is whether the inputs on the left will pay off.
6	Peach (Yellow peach)	5th place in domestic production volume. 9th in the world for production volume. The United States is the largest export destination, followed by the United Arab Emirates.	New variety's introduction, grafting, pruning and trimming technology transfer possible.	Although it is possible to improve quality through the improvements described on the left, it is necessary to confirm consumer preferences. Possible increase in canning and pureeing.

Sr. No	Crop name	Potential (Demand & Supply status and Price competitiveness)	Potential to improve productivity and yield through technology transfer and equipment introduction	Cost-effectiveness such as improvement of added value and cost reduction
7	Strawberry	No. 1 domestic production volume. No. 1 export volume in the world. Mainly exported to USA, Nepal and United Arab Emirates.	Introduction of suitable varieties.	Saudi Arabia and the Maldives are the main export destinations for Fresh, but although the price is rising, the export volume is decreasing. In the future, it will be necessary to identify varieties that match preferences of customers.
8	Litchi	11th place in India for production volume. 4th in the world in terms of production volume. However, export volume is not in the top 10 in the world.	Technology transfer of grafting, pruning and trimming is possible.	Growth in exports of fresh, frozen and canned products is expected.
9	Aonla (Amla)	It ranks 6th in India in terms of production volume. However, at present, only a few states are growing in production. Haryana is also flat. No. 1 in world production and export volume. The export destinations are the United States, the United Arab Emirates, and the United Kingdom, in that order.	Technology transfer of grafting, pruning and trimming is possible.	High content of vitamin C and polyphenols, expected to increase exports of amla candy and other processed products.
10	Lemon	India's lemon production is the largest in the world. Although Haryana is ranked 24th or below in terms of production volume in the country, the current lemon price is high at INR 10-15 per fruit.	Technology transfer of mulching, drip irrigation, grafting, pruning and trimming is possible.	With the spread of Western food, the consumption of lemons is also on the rise.
11	Sapota	7th place in domestic production volume. No. 1 in the world for both production volume and export volume. India exports to 24 countries and regions, mainly in the Middle East.	Technology transfer of grafting, pruning and trimming is possible.	It is a fruit with a relatively high sugar content, and consumption may not increase in the future for health reasons.

Sr. No	Crop name	Potential (Demand & Supply status and Price competitiveness)	Potential to improve productivity and yield through technology transfer and equipment introduction	Cost-effectiveness such as improvement of added value and cost reduction
12	Ber	Haryana ranks 6th in jujube production in India. No. 2 production volume and No. 1 export volume in the world. In Haryana, there are many wild varieties, so it is suitable for cultivation and expansion of cultivation can be expected in the future.	It is possible to introduce large-sized, high-quality varieties such as Taiwan honey jujube.	Growth in both domestic consumption and exports can be expected if fruit size and quality progress.

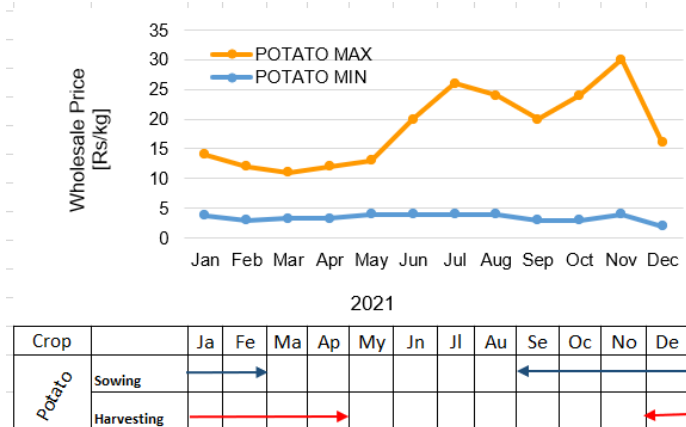
Source: JICA survey team

### Attachment 3.4.1 Minimummaximum monthly wholesale prices of horticultural crops at APMC Azadpur Mandi

#### i) Potato

The minimum price of potatoes ranges from Rs 2/kg in December to Rs 4/kg in most months, with the exception of May and June where the minimum price is Rs 4/kg. This suggests that there is relatively stable demand for potatoes throughout the year, with prices remaining fairly consistent from month to month.

The maximum price of potatoes ranges from Rs 11/kg in March to Rs 30/kg in November. This indicates that there are seasonal factors that impact the price of potatoes in the wholesale market, with prices typically rising after the harvest season (March to May).



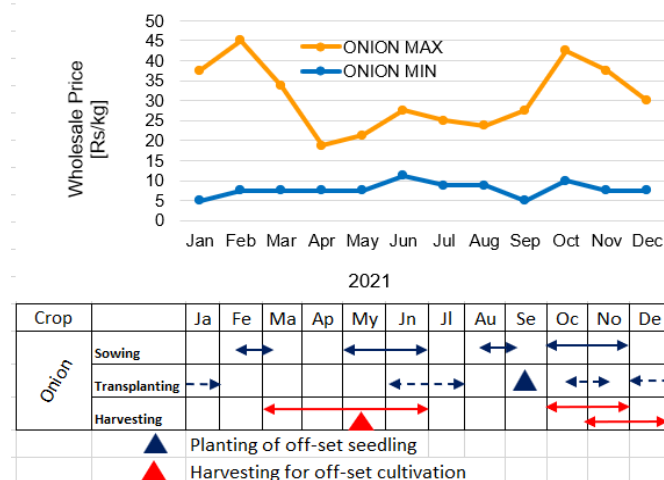
Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

Figure 3.4.1 Whole Price Changes of Potato in APMC Azadpur Mandi (2021)

#### ii) Onion

The minimum price of onions ranges from Rs 5/kg in January and September, with a high of Rs 11/kg in June. This suggests that there is relatively stable demand for onions throughout the year, with prices remaining fairly consistent from month to month.

However, the maximum price of onions shows a high degree of seasonality. The highest prices occur during the months of October to November, ranging from Rs 38/kg to Rs 43/kg. This is likely due to the fact that onions are a winter crop in Haryana, and the harvest season typically occurs from November to December. This can lead to a temporary shortage of onions in the market, driving up the prices.

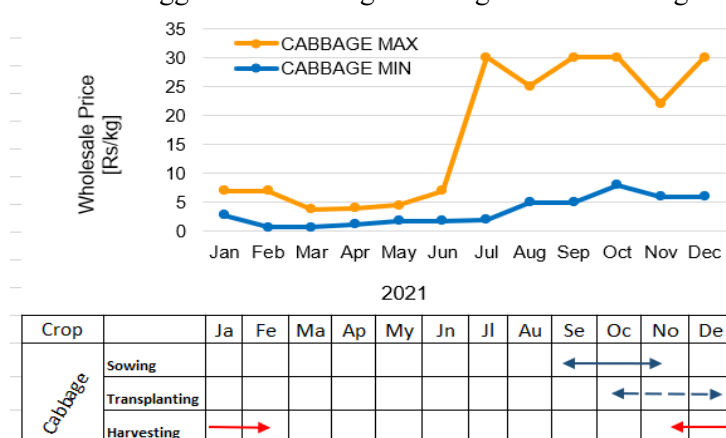


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

Figure 3.4.2 Whole Price Changes of Onion in APMC Azadpur Mandi (2021)

iii) Cabbage

The prices range from a minimum of 1-8 Rs/kg in the months of February to November, with the lowest prices being in February and the highest prices in November. The prices then increase significantly in the months from June to July, with a maximum price of 30 Rs/kg being recorded. This suggests that cabbage is in high demand during these months.



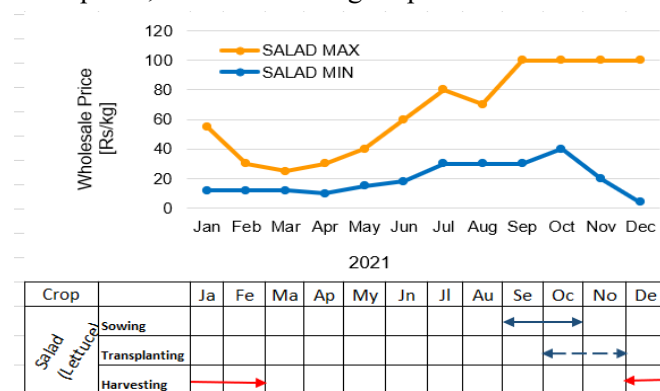
Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

Figure 3.4.3 Whole Price Changes of Cabbage in APMC Azadpur Mandi (2021)

iv) Salad (Lettuce)

Looking at the data, it can be found that the minimum prices remain relatively stable throughout the year, except for a dip in December. However, the maximum prices show a clear seasonal trend, with the highest prices occurring in the summer months of June, July, and August.

The reason for this seasonal trend may be due to that lettuce is a cool-weather crop and sensitive to high temperatures. In Haryana, the summers can be quite hot, and cooling transportation is required, which causes higher prices.

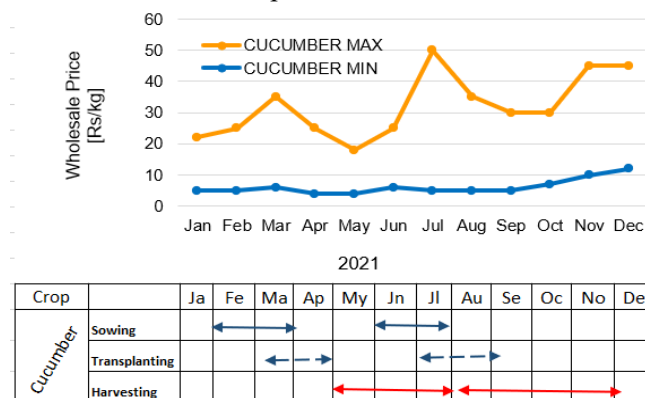


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

Figure 3.4.4 Whole Price Changes of Salad (Lettuce) in APMC Azadpur Mandi (2021)

v) Cucumber

The wholesale prices of cucumbers vary from a minimum of Rs 4/kg in April and May to a maximum of Rs 50/kg in August. The prices start to rise in February and reach their peak in July and August, then gradually decrease towards the end of the year. The average prices of cucumbers range from Rs 5-30/kg throughout the year, except for the peak months of July and August. Overall, the prices of cucumbers in Haryana state exhibit a seasonal trend with higher prices in summer months and lower prices in winter months.

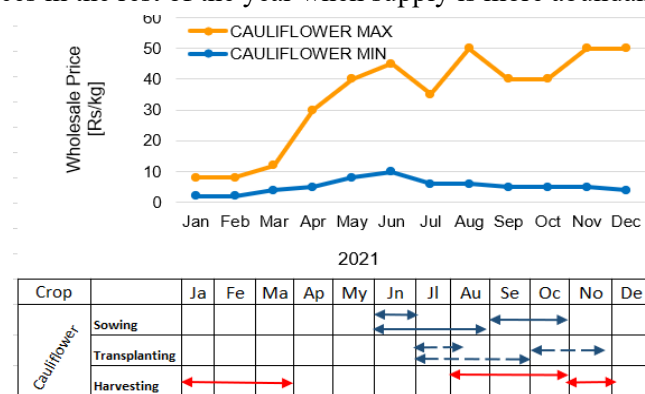


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.5 Whole Price Changes of Cucumber in APMC Azadpur Mandi (2021)**

vi) Cauliflower

The price rises from October to December, with the maximum prices ranging from Rs. 40/kg to Rs. 50/kg. Overall, the seasonal factors affecting cauliflower prices in Haryana State seem to be supply and demand, with higher prices in the summer months when demand is greater, and lower prices in the rest of the year when supply is more abundant.



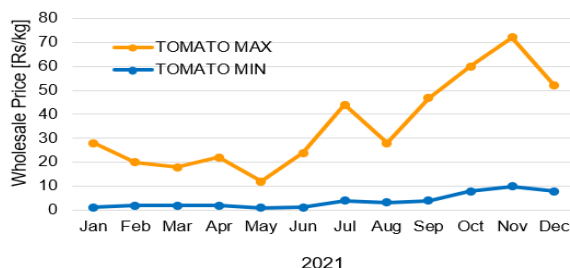
Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.6 Whole Price Changes of Cauliflower in APMC Azadpur Mandi (2021)**



vii) Tomato

The minimum price of tomatoes is highest in the months of October, November and December with a price of 10 and 8 Rs/kg respectively. The maximum price of tomatoes is highest in the month of November with a price of 72 Rs/kg. The prices of tomatoes generally show a rising trend from January till May, and then they start to decline until September.



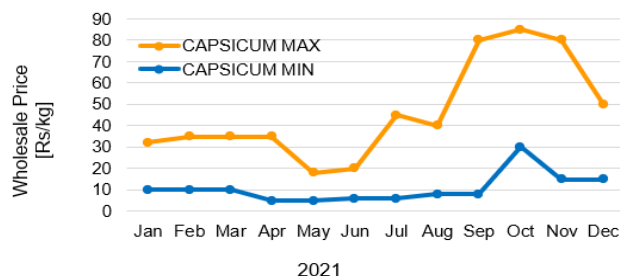
Crop		Ja	Fe	Ma	Ap	My	Jn	Jl	Au	Se	Oc	No	De
Tomato	Sowing						←	←	←	←		←	←
	Transplanting		→	→	→	→	→	→	→	→	→	→	→
	Harvesting	←	←	←	←	←	←	←	←	←	←	←	←

Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.7 Whole Price Changes of Tomato in APMC Azadpur Mandi (2021)**

viii) Capsicum

The minimum and maximum prices of Capsicum varied across the months, with prices being lowest from May to September and highest in October and November. The minimum price ranged from Rs 5/kg to Rs 30/kg, with the highest minimum price in October. The maximum price ranged from Rs 18/kg to Rs 85/kg, with the highest maximum price in October and November. The prices of Capsicum are generally lower during the summer months (May to September) and higher during the winter months (October to December).



Crop		Ja	Fe	Ma	Ap	My	Jn	Jl	Au	Se	Oc	No	De
Capsicum	Sowing						←	←	←	←	←	←	←
	Transplanting						→	→	→	→	→	→	→
	Harvesting	←	←	←	←	←	←	←	←	←	←	←	←

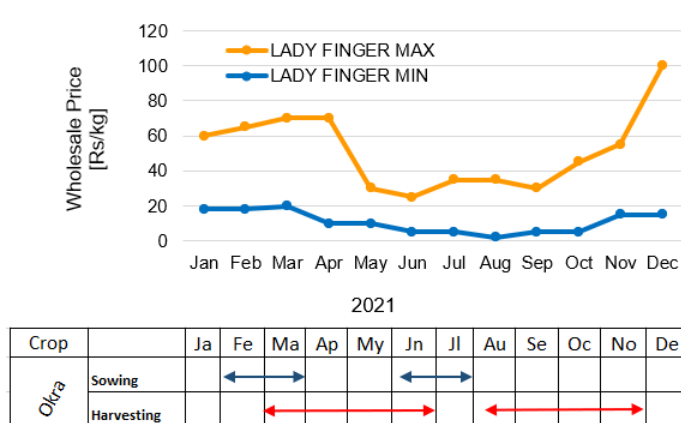
Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.8 Whole Price Changes of Capsicum in APMC Azadpur Mandi (2021)**

ix) Lady finger (Okra)

The minimum price ranges from Rs. 2/kg to Rs. 20/kg and the maximum price ranges from Rs. 30/kg to Rs. 100/kg throughout the year.

The prices are generally high in the months of March to May and October to December. This could be attributed to the fact that these are the peak harvest seasons of Lady Finger in Haryana. The prices are lower during the monsoon months of July to September due to an increase in supply.



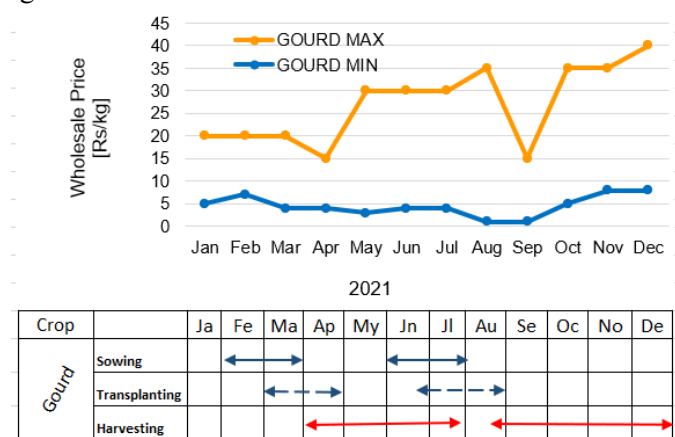
Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.9 Whole Price Changes of Lady finger (Okra) in APMC Azadpur Mandi (2021)**

x) Gourd

The minimum price starts at Rs 5/kg in January and February, dips to Rs 1/kg in August and September, then rises to Rs 8/kg in November and December. The maximum price starts at Rs 20/kg in January and February, peaks at Rs 35/kg in August and October and ends at Rs 40/kg in December.

There are two seasons in which the prices are relatively high, the first is from June to September, and the second is from October to December. These seasons coincide with the monsoon season in India, which brings a lot of rainfall and creates favourable conditions for the growth of gourds.

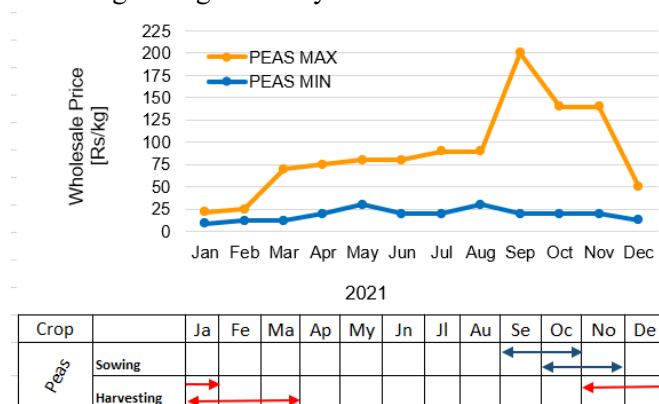


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.10 Whole Price Changes of Gourd in APMC Azadpur Mandi (2021)**

xi) Peas

The minimum prices ranged from Rs. 9/kg to Rs. 30/kg from January to May, which then decreased to Rs. 13/kg in December. The maximum prices had a huge variation, ranging from Rs. 22/kg to Rs. 200/kg throughout the year.

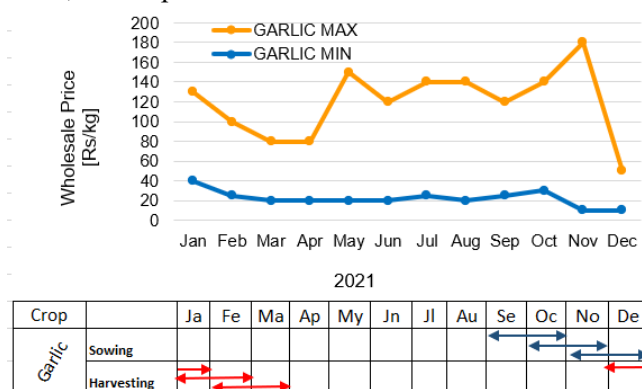


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.11 Whole Price Changes of Peas in APMC Azadpur Mandi (2021)**

xii) Garlic

The minimum and maximum prices of garlic both show a decreasing trend from January to March. From April to September, the minimum price of Garlic remains relatively stable at around 20-25, while the maximum price shows a slight increase from Rs. 80/kg to Rs. 140/kg. From October to December, both the minimum and maximum prices of Garlic show a significant increase, with a peak in November.

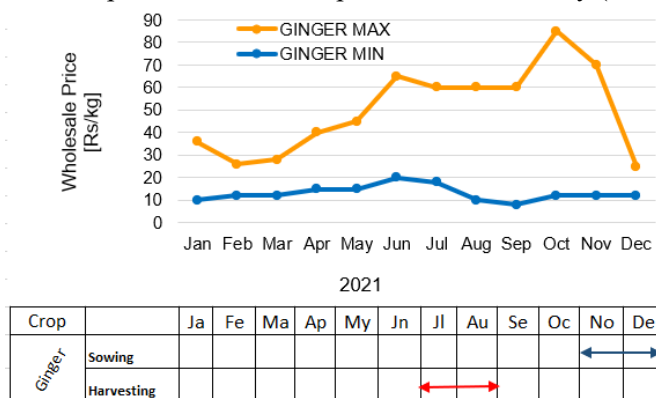


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.12 Whole Price Changes of Garlic in APMC Azadpur Mandi (2021)**

xiii) Ginger

The minimum price of ginger was relatively stable between January and September, ranging from 8 to 15 Rs/kg. The minimum price then increased sharply in October and remained high until December, reaching a peak of 12 Rs/kg. The maximum price of ginger fluctuated more than the minimum price, with a peak of 85 Rs/kg in October and a low of 25 Rs/kg in December. There were also other peaks in maximum price in June and July (reaching up to 60-65 Rs/kg).

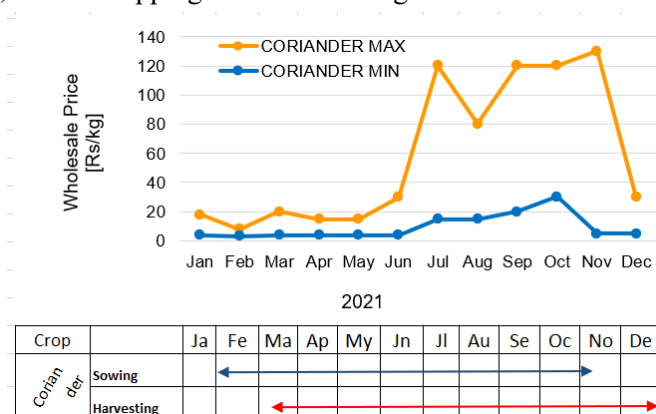


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.13 Whole Price Changes of Ginger in APMC Azadpur Mandi (2021)**

xiv) Coriander

The wholesale prices of coriander vary significantly throughout the year. The minimum price of coriander starts at Rs 4/kg in January and increases gradually to reach its peak at Rs 30/kg in October, before dropping back to Rs 5/kg in November and December. Similarly, the maximum price of coriander starts at Rs 18/kg in January, and reaches its peak at Rs 130/kg in November, before dropping back to Rs 30/kg in December.

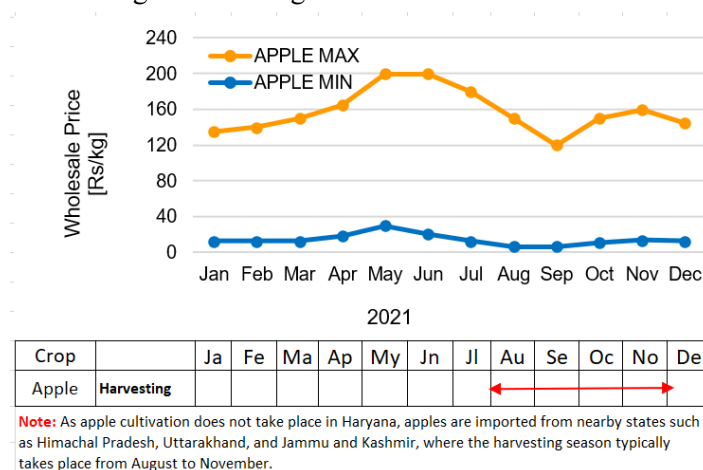


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.14 Whole Price Changes of Coriander in APMC Azadpur Mandi (2021)**

xv) Apple

The wholesale prices of apples show some variation throughout the year. The minimum price of apples remains relatively stable, starting at 13 Rs/kg in January and fluctuating between 6 Rs/kg and 30 Rs/kg before ending at 13 Rs/kg in December. The maximum price of apples shows more variability, starting at 135 Rs/kg in January, peaking at 200 Rs/kg in May and June, before decreasing to 145 Rs/kg in December.

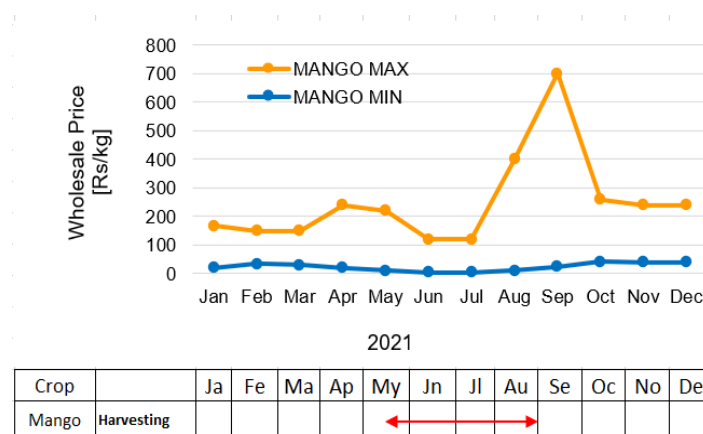


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.15 Whole Price Changes of Apple in APMC Azadpur Mandi (2021)**

xvi) Mango

The wholesale prices of mangoes show significant variability throughout the year. The minimum price of mangoes starts at Rs 20/kg in January and gradually increases to reach its peak at Rs 42/kg in October, before decreasing slightly to Rs 40/kg in November and December. The maximum price of mangoes starts at Rs 167/kg in January, increases to reach its peak at Rs 700/kg in September, before decreasing to Rs 240/kg in November and December.

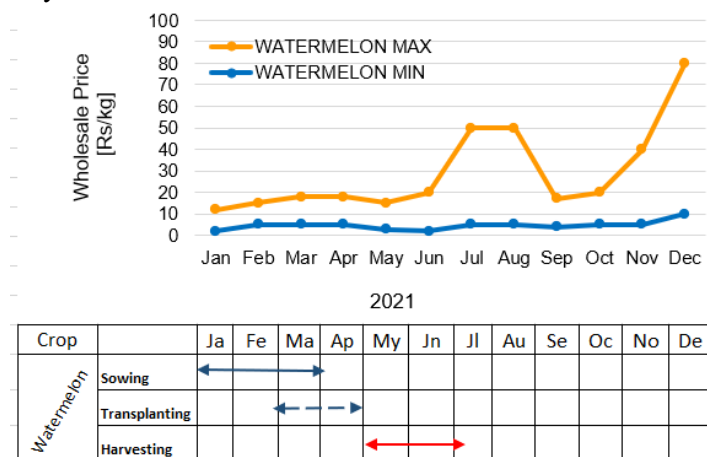


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.16 Whole Price Changes of Mango in APMC Azadpur Mandi (2021)**

xvii) Watermelon

The wholesale prices of watermelon display considerable variability throughout the year. The minimum price of watermelon starts at 2 Rs/kg in January and gradually increases to reach its peak at 5 Rs/kg in May, before fluctuating between 4 Rs/kg and 10 Rs/kg during the rest of the year. The maximum price of watermelon starts at 12 Rs/kg in January, increases to reach its peak at 80 Rs/kg in December, before fluctuating between 17 Rs/kg and 50 Rs/kg during the rest of the year.

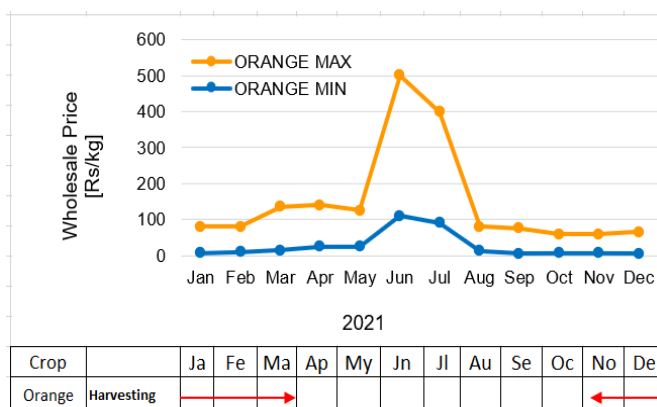


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.17 Whole Price Changes of Watermelon in APMC Azadpur Mandi (2021)**

xviii) Orange

The minimum price of oranges starts at Rs 8/kg in January, reaches its peak at Rs 100/kg in June, before dropping to Rs 5/kg in November and December. The maximum price of oranges starts at Rs 80/kg in January, reaches its peak at Rs 500/kg in June, before decreasing to Rs 65/kg in December.

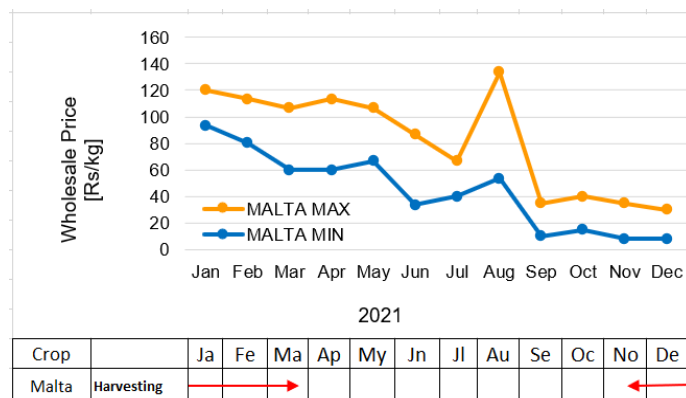


Source: <http://apmcazadpurdelhi.com/monthly-rate.html>

**Figure 3.4.18 Whole Price Changes of Orange in APMC Azadpur Mandi (2021)**

xix) Malta

The minimum price of Malta starts at Rs 60/kg in March and peaks at Rs 94/kg in January, before dropping to Rs 8/kg in November and December. The maximum price of Malta starts at Rs 120/kg in January, reaches its peak at Rs 134/kg in August, before decreasing to Rs 30/kg in December.

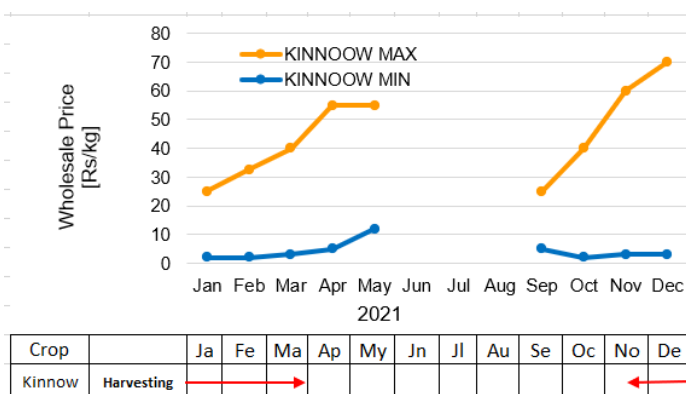


Source: <http://apmcazadpurdeldhi.com/monthly-rate.html>

**Figure 3.4.19 Whole Price Changes of Malta in APMC Azadpur Mandi (2021)**

xx) Kinnow

The wholesale prices of Kinnow oranges show significant variability throughout the year. The minimum price of Kinnow oranges starts at Rs 2/kg in January, increases to reach its peak at Rs 12/kg in May, before fluctuating between Rs 2/kg to Rs 5/kg from October to December. The maximum price of Kinnow oranges starts at Rs 25/kg in January, increases to reach its peak at Rs 55/kg in April and May, before fluctuating between Rs 25/kg to Rs 70/kg from October to December.



Source: <http://apmcazadpurdeldhi.com/monthly-rate.html>



**Figure 3.4.20 Whole Price Changes of Kinnow in APMC Azadpur Mandi (2021)**



**Attachment 3.4.2 Facilities of Sonipat Mega Food Park**

Facility	Capacity	Photo
Silos	5,000 MT×2 2,500MT×2	
Cold Storage	500MT Dual Chamber×5 500MT Chiller×5 500MT Freezer×5	 
Dry Warehouse	5,000 MT	
Core Processing Centre	Individual Quick Frozen (IQF) Pea Processing Line 1.5MT/hr	 
Quality Control and Testing Lab	200 m <sup>2</sup> (total floor area)	



Facility	Capacity	Photo
Standard Design Factory	5,400 m <sup>2</sup> (total floor area) (Lessee can bring their own equipment to install to this building)	
Administration Building	1,040 m <sup>2</sup> (total floor area)	
Primary Processing Centre @ Panipat	Dry Warehouse 2,000MT Cold Storage 1,000MT Sorting and Grading 3MT/hr	
Primary Processing Centre @ Karnal	Milk Chiller 10,000 L/day Milk Storage 10MT Cold Storage 500MT	

Source: JICA Survey Team

**Attachment 3.4.3 Cold Chain Companies and Facilities in Haryana**

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
<b>1. Ambala</b>						
1.	Ambala	S.R. Cold Store	Sanjeev Kumar, Shishpal, Shiyaram, Manish Kumar Vill. - Sirashgarh (Ambala)	4,500	1998 & 2001	Potato Banana
2.	Ambala	Shri Shivam Cold Store,	S SushilaKumari, Vill. - Mullana, 9896374128	1,500	1997	Potato
3.	Ambala	Markanda Cold Store & ICE Factory	Lekhraj Heralal, VPO- Saha 9991587882	3,550	1995 & 2001	NA
4.	Ambala	Kamdhanu Cold Store	ParsotumDass, Vill. - Tepla, Saha, 9416026199	2,250	1998	NA
5.	Ambala	S.P Cold Store & ICE factory	Harish Kumar Rakesh Mohan HarminderGoel, Vill. - Rukree (Dosarka), Ambala, 9416375948,	2,000	1991	NA
6.	Ambala	Milap Cold Store	Anil Ahuja, VPO- Shehzadpur 9355211994	2,000	1984 & 1984	NA
7.	Ambala	Janta Cold Store	Mohan Lal, VPO- Naraingarh 1734284072, 9729541488	2,500	1979 & 1979	NA
8.	Ambala	Shivalik Cold Store	Ajit Dang, VPO- Naraingarh	2,500	1975 & 1976	Potato & Onion
9.	Ambala	Shivalik Cold Storage	Village Raipur, Viran, Tehsil, Naraingarh	2,912	2015-16	NA
10.	Ambala	Shree Ganesh Cold Store	Gulshan Dang, VPO- Naraingarh 01734263362, 9466409017	2,200	1995 & 1996	Potato
11.	Ambala	HarMilap Cold Store	Vijay Dang, VPO- Naraingarh 01734263151, 9416009419	2,300	2000 & 2001	Potato
12.	Ambala	Khosla Cold Store	Pardeep Kumar S/o VedparkshKhosla, Hisar Road, Near Saranga Village, 9896604887	4,000	NA	Potato & Onion
13.	Ambala	Shri Shankar Puri Cold Store	Tirathram, Industrial Development Area, Near Motor Market, A/City.9991120049	1,500	1989 & 1990	Potato & Fruits
14.	Ambala	Dhillon Cold Store,	Rajaji, G.T. Road, Near Vill. Sahapur.9896182800	2,250	1979	Potato
15.	Ambala	M/s Markanda Cold Storage, Saha	Sh. Sukdev Kumar Chauhan S/o Sh. Munshi Singh, VPO.	6,500	NA	Fruit

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
			Badhuali, The-Naraingarh, Distt-Ambala 9416037377			
16.	Ambala	Shri Ganesh Cold Storage	Village Dehar, PO Ambli, Tehsil Naraingarh	1,650	2016-17	NA
<b>2. Bhiwani</b>						
17.	Bhiwani	Sh. Surender Cold Store, Plot No. 25, Sector-26, Industrial Area, Bhiwani	Samunder Singh S/o Sh. Abhey Ram & etc. (9813248737)	1,450	2005	Banana, Apple, Eggs, Grapes, Citrus
18.	Bhiwani	Hari Om Cold Store & Allied Industries	Plot No. 26, Sector-21, Industrial Area, Bhiwani	1,496	2016-17	NA
<b>3. Faridabad</b>						
19	Faridabad	Market Committee, DabuaSabji Mandi, Faridabad	Market Committee, DabuaSabji Mandi, Faridabad	130	2014-15	Fruit, vegetable
<b>4. Fatehabad</b>						
20	Fatehabad	M/s Kissan Cold Store, Opp. Azad Petrol Pump, Fatehabad	Sh. Mahender Singh	12	1998	Potato
21	Fatehabad	M/s Paryag cold Storage, Hissar Road, Fatehabad	Sh. Naresh Kumar	12	1998	Potato
22	Fatehabad	M/s Divya Cold Storage, G.T. Road Hissar Road Fatehabad	Sh. Arjun Mehta	8	2004	Potato
23	Fatehabad	M/s KapilKalash Store, Fatehabad	Sh. Kapil Kumar	50	2005	Banana
24	Fatehabad	M/s Guru Kirpa Store, Fatehabad	Sh. Subhash	50	2006	Banana
25	Fatehabad	M/s New Sat Guru Cold Store, Fatehabad	Sh. Deepak	40	2005	Banana
26	Fatehabad	M/s Mat Cold Store, Chandigarh Road, Tohana	Sh. Satnam Dara	15	1995	Potato, Fruit
27	Fatehabad	M/s Seti Cold Store, Tohana	Sh. Himansu Seti	20	1999	Potato, Fruit
28	Fatehabad	M/s Sindhu Cold Store, Tohana	Sh. Surender	7.5	1985	Potato
29	Fatehabad	M/s Badiyal Cold Store, Jakhhal	Sh. Narender Badiyal	12.5	1999	Potato, Fruit
<b>5. Gurugram</b>						
30	Gurugram	NHM Cold Store at Grain Market, Gurugram	Market Committee, Gurugram, 09468118037	500	NA	Potato, Tomato
<b>6. Hisar</b>						

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
31	Hisar	Sindhu Cold Store, Subzimandi, Hisar	Baljeet Sindhu 9416043856	60	2002-03	Banana & Citrus
32	Hisar	Cold Store, New Veg. Market	Secretary, Marketing Board, Hisar, 01662-275045	25	2012-13	NA
<b>7. Jhajjar</b>						
	Jhajjar	Nil	Nil	NA	Nil	Nil
<b>8. Jind</b>						
33	Jind	Aditi Cold Storage	Ajay Kumar, Near Subji Mandi, Jind, Mo 9416190486	1800	Potato	NA
34	Jind	Shiv Shakti Cold Storage,	Satish Kumar, Near Subji Mandi, Jind, Mo 9255458300	1200	Potato	NA
				NA	NA	NA
35	Jind	Laxmi Cold Storage, Jind	Not in Working Position Since 2000	NA	NA	NA
36	Jind	Guru Nanak Ice & Cold Storage, Jind	Not in Working Position Since 1995	NA	NA	NA
37	Jind	KhuranaJamidara Cold Storage	Not in Working Position Since 2002	NA	NA	NA
<b>9. Kaithal</b>						
38	Kaithal	Bharat Cold Storage Dhand Road Kaithal	Sh. R. S. Gupta 9416805676, 01746-320092	1500	1964	Potato
39	Kaithal	M/s. Pawan Kumar Cold Storage	Shergarh Road, Kaihal	772	2015-16	NA
<b>10. Karnal</b>						
40.	Karnal	M/s A C Cold store	Sh. Paramjeet SinghVill. Khera Chapra	1,200	1988	Potato
41.	Karnal	M/s Today Fresh	Sh. Anil Gupta Vill. Chirao	3,000	2012	Empty
42.	Karnal	M/s B M Cold Store	Sh. Aseem Gupta opp. sugar mill Meerut Road Karnal	2,500	1970	Potato
43.	Karnal	M/s Shiv Shakti	Sh. HargovindSachdeva	1,300	1997	Potato,
44.	Karnal	M/s Guru Kirpa Cold Store	Sh. Vidbhushan Chhabra Ranwar road Karnal	1,200	2004	Potato, Banana, and Apple
45.	Karnal	M/s Himalya Cold Store	Sh. Virender Sharma G T Road Karnal	2,000	1956	Fruit, Banana, Apple, and Grapes

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
46.	Karnal	M/s Jagdish Cold Store	Sh. Subash Sharma Namste Chock G T Road Karnal	2,500	1955	Closed
47.	Karnal	M/s Maan Cold Store	Sh. Randeep Singh Maan G T Road Karnal	2,200	1975	Potato, Banana.
48.	Karnal	M/s Bajaj Cold Store	Sh. Mohit S/o VedParkash H No. 1473 Sect. 9 Karnal	10	1998	Potato
49.	Karnal	M/s Madan Cold Store	Sh. Madan Singh Near Grain Markt. Gharaunda Karnal	20	1986	Potato
50.	Karnal	M/s Kishan Cold Store	Sh. Sukhwant Singh S/o Angreg Singh Bisham Colony Gharaunda Karnal	20	1988	Potato
51.	Karnal	M/s Haffed Cold Store	Haffed G T Road Taraori	300	1975	Potato, Egg. Chilly Dry, and Coriander Dry.
<b>11. Kurukshetra</b>						
52.	Kurukshetra	Jamidara Cold Store G.T.RoadUmriThanesar	Gurdiyal Singh Malik	1,750	1973	Potato
53.	Kurukshetra	Umri Cold Store G.T.RoadUmriTha	Rajbir Singh	800	1973	Potato
54.	Kurukshetra	Atwal Cold Store Ladwa Road Thanesar	Randhir Singh	1,750	1980	Potato
55.	Kurukshetra	Maan Cold Store Mann Ladwa Road SirsalaThanesar	Phool Singh	700	1974	Potato
56.	Kurukshetra	Hari Om Surbhi Cold Store Ladwa Road Thanesar	Prem Parkash	1,750	1995	Potato
57.	Kurukshetra	Staneswar Cold Store Dhand Road Thanesar	Avtar	1,000	1985	Potato/ Fruits
58.	Kurukshetra	Shivam Fruits KDB Road Thanesar	Gulshan Gaba	22	2005	Potato/ Fruits
59.	Kurukshetra	Dua Cold Store G.T. Road Shahabad	Vikay Kumar Dua	4,000	1998	Potato
60.	Kurukshetra	Bharat Cold Store G.T Road Shahabad	Yash Pal	4,500	1975	Potato

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
61.	Kurukshetra	Narang Cold Store G.T Road Shahabad	Ladha Prem	4,000	1980	Potato
62.	Kurukshetra	Raj Kamal Cold	Raj Kapoor	2,100	1975	Potato
63.	Kurukshetra	Mahesh Cold Store G.T Road Shahabad	R.D. Gupta	4,000	1998	Potato
64.	Kurukshetra	Dashmesh Cold Store Barara Road Shahabad	Daya Singh Gaba	1,600	1975	Potato
65.	Kurukshetra	Krishna Cold Store Barara Road Shahabad	Bansi Lal	5,000	2000	Potato
66.	Kurukshetra	AR Cold Store Barara Road Shahabad	Kiran Kumar	5,000	2001	Potato
67.	Kurukshetra	Jai Bharat Cold Store Barara Road Shahabad	Krishan Lokesh	3,500	1980	Potato
68.	Kurukshetra	Gabha Cold Store Barara Road Shahabad	Om Parkash Gaba	1,800	1980	Potato
69.	Kurukshetra	Potato Cold Store & Pack House Govt. of Haryana Shahabad	Marketing Board	2,500	2011	Potato/ Fruits
70.	Kurukshetra	Guru Nanak Cold Store Ladwa Road Shahabad	Daya Singh Gaba	2,000	1975	Potato
71.	Kurukshetra	Sachdeva Cold Store Ladwa Road Shahabad	Rai Mal Das & Son's	2,250	1975	Potato
72.	Kurukshetra	Neel Kanth Cold Store Ladwa Road Shahabad	Papu Gandhi	2,000	1977	Potato
73.	Kurukshetra	JaiKissan Cold Store Ladwa Road Shahabad	DilBag Rai	2,000	1977	Potato
74.	Kurukshetra	Jagdamba Cold Store Shahabad	Narender Kumar	2,000	1974	Potato
75.	Kurukshetra	Zimidara Cold Store Ladwa Road Shahabad	Hakkam Rai	2,000	1976	Potato
76.	Kurukshetra	Maansarovar Cold Store Ladwa Road Shahabad	Partap Singh Kaisi	3,000	1976	Potato

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
77.	Kurukshetra	Mittal Cold Store Shahabad	Panna Lal	3,750	1980	Potato
78.	Kurukshetra	Riki Ram Cold Store Shahabad	Rikhi Ram	1,750	1980	Potato
79.	Kurukshetra	Kansal Cold Store Shahabad	Virender Kumar	3,750	1995	Potato
80.	Kurukshetra	K.C. Cold Store Shahabad	Anil, Parveen, Rajiv	2,700	2000	Potato
81.	Kurukshetra	Sindhu Cold Store Shahabad	Harjot Singh	1,500	1997	Potato
82.	Kurukshetra	DD Agro Cold Store Shahabad	Harish Khuran	5,000	2012	Potato
83.	Kurukshetra	Jagdamba Cold Store Ladwa	Dev Raj	1,750	2000	Potato/ Fruits
84.	Kurukshetra	Indian Cold Store Ladwa	YashPal Chhabra	3,000	1977	Potato/ Fruits
85.	Kurukshetra	Goyal Cold Store Ladwa	Nathi Ram	750	1974	Potato
86.	Kurukshetra	Laxmi Cold Store Ladwa	ManMohan Chopra	1,500	1972	Potato
87.	Kurukshetra	Shanker Cold Store Ladwa	Ishwer Chand	750	1974	Potato
88.	Kurukshetra	Shri Ganesh Cold Store Ladwa	Vijay Kumar	2,000	2009	Potato
89.	Kurukshetra	Kissan Cold Store Babain Ladwa (Babain)	Baldev Raj Sethi	1,750	1980	Potato
90.	Kurukshetra	Bansal Cold Store Babain Ladwa (Babain)	Jagdish Bansal	2,000	1980	Potato
91.	Kurukshetra	AR Agro Cold Store Babain Ladwa (Babain)	Mohan Bansal	4,100	2012	Potato/ Fruits
92.	Kurukshetra	Dashmesh Cold Store Pehowa	Fuman Singh	1,100	2005	Potato
93.	Kurukshetra	M/S Mittal Cold Store Pehowa	Desh Raj	800	1996	Potato
94.	Kurukshetra	M/S Parag Cold Store Pehowa	Ramesh Kumar	700	2005	Potato/ Fruits
95.	Kurukshetra	M/S Hargovind Cold store, Shahbad	Sushil Garg	5,500	2013	Potato
96.	Kurukshetra	M/s. Hari Om Surbhi Cold Storage	Village Sirsama, Kurukshetra	1,100	2016-17	NA
<b>12. Nuh</b>						
	Nuh	NIL	NIL	NIL	NIL	NIL
<b>13. Mahendragarh</b>						
97.	Mahendragarh	Cold Storage Market Committee, Narnaul	S.E.C.O. Market Committee Narnaul	50	1 May 2011	Fruit & Vegetable

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
			Ph. No. 01282-250242			
98.	Mahendragarh	Sh. Krishan Cold Store, Kanina (ripening chamber)	Arvind S/o Kailash Chand, V.P.O.-Mandola Distt-Rewari Mob. - 9467720344	60	2011	Fruits
<b>14. Palwal</b>						
99.	Palwal	Refrigeration Rack System (Pre-Cooling chambers) Cold storage (Chiller and freezer), Ante room and blast freezer	Amit Sarin, Vill-Aurangabad Teh-Hodal, Distt-Palwal 9717292510	5,000	2013-14	others
100.	Palwal	CA/MA Storage (cold storage)	SwarajSingla and Krishna Devi, R/o Kailash Agro Pvt. Ltd., Devli, Distt-Palwal 01275-262898, 9810703406	2,000	2013-14	Fruits
<b>15. Panchkula</b>						
101.	Panchkula	M/s SSS Cold Store, Village Tabar, Block Barwala, District Panchkula	Sh Om Parkash, Managing Partner	5,000	2012-13	<b>Fruits</b> (Mango, Apple, Kinnowetc) <b>Potato</b>
<b>16. Panipat</b>						
102.	Panipat	Sudama Cold Store	Thakur Sehdev S/o Roop Singh	550	1991	Potato & Other Veg.
103.	Panipat	Surender Chandna Cold Store	Surender Chandna, Kachhe Camp, Panipat	1,500	2000	Not working
104.	Panipat	Khanna Cold Store	Rajiv Khanna, Kishanpura, Panipat	2,000	2000	Not working
105.	Panipat	Bhatla Cold Store, Matlauda	Ravinder Kumar, Matlauda, Panipat	1,000	2006	Potato & Other Veg.
106.	Panipat	Radha Cold Store	Radha Singh, Matlauda Shahar	1,000	2002	Potato & Other Veg.
107.	Panipat	Om Cold Store	Mukesh, Ugrakheri Mod, Ugrakheri	2,500	2012	Potato & Other Veg.
<b>17. Rewari</b>						
	Rewari	NIL	NIL	NIL	NIL	NIL
<b>18. Rohtak</b>						
108.	Rohtak	M/s Anso Agro	Sh. Sompal Singh S/o	5,000	NA	For fruits & veg
109.	Rohtak	M/s Ahlawat Cold Store, Nr. New	Sh. Arjun S/o Sh. Dilbag 9416856673	60	2007-08	Banana



Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
		Bus Stand, Meham				
110.	Rohtak	Inder Cold Store, Sukhpura	Pappu 9896467734	1,517	1986-87	Banana, Onion, Potato
111.	Rohtak	Saini Ice Factory & Cold Store, Dayanand Math, Near GohanaAdda	Vasudeve, 9255562346	18	2002-03	Banana
112.	Rohtak	HSAMB New Grain Market, Rohtak	Vijay Kathuria (ABM) 9896749859	110	2008-09	Banana, Papaya
113.	Rohtak	M/s. Anso Agrotech Pvt. Ltd.	Village Madina	5,020	2012-13	NA
<b>19. Sirsa</b>						
114.	Sirsa	Dumara cold Store Sirsa	VikashKocharSirsa	2,000	NA	Potato, Vegetable and milk
115.	Sirsa	Haryana Cold Store, sirsa	Rajeev Garg Sirsa	1,000	NA	Potato, fruit and Vegetable
116.	Sirsa	Kamboj cold Store	NA	3,000	NA	Potato
117.	Sirsa	Nehra cold Store, Sirsa	NA	75	NA	Fruit and vegetable
118.	Sirsa	Haryana Cold Store	Plot No. 51, Ind. Area, Ph-III, Sirsa	525	2015-16	NA
119.	Sirsa	M/s. Durma Cold Storage & Allied Industires	H.No.488, Ward No. 14, Sirsa	1,125	2016-17	NA
120.	NIL	NIL	NIL	NIL	NIL	NIL
121.	NIL	NIL	NIL	NIL	NIL	NIL
<b>20. Sonipat</b>						
122.	Sonipat	Dhingra Ice & Cold Storage, Kundli	Sh. Chman Lal Dhingra S/o Sh. Gopal Das, 09811458870	4,804	2011	Spices
123.	Sonipat	Anand Cold Chain, Nathupur	Sh. Harlin Kaur, 09911151554	2,938	2011	Fruits
124.	Sonipat	Pragati Cold Storage, 494, Rai Food Park, Rai	Sh. Lalwani, 09811023441	4,195	2011	Spices
125.	Sonipat	Balaji Agro Products I.E. Kundli	AtulGoel	5,100	2011	Spices
126.	Sonipat	Lah Cold Storage Pvt. Ltd., HSIIDC, Rai	Sh. Sandeep Agarwal, 09810084790	5,171	2012	Spices
127.	Sonipat	Anant Cold Storage Pvt. Ltd. VajidpurSaboli	Sh. Anand Kumar Gupta	3,800	2012	Fruits

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
			S/o Sh. Sardari Lal Gupta, 08459145025			
128.	Sonipat	Suboli Ice & Cold Storage Pvt. Ltd, Kundli, Sonipat	Sh. VinitMahaswari S/o Sh. Rajiv Mehaswari, 09818436818	6,047	2012	Spices
129.	Sonipat	Gupta Cold Storage	S Asha Gupta W/o Sh. PerladeSaroop Gupta, 08459145025	5,487	2012	Dry fruits
130.	Sonipat	Anant Cold Storage Pvt. Ltd.	Sh. Vinod Gupta, Vajidpur, Kundli,	6,000	2013	Spices
131.	Sonipat	R.S. Farzing & Puling Chamber Pvt.Ltd.	Rohina, Vill. Nathpur, 9810783377	3,892	NA	NA
132.	Sonipat	Anand Cold Store Chain	GaganAnand, Vill. Nathpur, 9911151554	15,000	NA	NA
133.	Sonipat	Viraz Cold Store	Vipin Gupta, Vill. Nathpur, 9811039880	10,000	NA	NA
134.	Sonipat	Ishwar Cold Store	Nishant, Vill. Nathpur, 8459432732	7,000	NA	NA
135.	Sonipat	Sala Ram Cold Store	Rajnish, Vill. Nathpur, 9811033769	7,000	NA	NA
136.	Sonipat	Harsna Cold Store	Naresh Kohli, Vill. Nathpur	7,000	NA	NA
137.	Sonipat	Jubin Cold Store	Suresh Kirplani, Vill. Nathpur, 9811086079	80,000	NA	NA
138.	Sonipat	Sah Sahib Cold Store	Chuni Lal Ji, Vill. Nathpur, 9312241906	73,000	NA	NA
139.	Sonipat	Suri Cold Store Grago Ltd.	Suri, Vill. Rai, 9315086627	50,000	NA	NA
140.	Sonipat	Pargati Cold Store	Chuni Lal Ladwani, Vill. Rai, 9811023441	45,000	NA	NA
141.	Sonipat	Sakti Ice & Cold Store	NimitaAahuja, Vill. Kundli, 9811198011	2,500	NA	NA
142.	Sonipat	AamsiLuthara Cold Store	Rajesh Luthara, Vill. Kundli, 9310001830	2,500	NA	NA
143.	Sonipat	Om Ram Cold Store	Lokesh Agarwal, Vill. Kundli	2,500	NA	NA
144.	Sonipat	Kufari Ice & Cold Store	Sachin, Vill. Kundli, 9811171055	11,000	NA	NA
145.	Sonipat	Kartari Devi Cold Store	Kartari Devi, Vill. Kundli	5,000	NA	NA
146.	Sonipat	R.J. Cold Store	Amresh, Vill. Kundli, 2319208	500	NA	NA
147.	Sonipat	Amod Agarwal	Amod, Vill. Kundli, 9811282884	11,000	NA	NA
148.	Sonipat	Sun Be Pipe Cold Store Ltd.	Ashwani Kumar, Vill. Kundli, 9818016000	1,240	NA	NA
149.	Sonipat	Narang Cold Store	ParashNarang, Vill. Kundli, 8459096306	5,000	NA	NA
150.	Sonipat	Kumar Cold Store	Hanslal, Vill. Kundli, 9871874874	5,000	NA	NA
151.	Sonipat	Gulsan Ice Sun Cold Store	Amod Agarwal, Vill. Kundli, 9811282884	4,800	NA	NA

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
152.	Sonipat	Sagar Cold Store	OmparkashDahal, Vill. Kundli, 9811613333	5,000	NA	NA
153.	Sonipat	Luhani Cold Store	GopiLuhani, Vill. Kundli, 9811313899	15,000	NA	NA
154.	Sonipat	Pargati Cold Store	C.L. Lalwani, Vill. Kundli, 9811023441	1,500	NA	NA
155.	Sonipat	Rosan Cold Store	Anil Sabarwal, Vill. Kundli, 9810013709	300	NA	NA
156.	Sonipat	Santosh Agro Food Pvt.Ltd.	Roshan Goyal, Vill. Kundli, 9810036352	5,479	2011-12	NA
157.	Sonipat	Sai Kirpa Ice Cold Store	Rajkumar Madan, Vill. Kundli, 9811048780	350	NA	NA
158.	Sonipat	K.H.I. Cold Store	Himan Sugar, Vill. Kundli, 9811825111	10,000	NA	NA
159.	Sonipat	Shiv Shakti Cold Store	Mr. Utsav, Vill. Kundli, 9311345383	NA	NA	NA
160.	Sonipat	S.P. Cold Store	R.K. Jain, Vill. Kundli, 9811082670	800	NA	NA
161.	Sonipat	RamjiDassDarsan Kumar Ice & Cold Store Pvt.Ltd.	Tirath Ram Manga, Vill. Kurar, 9215357403, 9215387403	80,000	NA	NA
162.	Sonipat	Khatri Cold Store	Dharmbir Khatri, Sabji Mandi, Sonapat 9811213988	NA	NA	NA
163.	Sonipat	Aasam Cold Store	Prem Chand, Subji Mandi, Sonapat 9215300164	NA	NA	NA
164.	Sonipat	Kisan Cold Store	Om Parkash, Delhi Road, Sonapat, 0130-2235739	NA	NA	NA
165.	Sonipat	Maha Singh Cold Store	Balwan Singh, Gohana, 9812111656	NA	NA	NA
166.	Sonipat	Kala Fruit Cold Store	Narender, Gohana, 9813793030	50	NA	NA
167.	Sonipat	M/s Dhingra Ice & Cold Storage Pvt. Ltd.	Village Kundli	554	2012-13	NA
168.	Sonipat	Delhi Agrocool Pvt. Ltd	Narela Pio Manyari Road, Village Kundli	5,311	2013-14	NA
169.	Sonipat	Hare Krishna Agrotech Cold	Village Nathupur	6,124	2013-14	NA
170.	Sonipat	Ved Prem Cold Storage Pvt. Ltd.	Village Nathupur	5,180	2013-14	NA
171.	Sonipat	Extra Cold Storage Pvt. Ltd.	Village Wazidpur, Saboli	5,625	2013-14	NA
172.	Sonipat	ANV Cold Store Pvt. Ltd.	Village Kundli	3,794	2014-15	NA

Sr. No	District	Name of Cold Storage	Owners of the cold store with complete address and contact number	Capacity of the cold store (in MTs)	Year of establishment	Type of produce store
173.	Sonipat	Salasar Cold Storage Pvt. Ltd.	Main Sapoli Road, Nathpur, Sonapat	480	2015-16	NA
174.	Sonipat	M/s. BMC Cold Storage	Village Jat Joshi, Sonapat	5,160	2016-17	NA
175.	Sonipat	M/s. KMC Cool Chain India Pvt. Ltd.	Village Nathupur, Rai, Sonapat	1,008	2016-17	NA
176.	Sonipat	S.K. International Foods	Plot No. 676, Siddharth Colony	918	2016-17	NA
177.	NIL	NIL	NIL	NIL	NIL	NIL
<b>21. Yamuna Nagar</b>						
178.	Yamuna Nagar	Himalya Cold Store Sarawan, Sadhaura	Sh. Ujjawal Singh Bajwa S/o Sh. KirpalBajwa, V.P. O Sarawan Mob- 8930000869	2,000	1979	Potato
179.	Yamuna Nagar	Kishan Cold Store, Rajpura, Sadhaura	Sh. Harnam Singh S/o Sh. Preetam Singh, Rajpura, V.P.O Rajpura	2,500	1973	Potato
180.	Yamuna Nagar	Zimidar Cold Store, Pando.	Sh. Kuldeep S/o Sh. Santokh Ram, V.P.O-Pando	2,000	1974	Potato
181.	Yamuna Nagar	Surya Cold Store, 06 Industries Area Yamuna Nagar	Sh. GulshanBatra 06 Industries Area Yamuna Nagar Mob- 9416452408	1,000	1996	Fruit and Potato
182.	Yamuna Nagar	Batra Cold Store	Sh. Ashok Batra, M2/ M 31 Industries Area Yamuna Nagar Mob- 9017365230	1,000	1971	Fruit and Potato
183.	Yamuna Nagar	Ishaar Cold Store	Sh. Paramjeet Sing, Industries Area New Fish Market Yamuna Nagar	1,500	1985	Potato
184.	Yamuna Nagar	Jindal Cold Store	Sh. Savtantar Jindal Railway Station Road, Yamuna Nagar	1,000	1975	Potato
185.	Yamuna Nagar	Sardar Cold Store	Sh. Kaka Bhatia Near UshaRathi Hospital Yamuna Nagar Mob- 9416002932	1,500	1981	Potato
186.	Yamuna Nagar	Shankar Cold Store	Sh. DharampalDhawan By Pass Chownk,	1,000	1990	Potato
187.	Yamuna Nagar	Cold Store	Private Sector at Bilaspur	100	2007-08	NA

Source: Haryana Government <https://hortharyana.gov.in/sites/default/files/17.11.2017%20upload/Cold%20Storage%2025.07.2019.pdf>

### Attachment 3.4.4 J-Method Farming Participated Japanese Companies

Company Name	Service or Product	Summary
<b>Farmland renovation and Plowing</b>		
Kyouwa Corporation	Sheet-Pipe system	<p>Kyouwa Corporation is a Japanese company that specializes in the design, manufacturing, and installation of precast concrete products, including prefabricated buildings, bridges, and civil engineering structures. The company was founded in 1962 and is headquartered in Tokyo, Japan.</p> <p>One of Kyouwa Corporation's main products is the Sheet-Pipe System, which is a precast concrete drainage system designed to provide a high level of durability, strength, and flexibility. The system is composed of precast concrete sheets and pipes that are assembled on site to create a range of drainage structures, including culverts, ditches, and stormwater channels.</p> <p>The Sheet-Pipe System offers several advantages over traditional drainage systems, including faster installation times, reduced maintenance requirements, and improved resistance to erosion and sedimentation. The system is also highly customizable, with a range of sizes and shapes available to meet specific project requirements.</p>
Taiyo Co. Ltd./ Taiyo India Pvt. Ltd. (Neemrana, Rajasthan)	Rotary Tiller Blade	<p>Taiyo Co. Ltd is Japan's leading manufacturer of Rotavator blades. The company was established in 1920 in Japan's Kochi prefecture.</p> <p>Rotary tiller blade technology is designed to improve the efficiency and effectiveness of rotary tillers.</p> <p>The blades are made from high-quality materials and have a unique shape and angle that helps to reduce soil compaction and improve soil aeration, promoting healthy soil conditions for plant growth. The blades are also designed to be easily replaceable, reducing downtime and increasing productivity for farmers.</p> <p>Overall, Taiyo Co. Ltd.'s rotary tiller blade technology contributes to more efficient and sustainable farming practices.</p>
<b>Seed</b>		
Japan Vegetable Seeds Co. Ltd.	Seed	JVS is a joint venture among Nippon Norin, Kurume, Nanto Seeds, Matsui Seeds and Mitsui & Co. for the purpose of "Bringing Japanese High Quality vegetable Seeds to the World".
JFE Steel Corporation	Iron powder coated seeds	JFE Steel Corporation is a global company that contributes to society through superior Japanese steel technology and provides an iron powder material "Konabijin" suitable for direct seeding of iron coated rice seed.
GRA&GREEN	Grafting Cassette/ Graft seedlings	<p>Grafting is a method of connecting different plants to improve their taste, size resistance, and enhance growth speed.</p> <p>However, stable production of grafted seedlings was considered difficult as it requires the experience and knowledge of skilled workers.</p> <p>To solve this difficulty of grafting, GRA &amp; GREEN has developed the Grafting Cassette. Our Grafting Cassette enables anyone to mass-produce grafted seedlings with stable quality.</p> <p>Some of the advantages of Grafting Cassette are,</p> <ul style="list-style-type: none"> <li>• Even beginners can make 250 grafting seedlings per hour</li> <li>• Quality is constant</li> <li>• Investment cost is minimal</li> </ul>
<b>Pest control</b>		
Nihon Nihyaku Co. Ltd.	Agricultural Chemicals	<p>Nihon Nohyaku Co., Ltd. provides various agricultural chemicals as the first Japanese manufacturer specializing in agricultural chemicals. High-quality products as well as enhanced services provided by local company (Nichino India Pvt. Ltd.) staff.</p> <p>Main Business of Nihon Nihyaku Co. Ltd is:</p> <ul style="list-style-type: none"> <li>• Agrochemicals (Agriculture/Professional Turf/Home &amp; Garden)</li> <li>• Wood Preservative</li> <li>• Agricultural Materials</li> <li>• Pharmaceuticals &amp; Animal Health Products</li> </ul>
The Koizumi Jute Mills Ltd.	Pest Control/ Nushi huratto sheet	Developing a wide range of products based on the technology cultivated from jute spinning. Provide "Mushi huratto sheet" that disturbs the flight of micro pests.
<b>Biostimulant and Water-saving technology</b>		
Ac-Planta	Skeepoon. Agri / Bio stimulant	<p>A venture represented by Prof. Dr. KIM, a specially appointed professor at the University of Tokyo. Provide a bio stimulant that dramatically confers drought and heat tolerances in plants.</p> <p>Skeepoon is an agricultural product suitable for the growth of a wide range of crops. It is a safe and reliable product that uses acetic acid, the main ingredient of</p>

Company Name	Service or Product	Summary
		vinegar, which is known for its health benefits. Skeepon is not a pesticide or fertilizer. It is friendly to both people and the earth, making plants resistant to dryness, high temperatures and salt damage.
Daiko Trading Co. Ltd.	Distributor of Skeepon Agri	Total distributor of Skeepon Agri in Japan. In addition, mainly import and sell soil conditioners containing microorganisms from India. Trade transactions with India for over 25 years.
Enplas Corporation	Pressure combination drip tube	Offers Drip irrigation tube, which is excellent for water-saving technology. There are advantages in the below <ul style="list-style-type: none"> <li>• cope with areas that lack water</li> <li>• labor time saving</li> <li>• increase crop fields</li> <li>• reduce damage to insect as this product is PC type (Pressure compensation type) coming out of water in the same amount.</li> </ul>
<b>Soil enrichment and fertilizer</b>		
Japan Conservations Engineers & Co. Ltd.	Fujimin/ Activation of Photosynthesis	Fujimin is the high concentrated fulvic acid solution that can be obtained by only the mass production technology using timber from forest thinning. Fulvic acid is one of the components of humic substances generally obtained from humic soil in forest. While fulvic acid has the effect of facilitating the absorption of fertilizer by plants and improving the soil environment, it can normally be found only in trace amounts in the terrestrial soil and the bottom of water bodies. As Fujimin® is produced with natural materials through non-microbial process, it has no environmental impact, even though fulvic acid concentration of Fujimin® has several hundred times as high as nature-derived.
TOMATEC Co. Ltd.	Micronutrient fertilizer	Manufacture and sell slow-release micronutrient fertilizer "F.T.E"(fritted trace elements) series that are composed of well-balanced micronutrients to support the growth of crops. With over 60-year experience, soil/crop analysis-based advice and proposals for optimum fertilization are available as a technical service. TOMATEC supplies glass fertilizers containing six elements (manganese, boron, iron, zinc, copper, and molybdenum), which are trace elements essential for the healthy growth of crops, using glass frit production technology. FTE is an environment friendly comprehensive trace element fertilizer so that these trace elements are slowly dissolved and absorbed during the growing period of crops.
<b>Farming consultation</b>		
AGRES Co. Ltd.	Farming consultation/leafy vegetables	Japan's largest spinach cultivation agricultural corporation. It has a field in Nobeyama, Nagano Prefecture, at an altitude of 1300m.
<b>IT</b>		
Nishimu Electronic Industries Co. Ltd.	MIHARAS-Agricultural IT sensor	Offers agricultural IT sensor "MIHARAS" that supports efficient farm management and productivity improvement by visualization of data of paddy fields and cultivated lands. Features <ul style="list-style-type: none"> <li>• Wide area monitoring by using mobile network.</li> <li>• Easy set-up, ready to use sensor</li> <li>• Low cost</li> </ul>
Integrity Co. Ltd.	INT-Sensor/Monitor and tracks environmental conditions	INT-SENSOR is a smart farming system that monitors and tracks environmental conditions, helping your crops thrive. We develop automation of agriculture processes and enable you to "Remote Work" in agriculture.
SAgri Co. Ltd.	Satellite x Analysis x Grid / AI technology	Company "SAgri" represents Satellite x Analysis x GRID, which uses AI technology to analyze big data such as satellite data to solve the social problems like agricultural issues. For example, they use satellites to investigate the situation of farmland and advise farmers to improve the operational issues.
Amegumi India	SUNBLAZE Phone	With our newly developed OS, we have produced the smartphone "SUNBLAZE Phone", which has overwhelmingly reduced costs and malfunctions. By introducing this low-cost smartphone for business, you can reduce management stress and increase productivity at low cost. The product is made for the people who never access Smartphones/Tablets. They don't have any tool to access useful apps, online classes, remote medical services and browsers themselves. If you want to let them, use for both of your benefit like

Company Name	Service or Product	Summary
		managing, educating or collecting data from people who don't have Smartphones, our tool is the one.
<b>Cold chain and Marketing</b>		
Nissan Steel Industry Co, Ltd.	Freshness keeping sheets/ Freshmama	Ethylene gas, which is the cause of aging of fruits and vegetables, is efficiently decomposed into carbon dioxide and water even in the dark, and the generated carbon dioxide and water contribute to maintaining the freshness of food. The validation test at the Institute of Scientific and Industrial Research Osaka University, has proven innovative functions not found in the past. Ethylene gas drops sharply after 3 hours of using the Freshmama and almost to zero after 6 to 24 hours. Even in the absence of light, in the refrigerator, the decomposition function is unchanged. Compared to commercial bags, Freshmama keeps fresh for about 7 to 14 days at room temperature.
DENSO CORPORATION	Cold Chain Delivery Service	The global company supplying products to car manufacturers all over the world. Provide the delivery management (with freshness management data) of mini-trucks equipped with refrigerators.
Wismettac Foods, Inc.	Cold Chain and Marketing	A food specialty trading company. Distributes fruit and vegetables worldwide and has an introduction record of Japanese varieties overseas. Provides expertise in product distribution, sales channel development and IP management of Japanese varieties.

Source: Ministry of Agriculture, Forestry and Fisheries the Government of Japan (MAFF)

Attachment 6.3.1 Potential PGs list

Sr.	District	Cluster Name	Cluster Code	FPO Name	Supported by Govt. for handholding and Management	Date of Registration	Number of Shareholders	Sacntioned under CCDP including completed projects	Under R&G	Category	Additional R&G	10,000 FPO Scheme
33	Ambala	Rator	CA-01	BegnaPCL	SP	20.09.2018	200		R&G	Horticulture		
23	Ambala	Bhurewala	CA-02	Worldfeed Farmer PCL	SFACH	11.09.2019	60			Horticulture		
24	Ambala	Bhurewala	CA-02	Laha Bagwani PCL	SFACH	25.03.2019	25			Horticulture		
22	Ambala	Ambli	CA-03	Ganauli Baghwani PCL	SFACH	29.03.2019	200			Horticulture		
38	Ambala	Nanhera	CA-04	Simply rooted FPCL	SP	16.01.2021	99	CCDP	R&G	Horticulture		
39	Ambala	Nanhera	CA-04	Ambli Baghwani PCL	SFACH	16.04.2019	160			Horticulture		
34	Ambala	Ghazipur	CA-05	Shivalya AgrotechPCL	SP	09.09.2019	183	CCDP	R&G	Horticulture		
	Ambala	Panjeto	CA-06									
35	Ambala	Konkpur	CA-07	Optimal Agro Producer Company Ltd	SP	09.11.2017	153	CCDP	R&G	Horticulture		
40	Ambala	Durana	CA-08	Sahabpura Farmer PCL	SFACH	08.03.2019	160			Horticulture		
26	Ambala	Kotkachua Khurd	CA-09	Kotkachwa Farmer PCL	SFACH	12.09.2019	100		R&G	Horticulture		
25	Ambala	Shahpur	CA-10	Turka Baghwani PCL	SFACH	18.03.2019	220		R&G	Horticulture		
27	Ambala	Saphera	CA-11	Saphera FarmerPCL	SFACH	27.06.2019	10			Horticulture		
30	Ambala	Barara	CA-12	Mitradi Farmer PCL	SFACH	11.04.2019	150		R&G	Horticulture		
37	Ambala	Barara	CA-12	Khetupad Farmer Producer Co. Ltd,	SP	23.01.2019	10	CCDP	R&G	Horticulture		
31	Ambala	Paonti	CA-13	Zaffarpur Farmers PCL	SFACH	13.03.2020	50			Horticulture		
28	Ambala	Rampur	CA-14	Shankra FPC Ltd.	SFACH	29.05.2020	153	CCDP		Horticulture		
29	Ambala	Chudiala	CA-15	Agriborn Farmer PCL	SFACH	27.03.2019	160			Horticulture		
36	Ambala		CA-16	Banaundi Farmers Producer Company Limited.	NA			NA			R&G	
32	Ambala		CA-17	NARYANGARH AGROFED FARMERS PRODUCER COMPANY LIMITED	NAFED	21.12.2021	10			Horticulture		1
	Bhiwani	Chandawas	CB-01									
370	Bhiwani	Leghya bhanan	CB-02	Jamindar FPCL	SP	13.08.2020	160			Horticulture		
362	Bhiwani	Chanana	CB-03	Tosham Farmer PCL	SFACH	06.03.2019	70		R&G	Horticulture		
373	Bhiwani	Chanana	CB-03	Giri Horticulture FPCL	SP	20.10.2020	25		R&G	Horticulture		
	Bhiwani	Badwa	CB-04									
359	Bhiwani	Kikral	CB-05	Auxagri Farmer PCL	SFACH	22.05.2019	10	CCDP	R&G	Horticulture		
364	Bhiwani	Miran	CB-06	Narora Farmer Producer Organisation	SFACH	26.03.2019	10			Horticulture		
371	Bhiwani	Kharkari Makhwan	CB-07	BSJ FPCL	SP					Horticulture		
383	Charkhi Dadri		CB-07	Rodhi farmer producer company limited	NA						R&G	
	Bhiwani	Dharan	CB-08									
	Bhiwani	Gagarwas	CB-09									
	Bhiwani	FartiyaBhima	CB-10									
363	Bhiwani	Sirsi	CB-11	Shimburam Sirsi Farmer PCL	SFACH	10.06.2019	10			Horticulture		
372	Bhiwani	Chahar	CB-12	Bahal FPCL	SP					Horticulture		
	Bhiwani	Rewari Khera	CB-13									
368	Bhiwani	Chang	CB-14	Vistrit Javik FPCL	SP				R&G	Horticulture		
358	Bhiwani	Dhani Harsukh	CB-15	Veg Guru Dhani Harsukh Farmer PCL	SFACH	02.05.2019	10		R&G	Horticulture		
360	Bhiwani	Bamla	CB-16	Bamla Farmer PCL	SFACH	08.03.2019	100	CCDP	R&G	Horticulture		
367	Bhiwani	Bamla	CB-16	Sahibi Producer Co. Ltd.	SP	03.09.2019	10		R&G	Horticulture		
	Bhiwani	DhaniKhushal	CB-17									
365	Bhiwani	Sikanderpur	CB-18	Barsi Agro PCL	SFACH	01.03.2019	10			Horticulture		
361	Bhiwani	Jmalpur	CB-19	Bhurtana Farmer PCL	SFACH	12.02.2019	10		R&G	Horticulture		
366	Bhiwani	Jmalpur	CB-19	Kathpalia Farmer PCL	SP					Horticulture		
369	Bhiwani	Biran	CB-20	Jharwai FPCL	SP	11.09.2020	198			Horticulture		
375	Charkhi Dadri	Mehra	CC-01	Bhiwani Green Farm PCL	SFACH					Horticulture		
377	Charkhi Dadri	Kadma	CC-02	Bagad Organic Farmer PCL	SFACH	21.02.2019	70	CCDP	R&G	Horticulture		
	Charkhi Dadri	Picopa	CC-03									
376	Charkhi Dadri	Rodrol	CC-04	Automoto FarmerPCL	SFACH	24.01.2020	160		R&G	Horticulture		
	Charkhi Dadri	Norangabass	CC-05									
386	Charkhi Dadri	Birhi Kalan	CC-06	Dadri Innovative Farmers PCL	SP	21.11.2016	160			Horticulture		
388	Charkhi Dadri		CC-06	Kasni Farmers PCL	SFACH				R&G	Horticulture		
381	Charkhi Dadri		CC-07	Krishak Shakti Farmer PCL	NABARD	29.03.2019	10			Horticulture		
	Charkhi Dadri	Kheri Batter	CC-08									
389	Charkhi Dadri	Dhani Phouhat	CC-09	New Dadri progressive FPCL	SFACH	18.10.2020	160			Horticulture		
380	Charkhi Dadri	Mirch	CC-10	Mirchiya green Farmers PCL	SFACH	25.01.2019	160		R&G	Horticulture		
	Charkhi Dadri	Berla	CC-11									
374	Charkhi Dadri	Kanhra	CC-12	Kisan Hitkari Bhagwani PCL	SFACH	13.06.2020	160			Horticulture		
378	Charkhi Dadri	Kanhra	CC-12	Kanhra Agro Farm PCL	SFACH	05.01.2019	160			Horticulture		
	Charkhi Dadri	Hansawas Kalan	CC-13									
	Charkhi Dadri	Dhoka Dina	CC-14									
379	Charkhi Dadri	Mandi Hariya	CC-15	The Mandi Hariya Farmers PCL	SFACH					Horticulture		
	Charkhi Dadri	Dwarka	CC-16									
	Charkhi Dadri	Arya Nagar	CC-17									
387	Charkhi Dadri	Achhina	CC-18	Nkui FarmerPCL	SP	08.05.2019	38			Horticulture		
382	Charkhi Dadri		CC-19	MILLETS BADHRA KISAN PRODUCER COMPANY LIMITED	SFAC-HR	04.10.2021	300			Horticulture		1
384	Charkhi Dadri		CC-19	BAUND OIL SEED FARMER PRODUCER COMPANY (BOSFPC)	SFAC-HR	13.09.2021	310			Horticulture		1
385	Charkhi Dadri		CC-20	DADRI MILLETS FARMER PRODUCER COMPANY (DMFPC)	SFAC-HR	26.10.2021	300			Horticulture		1
390	Charkhi Dadri		CC-21	JHOJHU OIL SEEDS FARMER PRODUCER COMPANY LIMITED	SFAC-HR	18.10.2021	310			Horticulture		1
198	Faridabad	Badarpur Said	CFBD-01	Badarpur Said pargatisel agro FPCL	SFACH	18.04.2019	160			Horticulture		
	Faridabad	Dhauj	CFBD-02									
200	Faridabad	Deeg	CFBD-03	Dauji Phool Utpadak PCL	SFACH	05.10.2019	30		R&G	Horticulture		
207	Faridabad	Deeg	CFBD-03	Killindri FPCL	SP	13.04.2019	160			Horticulture		
	Faridabad		CFBD-04									
199	Faridabad	Chhainsa	CFBD-05	Dayalpur Pargatisel Agro Farmer PCL	SFACH	22.04.2019	30		R&G	Horticulture		
202	Faridabad	Chhainsa	CFBD-05	Bhole Baba FPCL	NA	06.02.2015	210		NA	MIX	R&G	
203	Faridabad	Chhainsa	CFBD-05	M/s Fresh Field Farmer producer Company Ltd	SFACH	26.05.2020	50	CCDP	R&G (Repeat)	Horticulture		
201	Faridabad	Mohna	CFBD-06	Mohana Agro FPCL	SFACH	28.05.2019	160			Horticulture		



Sr.	District	Cluster Name	Cluster Code	FPO Name	Supported by Govt. for handholding and Management	Date of Registration	Number of Shareholders	Sacntioned under CCDP including completed projects	Under R&G	Category	Additional R&G	10,000 FPO Scheme
208	Faridabad		CFBD-07	Faridabad Vegetable Farmers PCL	ITSL/SFAC	26.03.2014	10			Horticulture		
204	Faridabad			Aksha Farmer producer Cooperative society	SFACH		10			Horticulture		
205	Faridabad			Diwan Farmer Producer Society	SFACH		10			Horticulture		
206	Faridabad			The Shree Krishna Farmer producer Society	SFACH		10			Horticulture		
461	Fatehabad	Tohana	CFTB-01	Tohana Bagwani Farmer Producer Company	SFACH	27.02.2019	160			Horticulture		
418	Hisar		CFTB-01	Samain Agro Producer Company Limited	NA						R&G	
459	Fatehabad	Akanwali	CFTB-02	Akanwali Vegetable Farmer PCL	SFACH	06.02.2019	10			Horticulture		
474	Fatehabad	Akanwali	CFTB-02	Tohana Agro Producer Co. Ltd.	SP	31.05.2019	165	CCDP	R&G	Horticulture		
	Fatehabad	Puranmajra	CFTB-03									
475	Fatehabad	Sadhanwas	CFTB-04	Arshal Agro PCL	SP	12.04.2019	159	CCDP		Horticulture		
469	Fatehabad	Sidhani	CFTB-05	Sidhani Farmers PCL	SFACH	07.02.2020	10			Horticulture		
468	Fatehabad	Meyond Kalan	CFTB-06	Ramphal Kissan Agro PCL	SFACH	13.06.2019	160			Horticulture		
	Fatehabad	Lehrian	CFTB-07									
473	Fatehabad	Bhuna	CFTB-08	Saladeri Fruits & Vegetables PCL	SFACH	02.04.2019	110	CCDP	R&G	Horticulture		
458	Fatehabad	Jandli Kalan	CFTB-09	Jandli Baghwani PCL	SFACH	31.10.2019	160	CCDP	R&G	Horticulture		
464	Fatehabad	Jandli Kalan	CFTB-09	Kumharia Baghwani PCL	SFACH	01.05.2019	160			Horticulture		
	Fatehabad	Berabadi	CFTB-10									
462	Fatehabad	Mehmra	CFTB-11	Ratia Baghwani PCL	SFACH	14.02.2019	10			Horticulture		
476	Fatehabad	Mehmra	CFTB-11	HT agro & Food Processing PCL	SFACH	05.10.2018	150	CCDP	R&G	Horticulture		
	Fatehabad	Baliala	CFTB-12									
470	Fatehabad	Chimo	CFTB-13	Ratia Onion Farmers PCL	SFACH	21.05.2018	10			Horticulture		
465	Fatehabad	Bharpur	CFTB-14	Farmborn Farmer PCL	SFACH	02.05.2019	185		R&G	Horticulture		
467	Fatehabad	Bharpur	CFTB-14	Alawalwas Horticulture Farmer PCL	SFACH	04.07.2019	10			Horticulture		
	Fatehabad	Kukranwali	CFTB-15									
460	Fatehabad	MP Rohi	CFTB-16	Bhirdana Horticulture Farmers PCL	SFACH	07.02.2019	200		R&G	Horticulture		
472	Fatehabad	Azad Nagar	CFTB-17	Surendarm Agro PCL	SFACH	27.11.2018	411		R&G	Horticulture		
466	Fatehabad	Kumharia	CFTB-18	Jeesukh Farmer PCL	SFACH	25.05.2019	160			Horticulture		
471	Fatehabad	Sekhpura Dharoli	CFTB-19	Sajag Horticulture PCL	SFACH	30.08.2018	100		R&G	Horticulture		
	Fatehabad	Dhabi Kalan	CFTB-20									
	Fatehabad	Alawalwas	CFTB-21									
477	Fatehabad		CFTB-23	SMART KISSAN PRODUCER COMPANY LIMITED	SFAC-HR	28.09.2021	300			Horticulture		1
478	Fatehabad		CFTB-24	OPEN GREEN AGRO PRODUCER COMPANY LIMITED	SFAC-HR	03.09.2021	300			Horticulture		1
463	Fatehabad		District Level	Fatehabad Fisheries FPCL	SFACH	13.06.2020	100			Fisheries	R&G	
265	Gurugram	Unchamajra	CG-01	Uncha Majra Farmer PCL.	SFACH	28.12.2019	151		R&G	Horticulture		
266	Gurugram	Unchamajra	CG-01	Sabhi Kisan PCL	SFACH	11.02.2020	102		R&G	Horticulture		
280	Gurugram		CG-01	Pataudi Fed Vegetable Producer Company Limited	NAFED					Horticulture		1
	Gurugram	Bhora Kalan	CG-02									
268	Gurugram	Inchhapuri	CG-03	Inchhapuri Farmer PCL	SFACH	18.01.2019	26			Horticulture		
267	Gurugram	Narhera	CG-04	Narhera PCL	SFACH	5.04.2019	25			Horticulture		
269	Gurugram	Tajnagar	CG-05	Sanpka PCL	SFACH	25.04.2019	201		R&G (Repeat)	Horticulture		
273	Gurugram	Tajnagar	CG-05	Tirpari FPCL	SFACH	04.07.2020	10			Animal Husbandary	R&G	
275	Gurugram	Tajnagar	CG-05	Gurgaon Vegetable PCL	NABARD	14.11.2013	849			Horticulture		
270	Gurugram	Farrukhnagar	CG-06	Farrukhnagar FPCL	SFACH	28.07.2020	10			Horticulture		
271	Gurugram	Farrukhnagar	CG-06	Yogya Farmer PCL	SFACH	17.07.2019	203		R&G	Horticulture		
281	Gurugram	Farrukhnagar	CG-06	Harbla FPO Farrukhnagar PCL	SP	19.06.2019	187			Horticulture		
277	Gurugram		CG-06	Farukhnagar Treta Fed Sabji Utpadak Producer Company Ltd	NAFED					Horticulture		1
272	Gurugram	Sohna	CG-07	Baluda FPCL	SFACH	7.05.2019	21			Horticulture		
274	Gurugram	Sohna	CG-07	Sohna Jaiwik FPCL	SFACH	1.07.2020	10			Horticulture		
278	Gurugram		CG-07	Green Squash Farmer Producer Company Limited	SFAC					Horticulture		1
276	Gurugram	Hamirpur	CG-08	Sadhrana Farmer PCL	SFACH	27.05.2019	57		R&G	Horticulture		
279	Gurugram		CG-08	Geofrost Farmer Producer Company Limited	SFAC					Horticulture		1
414	Hisar	Kuleri	CH- 01	SHREE DAADU RAM FARMER PCL	SFACH	11.04.2019	50	CCDP	R&G (Repeat)	Horticulture		
437	Hisar	Kirada	CH- 02	FARM INNOVATIONS VEGETABLES PCL	VGAI/SFAC	10.08.2016	1100			Horticulture		
412	Hisar	Modha Khera	CH- 03	CHULI KHURD FARMER PCL	SFACH	29.01.2019	150	CCDP	R&G (Repeat)	Horticulture		
415	Hisar	Modha Khera	CH- 03	ADAMPUR FARMERS PCL	SFACH	21.12.2018	400		R&G	Horticulture		1
456	Hisar	Modha Khera	CH- 03	Siswal Baagwani PCL	SFACH	29.01.2019	70		R&G	Horticulture		
434	Hisar	Narnaund	CH- 04	BHAINI AMIRPUR FARMERS PCL	SFACH	21.05.2019	10			Horticulture		
444	Hisar	Narnaund	CH- 04	HEALTHONIA PCL	SP	26.10.2018	562		R&G	Horticulture		
	Hisar	Madha	CH- 05									
433	Hisar	Petwar	CH- 06	SATROL KISAN MITRA FARMER PCL	SFACH	29.04.2019	10			Horticulture		
421	Hisar	Mangali	CH- 07	Agriners Farmer PCL	NA	17.07.2019	180			MIX	R&G	
452	Hisar	Mangali	CH- 07	HARIAGRI PCL	SP					Horticulture		
407	Hisar	Kaimari	CH- 08	Kaimri Baghwani PCL	SFACH	15.01.2019	55		R&G (Repeat)	Horticulture		
438	Hisar	Kaimari	CH- 08	SAFE AGRO PCL	SP	29.09.2014	1545			Horticulture		
430	Hisar	Satrod Khurd	CH- 09	RAIPURIYA FARMER PCL	SFACH	01.07.2019	10			Horticulture		
448	Hisar		CH-09	BIR FARMER PCL	SP					Horticulture		
413	Hisar	Saharwa	CH- 10	Kisankhushi PCL	SFACH	23.05.2019	250	CCDP		Horticulture		
416	Hisar	Saharwa	CH- 10	Saharwa Farmer Producer Company Limited	NA	11.02.2019	160			MIX	R&G	
432	Hisar	Saharwa	CH- 10	RUKKA TALWANDI FARMERS PCL	SFACH	01.02.2019	160			Horticulture		
442	Hisar	Saharwa	CH- 10	My cure PCL	SP			CCDP	R&G	Horticulture		
446	Hisar	Mattarshyam	CH- 11	MATTERSHYAM FARMER PCL	SP			CCDP	R&G	Horticulture		
411	Hisar	Balsamand	CH- 12	KHADYAN PADARTH PCL	NABARD	05.04.2017	1501			Horticulture		
445	Hisar	Balsamand	CH- 12	DHIRANWAS FARMER PCL	SP	11.02.2019	80		R&G	Horticulture		
450	Hisar	Balsamand	CH- 12	RAWALWAS PCL	SP	14.11.2018	1000		R&G	Horticulture		
453	Hisar	Balsamand	CH- 12	HARYANVI JAMIDAR PCL	SP				R&G	Horticulture		
441	Hisar		CH-12	BALSAMAND FARMERS PCL	SP					Horticulture		

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422	Hisar	Uklana	CH- 13	Periurban Farmer Producer Company Limited	NA	17.07.2019	160			MIX	R&G	
420	Hisar		CH-13	Uklana Farmer Producer Company Limited	NA						R&G	
425	Hisar		CH-13	Bheri akbarpur farmer producer company limited	NA	06.05.2019	12				R&G	
439	Hisar		CH-13	SUNGROWERS PCL	SP					Horticulture		
	Hisar	Parbhuwala	CH- 14									
419	Hisar	Daulatpur	CH- 15	Mylife Force Producer Company Limited	NA	06.11.2018	80			MIX	R&G	
449	Hisar	Daulatpur	CH- 15	Hansi Fruit and Veg. PCL	SP	26.09.2020	25		R&G	Horticulture		
451	Hisar	Daulatpur	CH- 15	PRACHINE KRISHI PCL	SP					Horticulture		
408	Hisar	Dhani	CH- 16	Jiyanshi Kissan PCL	SFACH	4.07.2018	150	CCDP	R&G (Repeat)	Horticulture		
440	Hisar	Dhani	CH- 16	GHIRAI FARMER PCL	SP					Horticulture		
443	Hisar	Dhani	CH- 16	Bhatol Jattan Farmer Producer Company Limited	SP	22.10.2018	100			Horticulture		
406	Hisar	Behbalpur	CH- 17	ASSURED AGRI INCOME PCL	NABARD	21.10.2016	650		R&G	Horticulture		
427	Hisar	Kheri Barki	CH- 18	Orchards Developers PCL	NABARD	05.10.2016	165	CCDP	R&G	Horticulture		
429	Hisar	Kheri Barki	CH- 18	Bhyan Fruit and Vegetables Farmers PCL	SFACH	06.05.2019	25			Horticulture		
428	Hisar	Jagawara	CH- 19	JAIJWAN PCL	SFACH	31.05.2019	10	CCDP	R&G	Horticulture		
409	Hisar	Dhani Pirwala	CH- 20	DHARTIPUTAR FARMER PCL	SFACH	18.02.2019	10			Horticulture		
431	Hisar	Hansi	CH- 21	NEW HISAR VEGETABLES FARMERS PCL	SFACH	19.06.2020	50	CCDP	R&G	Horticulture		
410	Hisar	Badhwar	CH- 22	Haryanvi Kisan PCL	SFACH	29.10.2018	50			Horticulture		
	Hisar	Siswal	CH- 23									
417	Hisar	Mirzapur	CH- 24	Sahanshil Farmer Producer Company Limited	NA	19.06.2019	170			MIX	R&G	
423	Hisar		CH-25	Sea Hawks Farmers Producer Company Limited	NA						R&G	
447	Hisar		CH-25	SISAI BOLAN FARMER PCL	SP					Horticulture		
436	Hisar		District Level	The Khalsa Coop Multipurpose Society Ltd, Nagla Jagir	SFACH	NA	10			Horticulture		
457	Hisar		District Level	The Jamalpur Kisan Coop Multipurpose Society Ltd, Jamalpur	SFACH					Horticulture		
424	Hisar			Bilasgarbabaji farmer producer company limited	NA					MIX	R&G	
426	Hisar			THE LITANI KISAN COOPERATIVE MULTIPURPOSE SOCIETY LIMITED	SFACH	03.09.2019	11			Animal Husbandary	R&G	
435	Hisar			The Shiv Shankar Kisan Coop Multipurpose Society LTd	SFACH	NA	10			Horticulture		
455	Hisar			The Madanpura Kisan Coop Multipurpose Society Ltd	SFACH	NA	10			Horticulture		
335	Jhajjar	Jhajjar	CJH-01	Haryana Organic Crop FPCL.	NABARD	02.02.2017	700		R&G	Horticulture		
339	Jhajjar	Jhajjar	CJH-01	Jhajjar VegetablePCL	SP					Horticulture		
	Jhajjar	Kheri Khumar	CJH-02									
332	Jhajjar	Hasanpur	CJH-03	Dawla progressive Farmer PCL	SFACH	04.09.2020	10	CCDP	R&G	Horticulture		
344	Jhajjar	Raipur	CJH-04	Silani Farmer PCL	SP					Horticulture		
	Jhajjar	Gubhana	CJH-05									
352	Jhajjar	Bupnia	CJH-06	Bupaniya Farmers PCL	SFACH	22.04.2019	10			Horticulture		
328	Jhajjar	Badli	CJH-07	Badli Farmers PCL	SFACH	30.04.2019	100		R&G	Horticulture		
334	Jhajjar	Badli	CJH-07	Jaivik Aahar Producer Company Ltd	NABARD	05.12.2017	350		R&G	Horticulture		
327	Jhajjar	Pelpa	CJH-08	Jai Dada PCL	SFACH	02.04.2019	10		R&G	Horticulture		
348	Jhajjar	Pelpa	CJH-08	Pelpa Farmers PCL	SFACH	06.06.2019	10			Horticulture		
333	Jhajjar	Luksar	CJH-09	New jhajjer Badli progressive FPCL	SFACH	25.09.2020	10		R&G	Horticulture		
326	Jhajjar	Sidipur	CJH-10	Nuna Majra Farmers PCL	SFACH	25.04.2019	10		R&G	Horticulture		
330	Jhajjar	Matain	CJH-11	Chhariya Farmers PCL	SFACH	16.10.2018	100		R&G	Horticulture		
350	Jhajjar	Matain	CJH-11	Mattan Farmers PCL	SFACH	15.03.2019	11			Horticulture		
351	Jhajjar		CJH-11	Kharhar Farmer PCL	SFACH	28.02.2019	10			Horticulture		
	Jhajjar	Bamnauli	CJH-12									
	Jhajjar	Parnal	CJH-13									
	Jhajjar	Jasor Kheri	CJH-14									
324	Jhajjar	Sunderhati	CJH-15	Gubhana Young PCL	SFACH	27.08.2019	100		R&G	Horticulture		
329	Jhajjar	Sunderhati	CJH-15	Sundrehethi Farmers PCL	SFACH	26.03.2019	15		R&G	Horticulture		
	Jhajjar	Surajgarh	CJH-16									
346	Jhajjar	Birohad	CJH-17	Daniya Farmer PCL	SP	03.09.2019	75	CCDP	R&G	Horticulture		
349	Jhajjar	Marot	CJH-18	Dada Sundu Vegetable Farmers PCL	SFACH	7.05.2019	10			Horticulture		
342	Jhajjar	Marot	CJH-19	Jakhar Farmer PCL	SP	1.10.2018	100			Horticulture		
343	Jhajjar	Marot	CJH-19	Salhawas farmer PCL	SP	18.10.2018	163			Horticulture		
354	Jhajjar	Marot	CJH-19	Ahri Farmers PCL	SFACH	19.07.2019	10			Horticulture		
356	Jhajjar	Marot	CJH-19	Sahlawas Farmers PCL	SP			CCDP	R&G	Horticulture		
340	Jhajjar	Dhakla	CJH-20	Bhai chara Agro PCL	SP	18.07.2018	100			Horticulture		
341	Jhajjar	Patasani	CJH-21	Dadanpur Farmer PCL	SP	03.08.2018	72			Horticulture		
325	Jhajjar	Tumbaheri	CJH-22	Girdharpur Farmers PCL	SFACH	08.05.2019	10			Horticulture		
	Jhajjar	Dubaldhan	CJH-23									
355	Jhajjar	Malikpur	CJH-24	Pahadipur Farmer PCL	SFACH	29.03.2019	11			Horticulture		
353	Jhajjar	Palda	CJH-25	Jahazgarh Farmer PCL	SFACH	04.04.2019	10			Horticulture		
337	Jhajjar		CJH-25	New Beri Fisheries Farmer PCL	NA	28.10.2020	160			Fisheries	R&G	
338	Jhajjar	Bhambhewa	CJH-26	Near 2 Nature Farmer Producer Company Limited	NABARD	09.09.2020	10			Horticulture		
357	Jhajjar		CJH-27	Tatamberi Farmers PCL	SFACH	01.04.2019	10		R&G	Horticulture		
331	Jhajjar		CJH-28	Patauda Organic Grover PCL	SFACH	11.11.2019	65		R&G	Horticulture		
345	Jhajjar		CJH-29	Kheri Hosadarpur FPC Ltd.	SP	01.08.2019	190		R&G	Horticulture		
347	Jhajjar		CJH-30	Dhanirwas Farmer PCL	SP					Horticulture		
567	Jind	Narwana	CJ-01	Tej Agrocare FPCL	SP	04.09.2020	10			Horticulture		
569	Jind	Narwana	CJ-01	Narwana Baagwani PCL	SFACH	07.12.2018	10			Horticulture		
571	Jind		CJ-01	Sulhera Baagwani PCL	SFACH	08.02.2019	10			Horticulture		
554	Jind	Dhabi Tek Singh	CJ-02	Ujhana FPCL	SFACH	25.08.2020	10			Horticulture		
565	Jind	Dhabi Tek Singh	CJ-02	Datasinghwal FPCL	SP	07.09.2020	10	CCDP	R&G	Horticulture		
566	Jind	Dhabi Tek Singh	CJ-02	Udaan FPCL	SP	03.10.2018	10			Horticulture		

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	Jind	Kamach Khera	CJ-03									
558	Jind	Pillukhera	CJ-04	Jamni Baghwani PCL	SFACH	01.03.2019	10		R&G	Horticulture		
559	Jind	Pillukhera	CJ-04	Pillukhera Farmer Producer Company Ltd.	SFACH	23.07.2019	10			Horticulture		
	Jind	Khera Khemawati	CJ-05									
	Jind	Safidon	CJ-06									
570	Jind	Rattakher	CJ-07	Rattakhera Food Farmer Producer Company Ltd.	SFACH	30.03.2019	10		R&G	Horticulture		
557	Jind	Ikkas	CJ-08	Jind Farm Divine FPCL	SFACH	12.03.2018	10		R&G	Horticulture		
560	Jind	Amarheri	CJ-09	Vedicaahar Farmer Producer Co. Ltd.	NABARD	03.10.2020	10		R&G	Horticulture		
562	Jind		CJ-09	Pure Roots Farmer Producer Company	NABARD	03.10.2020	10		R&G	Horticulture		
555	Jind	Alewa	CJ-10	Badhana Cluster Farmer PCL	SFACH	19.06.2018	100		R&G	Horticulture		
549	Jind	Uchana Kalan	CJ-11	Budain Baghwani PCL	SFACH	13.07.2020	10		R&G	Horticulture		
550	Jind	Uchana Kalan	CJ-11	Safakheri Honey Farmers Producer Company Ltd.	SFACH	26.05.2020	10			Horticulture		
568	Jind	Uchana Kalan	CJ-11	Dumarkha Farmer Producer Company Ltd.	SFACH	17.06.2019	10			Horticulture		
553	Jind	Kabarchha	CJ-12	Kabarchha Farmer Producer Company Ltd.	SFACH	11.07.2019	10		R&G	Horticulture		
548	Jind	Jajanwala	CJ-13	Jajanwala Farmer Producer Company Ltd.	SFACH	20.03.2019	100		R&G	Horticulture		
552	Jind	Tarkha	CJ-14	Tarkha Farmers PCL	SFACH	18.09.2018	10	CCDP	R&G	Horticulture		
556	Jind		CJ-14	Digital Kissan Farming And Organic Producer Company Limited	NA						R&G	
551	Jind	Mohangarg Chabra	CJ-15	Mohangarg FPC Ltd.	SFACH	27.05.2020	10			Horticulture		
563	Jind		CJ-15	Hatkeshwar Vegetable producer Company Limited	NABARD	30.06.2021	320			Horticulture		1
572	Jind	Muaana	CJ-16	Jind Vegetable FPCL	ISAP/SFAC	15.06.2016	100	CCDP	R&G	Horticulture		
561	Jind	Bhana Brahmana	CJ-17	Humkisan Producer Co. Ltd.	SFACH	03.12.2020	10			Horticulture		
564	Jind			Babaphoolsaad Farmer Producer Company Limited	NABARD	01.07.2021	304			Horticulture		1
519	Kaithal	Kharkara	CK-01	Josan Healthy Veggies Farmers PCL	SFACH	07.11.2019	38		R&G	Horticulture		
516	Kaithal	Cheeka	CK-02	Kharaudi Bagwani PCL	SFACH	25.02.2019	81	CCDP	R&G	Horticulture		
518	Kaithal	Cheeka	CK-02	Udyami Kissan PCL	SFACH	31.01.2019	110		R&G	Horticulture		
537	Kaithal	Cheeka	CK-02	CHEEKA AGROTECH PCL	SFACH	14.05.2019	52	CCDP	R&G	Horticulture		
536	Kaithal	Harigarh kingon	CK-03	HEALTHY HARVESTER PCL	SFACH	26.08.2020	10		R&G	Horticulture		
538	Kaithal	Harigarh kingon	CK-03	CHEEKA VEGETABLE FARMER PCL	SFACH	18.12.2018	10			Horticulture		
517	Kaithal	Ratta Khera	CK-04	PAPRALA BAGHWANI PCL	SFACH	14.03.2019	82	CCDP	R&G	Horticulture		
531	Kaithal	Kalayath	CK-05	Kawartan Farmers Producer Company Ltd.	SFACH	14.02.2020	42	CCDP	R&G	Horticulture		
529	Kaithal		CK-05	Phool Singh Producer Company Limited	NA						R&G	
520	Kaithal		CK-06	KALAYAT BAGHWANI PCL	SFACH	19.02.2019	78	CCDP	R&G	Horticulture		
533	Kaithal	Kalayath	CK-06	JULANI KHERA JAIK Agriculture PCL	SFACH	28.09.2018	66		R&G	Horticulture		
534	Kaithal	Kalayath	CK-06	Dubbal Baghwani FPC Limited, Kaithal	SFACH	26.10.2020	10			Horticulture		
545	Kaithal	Kalayath	CK-06	KAITHAL MUSHROOM FARMERS PCL	SP	22.06.2020	80		R&G	Horticulture		
521	Kaithal	Narwal	CK-07	RAJAUND BAGHWANI PCL	SFACH				R&G	Horticulture		
522	Kaithal	Narwal	CK-07	Kithana Farmer Prodcer Company Ltd.	SFACH				R&G	Horticulture		
532	Kaithal	Kheri Sikender	CK-08	Kaithal Kisan Bharti Farmers Producer Company Ltd.	SFACH					Horticulture		
523	Kaithal	Dussain	CK-09	DEEG BAGHWANI PCL	SFACH	29.01.2019	18			Horticulture		
539	Kaithal	Malikpur	CK-10	Nauch Baghwani Farmers Producer Company Ltd.	SFACH	14.02.2020	10		R&G	Horticulture		
544	Kaithal	Malikpur	CK-10	KAITHAL VEGETABLE FARMERS PCL	ISAP/SFAC	10.11.2016	1016	CCDP	R&G	Horticulture		
525	Kaithal	Siwan	CK-11	Siwan Farmers PCL	SFACH	04.01.2019	52			Horticulture		
526	Kaithal	Siwan	CK-11	LDM Organic Vegetables Farmers PCL	SFACH	27.06.2019	10			Horticulture		
527	Kaithal	Siwan	CK-11	PARNEET FARMER PCL	SFACH	20.11.2020	10			Horticulture		
524	Kaithal	Pharal	CK-12	RAWAN HERA FARMER PCL	SFACH	29.05.2019	21			Horticulture		
535	Kaithal	Pharal	CK-12	KHERI RAIWALI PCL	SFACH	29.08.2020	10			Horticulture		
546	Kaithal	Kheri Matrawa	CK-13	Priyanshi Farmer Producer Co. Ltd.	SP	25.06.2021	10			Horticulture		
530	Kaithal		CK-14	Shiv Goraksh Farmer Producer Company Limited	NA						R&G	
540	Kaithal		CK-15	DHAND HORTICULTURE FARMER PRODUCER COMPANY (DHFPC)	SFAC-HR	20.09.2021	300			Horticulture		1
541	Kaithal		CK-16	GUHLA FARMERS PRODUCER COMPANY LIMITED	SFAC-HR	01.10.2021	262			Horticulture		1
542	Kaithal		CK-17	KAITHAL HORTICULTURE FARMER PRODUCER COMPANY (KHFPCL)	SFAC-HR	16.09.2021	300			Horticulture		1
543	Kaithal		CK-18	KALAYAT HORTICULTURE FARMER PRODUCER COMPANY LIMITED	SFAC-HR	17.10.2021	238			Horticulture		1
547	Kaithal		CK-19	SIWN HORTICULTURE FARMERS PRODUCER COMPANY LIMITED	SFAC-HR	20.10.2021	300			Horticulture		1
528	Kaithal			Kamla Devi Farmer Producer Company Limited	NA						R&G	
133	Karnal	Mohamad Nagar	CKNL-01	Nasirpur Farmers PCL	SFACH	14.02.2019	10			Horticulture		
	Karnal	Kachwa	CKNL-02									
110	Karnal	Kunjpur	CKNL-03	GODGIFT FARMERS PCL	SFACH	13.08.2019	28		R&G	Horticulture		
107	Karnal	Rasulpur	CKNL-04	GO AGRO PCL	SFACH	24.07.2019	59		R&G	Horticulture		
136	Karnal		CKNL-04	Karnal Bagwani Producer Company Limited	NABARD	05.08.2021	10			Horticulture		1
134	Karnal		CKNL-05	Dadar Farmers PCL	SP	27.02.2019	10			Horticulture		
102	Karnal	Mubarkabad	CKNL-06	Mubarkabad Farmers PCL	SFACH	12.03.2019	56		R&G	Horticulture		
99	Karnal	Rasin	CKNL-07	SHEKHPURA FARMERS PCL	SFACH	16.01.2019	15			Horticulture		
101	Karnal	MOHAMAD NAGAR	CKNL-07	RASIN FARMERS PCL	SFACH	22.02.2019	25		R&G	Horticulture		
120	Karnal		CKNL-07	Munak Farmers Producer Company Limited	SFAC					Horticulture		1
103	Karnal		CKNL-08	PECTRA FRUIT & VEGETABLES FARMERS PCL	SFACH	23.04.2019	75		R&G	Horticulture		
104	Karnal	Harsinghpura	CKNL-09	Guru jaivik FPCL	SFACH	01.08.2020	15			Horticulture		
122	Karnal		CKNL-09	BHALAL FARMERS PCL	SFACH	26.04.2019	10			Horticulture		
100	Karnal	Chora	CKNL-10	Arainpura Farmers Producer Co. Ltd.	SFACH	11.02.2020	82	CCDP	R&G	Horticulture		
123	Karnal	Chora	CKNL-10	GHARAUNDA FARMERS PCL	SFACH					Horticulture		

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116	Karnal		CKNL-10	Gyanpura Farmers Producer Company Limited	SFAC					Horticulture		1
	Karnal		CKNL-11									
	Karnal		CKNL-12									
118	Karnal		CKNL-13	Nissing Farmers Producer Company Limited	SFAC					Horticulture		1
125	Karnal	Padhana	CKNL-14	SANDHIR FARMERS PCL	SFACH	25.03.2019	44			Horticulture		
128	Karnal	Padhana	CKNL-14	KARNAL VEGETABLE PCL	SP	26.07.2013	1057	CCDP	R&G	Horticulture		
129	Karnal	Padhana	CKNL-14	PADHANA VEGETABLE FARMER PCL	SP					Horticulture		
113	Karnal	Takhana	CKNL-15	PROGROWERS PCL	NABARD	09.02.2017	255	CCDP	R&G	Horticulture		
	Karnal		CKNL-16									
112	Karnal	Kurlan	CKNL-17	BHAMBERHERI FARMERS PCL	SFACH	29.03.2019	20		R&G	Horticulture		
124	Karnal	Manpura	CKNL-18	SUKHAN FARMERS PCL	SFACH	10.01.2019	160			Horticulture		
131	Karnal	Salwan	CKNL-19	Salwai Vegetable Farmers PCL	SFACH	23.03.2019	10			Horticulture		
132	Karnal	Chochra	CKNL-20	Chochra Farmers PCL	SFACH	26.04.2019	10			Horticulture		
130	Karnal	Bahari	CKNL-21	Lahna Vegetable Farmers PCL	SFACH	07.03.2019	10			Horticulture		
105	Karnal	Dhanorajagir	CKNL-22	Dhanour Jagir Vegetable Farmers PCL	SFACH	12.03.2019	80			Horticulture		
127	Karnal	Dhanorajagir	CKNL-22	New Dharoura FPCL	SP					Horticulture		
	Karnal	Khukhani	CKNL-23									
111	Karnal	Jaipura	CKNL-24	Jaainpur Honey and Vegetable Farmers PCL	SFACH					HONEY	R&G	
	Karnal	Smora	CKNL-25									
106	Karnal	Indergarh	CKNL-26	NEW INDRI VEGETABLE FARMERS PCL	SFACH					Horticulture		
126	Karnal	Indergarh	CKNL-26	Karnal Khera Kisan FPC Ltd.	SP					Horticulture		
115	Karnal		CKNL-26	Indri Bagwani Producer Company Limited	NABARD	19.07.2021	10			Horticulture		
	Karnal	Raiyat Khana	CKNL-27									
	Karnal	Gheer	CKNL-28									
108	Karnal	Kachwa	CKNL-29	Harvestly FramersPCL	NABARD	07.11.2020	160		R&G	Horticulture		
109	Karnal	Kachwa	CKNL-29	Bir Naraina FPCL	SFACH	10.07.2020	160			Horticulture		
135	Karnal		CKNL-30	Farmaganic Agrotech Producer Company Limited	SP			CCDP	R&G	Horticulture		
119	Karnal		CKNL-31	Jmd Farmers Producer Company Limited	SFAC					Horticulture		1
121	Karnal		CKNL-32	Mishti Fruit & Vegetable Producer Company Limited	SFAC					Horticulture		1
114	Karnal			Horticulture FARMERS PCL	NABARD	25.02.2016	550			Horticulture		
117	Karnal			Assandh Farmers Producer Company Limited	SFAC					Horticulture		1
63	Kurukshetra	Umri	CKKR-01	Kurukshetra fpcl	SFACH	27.05.2020	180	CCDP	R&G	Horticulture		
84	Kurukshetra	Umri	CKKR-01	kurukshetra vegetables fpcl	SP			CCDP	R&G	Horticulture		
90	Kurukshetra	Umri	CKKR-01	Sodhi Bodhi Farmer Producer Co. Ltd	SP	30.01.2021	10	CCDP	R&G	Horticulture		
85	Kurukshetra	Kaulapur	CKKR-02	Farm friends agro food fpcl	SP	06.01.2020	160			Horticulture		
91	Kurukshetra	Amin	CKKR-03	S.S Chinda Farmer Producer Co. Ltd	SP	09.02.2021	10			Horticulture		
78	Kurukshetra		CKKR-03	Thaneshar Farmers PCL	NABARD	03.06.2016	10			Horticulture		
97	Kurukshetra		CKKR-03	Thanesar Farmers Producer Company Limited	SFAC-HR	03.06.2016	10			Horticulture		1
74	Kurukshetra	KinthlaKhurd	CKKR-04	Ananta Organic Farmer PCL	SFACH	02.08.2020	10	CCDP	R&G	Horticulture		
76	Kurukshetra	Niwarsi	CKKR-05	Growpro Farmer Producer Co. Ltd,	SFACH	28.02.2021	10	CCDP	R&G	Horticulture		
89	Kurukshetra	Niwarsi	CKKR-05	Saini Farmers PCL	SP	29.09.2020	10		R&G	Horticulture		
65	Kurukshetra	Kheri Dadlan	CKKR-06	subji utpadak fpcl	NABARD	03.03.2016	96	CCDP	R&G	Horticulture		
64	Kurukshetra	Dhanaura	CKKR-07	Grow smart fpcl	NABARD	03.01.2017	165	CCDP	R&G	Horticulture		
70	Kurukshetra	Rampura	CKKR-08	Markandeshwar Farmers PCL	SFACH	10.05.2018	169	CCDP	R&G	Horticulture		
86	Kurukshetra	Rampura	CKKR-08	Crown Fruits & Vegetables FPO	SP			CCDP	R&G	Horticulture		
77	Kurukshetra		CKKR-08	Babain Vegetable Farmers PCL	NABARD	21.11.2016	10			Horticulture		
79	Kurukshetra		CKKR-08	RIJUL FARMERS PRODUCER COMPANY LIMITED	SFAC-HR	12.10.2021	10			Horticulture		1
	Kurukshetra	Birsujra	CKKR-09									
66	Kurukshetra	Kishangarh	CKKR-10	Chhapra Farmers PCL	SFACH	21.06.2019	196		R&G	Horticulture		
	Kurukshetra		CKKR-11									
87	Kurukshetra	Ismailabad	CKKR-12	shadu Ram Dhani Ram	SP	17.06.2020	10			Horticulture		
71	Kurukshetra	Ismailabad	CKKR-12	Jimidara FPC Limited, Kurukshetra	SFACH	11.09.2020	160			Horticulture		
	Kurukshetra	Jainpur	CKKR-13									
67	Kurukshetra		CKKR-14	Khanpur Jattan Farmers PCL	SFACH	03.12.2019	70	CCDP	R&G	Horticulture		
68	Kurukshetra		CKKR-15	Pehowa Farmers Proucer Co. Ltd.	SFACH	29.05.2017	223	CCDP	R&G	Horticulture		
88	Kurukshetra		CKKR-15	C.S.agro fpcl	SP					Horticulture		
69	Kurukshetra	Thana	CKKR-16	PEHOKSHETRA Farmers PCL	SFACH	04.12.2019	189		R&G	Horticulture		
92	Kurukshetra	Haibatpur	CKKR-17	Kharindwa Producer Co. Ltd	SP	05.07.2021	10		R&G	Horticulture		
93	Kurukshetra	Haibatpur	CKKR-17	Haibatpur Farmers PCL	SFACH	03.11.2019	52			Horticulture		
94	Kurukshetra	Khrindwa	CKKR-18	Buhawa Farmers PCL	SFACH	20.03.2019	156			Horticulture		
75	Kurukshetra	Sura	CKKR-19	Garvik Farmers Producer Company Ltd.	SFACH	17.07.2020	10	CCDP	R&G	Horticulture		
72	Kurukshetra	Jalbhera	CKKR-20	Green safe FPCL	SFACH	25.08.2020	10	CCDP	R&G	Horticulture		
73	Kurukshetra	Shanti Nagar	CKKR-21	kanhiya fpcl	SFACH	09.12.2020	160			Horticulture		
95	Kurukshetra	Kaulapur	CKKR-22	Kaulapur Agro Producer Company Limited	SFACH	2.11.2020	10	CCDP	R&G	Horticulture		
80	Kurukshetra		CKKR-23	Ismailabad Farmer Producer Co. Ltd.	SFAC-HR	10.11.2021	165			Horticulture		1
81	Kurukshetra		CKKR-24	Parhladpur Farmer Producer Co. Ltd.	SFAC-HR	07.10.2021	260			Horticulture		1
82	Kurukshetra		CKKR-25	Surjankhera Farmer Producer Co. Ltd.	SFAC-HR	29.09.2021	10			Horticulture		1
83	Kurukshetra		CKKR-26	Bhu Nurture Farmer Producer Company Limited	SFAC-HR	01.04.2022	10			Horticulture		1
98	Kurukshetra		CKKR-27	Kalsana Farmer Producer Co. Ltd.	SFAC-HR	30.09.2021	300			Horticulture		1
96	Kurukshetra			Mirztra Farmers PCL	SFACH	NA	10			Horticulture		
	Narnaul	Dancholi	CNR-01									
318	Narnaul	Dhanota	CNR-02	Dhanota FPCL	SP	13.11.2019	25			Horticulture		
	Narnaul	Maroli	CNR-03									
299	Narnaul	Bigopur	CNR-04	Bigopur Farmers PCL	SFACH	31.01.2019	123			Horticulture		
313	Narnaul		CNR-04	Nizampur Agro Farmer Producer Company Limited	NABARD	14.10.2020	10			Horticulture		
300	Narnaul	Gothari	CNR-05	Rawatjaivik fpcl	SFACH	28.07.2020	145	CCDP	R&G	Horticulture		



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	Narnaul	Sobhapur	CNR-06									
297	Narnaul	Patikara	CNR-07	Nakai Seed PCL	SFACH	28.02.2019	202	CCDP	R&G	Horticulture		
312	Narnaul		CNR-07	Digital Agro Farmer Producer Company Limited	NABARD	31.08.2020	10			Horticulture		
320	Narnaul	Sihma	CNR-08	Guwani Farmer PCL	SFACH	29.01.2020	20			Horticulture		
314	Narnaul		CNR-08	Baba Rupa Dass Farmer Producer Company Limited	NABARD	12.08.2020	10			Horticulture		
309	Narnaul	Mandhiyali	CNR-09	Nanwan Farmer PCL	SFACH	21.02.2019	35			Horticulture		
306	Narnaul	Digrota	CNR-10	Digrota Farmer PCL	SFACH	12.02.2019	203			Horticulture		
319	Narnaul	Surehti	CNR-11	GUNGLA BABA FPCL	SP	13.10.2020	10			Horticulture		
311	Narnaul	Dalanwas	CNR-12	Dalanwas Farmer PCL	SFACH	17.12.2019	168	CCDP	R&G	Horticulture		
310	Narnaul	Nawan	CNR-13	Bhayo Natha Farmers PCL	SFACH	27.02.2019	151	CCDP	R&G	Horticulture		
316	Narnaul		CNR-13	Satnali Agro Farmer Producer Company Limited	NABARD	12.10.2020	10			Horticulture		
305	Narnaul	Lawan	CNR-14	J.B.R.D. Farmers PCL	SFACH	12.02.2019	190			Horticulture		
304	Narnaul	Bhandor Uchhi	CNR-15	BAWANIA PICKLE PCL	SFACH	31.05.2019	126		R&G	Horticulture		
	Narnaul	Dhana	CNR-16									
303	Narnaul	Karira	CNR-17	Karira Farmer PCL	SFACH	04.02.2018	187			Horticulture		
317	Narnaul		CNR-17	Agrihitkari Farmer Producer Company	NABARD	22.02.2021	10			Horticulture		
302	Narnaul	Gudha	CNR-18	AGRIINNOVATION FPCL	SFACH	21.08.2020	136	CCDP	R&G	Horticulture		
	Narnaul	Gomla	CNR-19									
321	Narnaul	Rajpura	CNR-20	Jathu Baba Farmer PCL	SFACH	21.02.2019	10			Horticulture		
	Narnaul	Sarai	CNR-21									
301	Narnaul	Ratta Kalan	CNR-22	Mundiakhera Farmer PCL	SFACH	31.01.2019	156			Horticulture		
298	Narnaul		CNR-23	Kutbapur Agro Smart FPCL	SFACH	03.04.2019	200		R&G	Horticulture		
307	Narnaul		CNR-24	SGL Agro India Producer Company Limited	NA						R&G	
322	Narnaul		CNR-25	Nangalchodhari Farmer Producer Company Ltd	SFAC-HR	23.11.2021	100			Horticulture		1
308	Narnaul		CNR-26	Khudana Farmer Producer Company Limited	NA						R&G	
323	Narnaul		CNR-26	Narnul Organic Farmer Producer Company Ltd	SFAC-HR					Horticulture		1
315	Narnaul			Haalli Aritech Farmer Producer Company Limited	NABARD	21.09.2020	10			Horticulture		
227	Nuh	Barka Alimudin	CNU-01	Jaikam Vegetable Farmer PCL	SFACH	24.05.2019	102			Horticulture		
251	Nuh	Barka Alimudin	CNU-01	Pargtsheel Unnat Veg Farmers Producer Co. Ltd.	SP	23.07.2017	100		R&G	Horticulture		
254	Nuh	Barka Alimudin	CNU-01	Karim Unnat Farmer PCL	SP	08.12.2018	553			Horticulture		
259	Nuh	Barka Alimudin	CNU-01	NUH BAGWANI PRODUCER COMPANY LTD	SFACH	08.02.2019	104			Horticulture		
258	Nuh	Ujina	CNU-02	RBM Kisaan Agro Producer Co. Ltd.,	SP	29.08.2021	763		R&G	Horticulture		
262	Nuh	Ujina	CNU-02	Ujina Bagwani Farmer PCL	SFACH	25.02.2019	10			Horticulture		
573	Nuh		CNU-02	New Mewat Fisheries	SP	23.08.2020	98			Fisheries	R&G	
249	Nuh	Meoli	CNU-03	Rao Mahlla Horticulture Farmers PCL	ITSL/SFAC	18.09.2014	1560	CCDP	R&G	Horticulture		
252	Nuh	Meoli	CNU-05	Mala and Mehrab Farmers PCL	SP	18.12.2013	470			Horticulture		
257	Nuh	Meoli	CNU-03	Nuh Farmer's Welfare PCL	SP	10.03.2020	10			Horticulture		
261	Nuh	Meoli	CNU-03	Tofik Agro Farmers PCL	SP	21.02.2019	175		R&G	Horticulture		
	Nuh	Ghagash	CNU-04									
250	Nuh	Satawari	CNU-05	Mewat vegetable farmer Producer Company Ltd	ITSL/SFAC	26.03.2014	1106		R&G	Horticulture		
255	Nuh		CNU-05	ZIH High Value Vegetables Farmers PCL	SP	01.10.2018	160	CCDP	R&G	Horticulture		
	Nuh	Basai	CNU-06									
239	Nuh	Bajidpur	CNU-07	Jhimrawat FPCL	SFACH	19.08.2020	10			Horticulture		
260	Nuh	Bawla	CNU-08	Dhengal Agriculture Tauru Producer Compnay Ltd.	SP	11.11.2014	1500		R&G	Horticulture		
231	Nuh	Khorikalan	CNU-09	Nuh Sabji PCL	SFACH	01.04.2019	97			Horticulture		
	Nuh	Mohdpur ahir	CNU-10									
	Nuh	Pachgaon	CNU-11									
225	Nuh	Puhana	CNU-12	Marayam Agro PCL	SFACH	22.02.2019	165		R&G	Horticulture		
238	Nuh	Godhola	CNU-13	Sahchokha FPCL	SFACH	11.05.2020	10			Horticulture		
233	Nuh	Nai	CNU-14	Bichore Baghwani PCL	SFACH	25.03.2019	100		R&G	Horticulture		
246	Nuh		CNU-14	Nogayya Farmers Producer Company Limited	SFAC	07.04.2022	10			Horticulture		1
	Nuh	Naheda	CNU-15									
	Nuh	Bisru	CNU-16									
256	Nuh	Satakपुरी	CNU-17	Punhana farmer PCL	SP	05.02.2019	101			Horticulture		
228	Nuh	Mamlika	CNU-18	Khan Farmers PCL	SFACH	09.05.2019	165		R&G	Horticulture		
	Nuh	Dhana	CNU-19									
264	Nuh		CNU-19	Gorwal Farmer Producer Company Limited	SFAC					Horticulture		1
230	Nuh	Mundheta	CNU-20	Chirkhlot Farmer Producer Company Limited	SFACH	28.06.2019	100		R&G	Horticulture		
234	Nuh	Mundheta	CNU-20	Mundheta Bagwani PCL	SFACH	05.03.2019	102		R&G	Horticulture		
229	Nuh	Naseer Bas	CNU-21	Baghdya Farmer PCL	SFACH	04.07.2019	101			Horticulture		
248	Nuh	Rasnavas	CNU-22	Rajjak Vegetable Farmers PCL	SFACH	06.06.2019	100			Horticulture		
226	Nuh	F.P. Jhirka	CNU-23	Jhirka Baghwani PCL	SFACH	29.05.2019	152			Horticulture		
247	Nuh	F.P. Jhirka	CNU-23	Mangriya Sabji PCL	SFACH	16.04.2019	100			Horticulture		
253	Nuh	Agon	CNU-24	Gumal Farmer PCL	SP	19.09.2019	100			Horticulture		
	Nuh	Reegarh	CNU-25									
232	Nuh	Mundaka	CNU-26	Malibass Bagwani PCL	SFACH	20.02.2019	100			Horticulture		
	Nuh	Reegarh	CNU-27									
241	Nuh		CNU-28	Nagina Farmer Producer Company Limited	NABARD	06.04.2020	10			Horticulture		
235	Nuh			Sahid Virpal Producer Company Limited	NA				R&G		R&G	
236	Nuh			Faijal Co. multipurpose Society	NA	25.02.2019	11				R&G	
237	Nuh			Faijan multipurpose Society	NA	25.02.2019	11				R&G	
240	Nuh			Gawadia Sabji Utpadak PCL	SP					Horticulture		
242	Nuh			Shesola Farmers Producer Company Limited	NABARD	02.09.2019	10			Horticulture		
243	Nuh			Alahhaaffia Farmers Producer Company Limited	NABARD	07.07.2020	10			Horticulture		

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244	Nuh			sohna Adarsh Farmers Producer Company Limited	NABARD	24.07.2020	10			Horticulture		
245	Nuh			jaiBaba Shamnath Farmers Producer Company Limited	NABARD	27.08.2020	10			Horticulture		
263	Nuh			Kolgoan Farmers Producer Company Limited	SFAC					Horticulture		1
209	Palwal	Ghudawali	CPL-01	Ghudawali Farmer PCL	SFACH	12.03.2019	50		R&G	Horticulture		
221	Palwal	Malai	CPL-02	Gulesra Farmer PCL	SFACH	08.03.2019	160			Horticulture		
210	Palwal	Gehlab	CPL-03	Sehrawat Baghwani PCL	SFACH	05.03.2019	100		R&G	Horticulture		
	Palwal	Alimeo	CPL-04									
211	Palwal	Madnaka	CPL-05	Madnaka Baghwani PCL	SFACH	08.03.2019	30			Horticulture		
224	Palwal		CPL-05	Unnatshil Agro Farmer Producer Company Limited	SFAC	10.12.2021	10			Horticulture		1
212	Palwal	Selvi	CPL-06	Vegstar Farmer PCL	SFACH	13.03.2019	160			Horticulture		
213	Palwal	Bedha Patt	CPL-07	Faridabad Agro producer Company Ltd	SFACH	20.08.2020	25		R&G	Horticulture		
	Palwal	Hodal	CPL-08									
214	Palwal		CPL-09	Fhatnagar Vegetables Farmers PCL	SFACH	01.04.2019	160			Horticulture		
	Palwal	Kashipur	CPL-10									
220	Palwal		CPL-11	Palwal Farmer PCL	SFACH	29.03.2019	100		R&G	Horticulture		
219	Palwal		CPL-12	Jugore Farmer PCL	SFACH	28.03.2019	50		R&G	Horticulture		
215	Palwal	Ghori	CPL-13	Maldey Farmer PCL	SFACH	01.11.2018	25			Horticulture		
	Palwal	Thanthri	CPL-14									
	Palwal		CPL-15									
218	Palwal		CPL-16	Prithla Farmer PCL	NA	10.09.2020	10		NA	Animal Husbandary	R&G	
223	Palwal		CPL-17	Harhit Farmer Producer Company Limited	SFAC	18.10.2021	195			Horticulture		1
216	Palwal			Annamrit Farmers Producer Company Limited	NA	18.04.2019	50		NA	Agriculture	R&G	
217	Palwal			Hathin Farmers PCL	NA	03.02.2020	30		NA	Animal Husbandary	R&G	
222	Palwal			The Hassanpur Cooprative Vegetable and fruit Growers Marketing Society Ltd,	ITSL/SFAC	31.12.2014	10			Horticulture		
8	Panchkula	Uttaro	CP-01	Uddhav Agro FPCL	SFACH					Horticulture		
2	Panchkula	Dahara	CP-02	Morni Hills Sabji Utpadak Sangthan	NABARD	28.1.2016	409			Horticulture		
3	Panchkula	Dahara	CP-02	Tangri FPCL	NABARD	07.9.2016	210			Horticulture		
4	Panchkula	Dharla Dabush	CP-03	Bhoj Naggal FPCL	SFACH	13.6.2020	76			Horticulture		
14	Panchkula	Raji Tikri	CP-04	Morni hills Farmers PCL	SFACH	4.03.2018	230		R&G	Horticulture		
	Panchkula	Raji Tikri	CP-05									
11	Panchkula	Garhi Kotaha	CP-06	Panchkula FPC	VGAI/SFAC	03.11.2016	250			Horticulture		
21	Panchkula	Garhi Kotaha	CP-06	Samlasan Baghwani PCL	SFACH	05.09.2019	10			Horticulture		
	Panchkula	Tabar	CP-07									
	Panchkula	Jabyal	CP-08									
1	Panchkula	Dakrog	CP-09	Kalka FPCL	NABARD	25.08.2015	510			Horticulture		
13	Panchkula	Dakrog	CP-09	Nadawala Fruits & Vegetables PCL	SFACH	09.01.2018	10		R&G	Horticulture		
12	Panchkula	Kothi	CP-10	Devvari Farmers Producer Compnay Ltd.	SFACH	17.11.2017	166		R&G	Horticulture		
6	Panchkula	Tipra	CP-11	Bhoj Tipra FPCL	SFACH	08.09.2020	32			Horticulture		
15	Panchkula	Tipra	CP-11	Gigraj Agro Farmers PCL	SFACH	13.04.2018	180		R&G	Horticulture		
5	Panchkula	Barwala	CP-12	Bataur Horticulture Farmers PCL	SFACH	23.04.2019	158		R&G	Horticulture		
16	Panchkula	Barwala	CP-12	Barwala Horticulture FPCL	SP	08.02.2019	10			Horticulture		
17	Panchkula	Barwala	CP-12	Lord Shiva Agrotech PCL	SP	30.05.2019	10		R&G	Horticulture		
18	Panchkula	Barwala	CP-12	Shivjot Agrotech Producer Co. ltd,	SP	11.02.2021	120			Horticulture		
19	Panchkula	Barwala	CP-12	Morningside Agrotech Producer Co. ltd	SP	28.01.2021	114		R&G	Horticulture		
20	Panchkula	Kazampur	CP-13	Agroserve Farmer Producer Co. Ltd,	SP	15.01.2021	155	CCDP	R&G	Horticulture		
10	Panchkula		CP-14	Mandhna FPCL	SFACH	20.11.2020	28			Horticulture		
9	Panchkula		CP-15	Bhogpur Progressive Farmer Producer Co. Ltd,	SFACH	21.01.2021	61			Horticulture		
7	Panchkula		CP-16	Bhoj Koti FPCL. Panchkula	SFACH	24.08.2020	102			Horticulture		
159	Panipat	Jorashi Khas	CPN-01	SWERA FRUITS AND VEGETABLES PCL	SP					Horticulture		
164	Panipat	Garhi Chajju	CPN-02	Ruhal Fruits and veg FPCL	SP					Horticulture		
165	Panipat	Garhi Chajju	CPN-02	Shahur Malpur Mushroom FPCL	SP					Horticulture		
145	Panipat	Karnsh	CPN-03	RUHAL VEGETABLES PCL	SFACH	08.09.2019	57			Horticulture		
161	Panipat	Karnsh	CPN-03	Jattipur Kissan Vegetables PCL	SP					Horticulture		
162	Panipat	Dehra	CPN-04	Karkoli Farmer PCL	SP				R&G	Horticulture		
160	Panipat	Near	CPN-05	GROWTH HARVEST FRUITS AND VEGETABLE PCL	SP					Horticulture		
143	Panipat	Nurpur	CPN-06	Noorpur Gjjran Vegetable Farmers PCL	SFACH	23.05.2019	60			Horticulture		
	Panipat	Ujha	CPN-07									
144	Panipat		CPN-08	Khadar Fruit & Vegetable Producer Company Ltd.	SFACH	05.07.2019	22			Horticulture		
148	Panipat		CPN-08	Bapoli Farmer Producer Company Limited	SFAC	23.11.2021	10			Horticulture		1
157	Panipat		CPN-09	SANOLIKALAN FPCL	SP					Horticulture		
167	Panipat		CPN-09	Sanoli Khurd Farmer Producer Company Limited	SFAC	01.12.2021	10			Horticulture		1
149	Panipat	Mahrana	CPN-10	Baba Samer Dass Farmer Producer Company Limited	SFAC	30.12.2021	10			Horticulture		1
158	Panipat	Israna	CPN-11	Nandal Kissan PCL	SP					Horticulture		
	Panipat		CPN-12									
163	Panipat	Buana Lakhu	CPN-13	Malik Farmer Producer Co. Ltd,	SP	29.06.2021	25			Horticulture		
139	Panipat	Ugrakheri	CPN-14	PRIYANK AND SAMARTH FRUITS & VEGETABLES PCL	SFACH	30.05.2019	52	CCDP	R&G	Horticulture		
155	Panipat	Ugrakheri	CPN-14	Surboday Farmers PCL	SP				R&G	Horticulture		
137	Panipat	Babarpur	CPN-15	Barouli Vegetable Farmers PCL	SFACH	03.06.2019	78		R&G	Horticulture		
147	Panipat	Babarpur	CPN-15	SHIV SHANKAR VEGETABLE PCL	NABARD	12.10.2016	76			Horticulture		
152	Panipat	Babarpur	CPN-15	JAGLAN FARMER PCL	SP	12.05.2018	10			Horticulture		
153	Panipat	Babarpur	CPN-15	MOLAR BADOLI FARMER PCL	SP					Horticulture		
138	Panipat	Jattal	CPN-16	Jagruk Farmer Vegetable PCL	SFACH	03.11.2019	15			Horticulture		
154	Panipat	Jattal	CPN-16	Sondhapur Farmer PCL	SP					Horticulture		

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140	Panipat	Siwah	CPN-17	UNNAT KISAN VEGETABLE FARMERS PCL	SFACH	28.05.2019	108			Horticulture		
150	Panipat	Mehmadpur	CPN-18	GREEN FIELD VEGETABLES AND FRUITS PCL	SFACH	25.04.2019	11			Horticulture		
156	Panipat		CPN-19	Jagratisheel Kisan Vegetable Farmers PCL	SP					Horticulture		
151	Panipat		CPN-20	MADLAUDA VEGETABLE FARMERS PCL	SFACH	03.11.2019	10			Horticulture		
141	Panipat		CPN-21	VANDANA PROCESSING FOODS PCL	SFACH	15.05.2019	82			Horticulture		
	Panipat		CPN-22									
166	Panipat		CPN-23	Mahawati Farmers Producer Company Limited	SFAC					Horticulture		1
142	Panipat			Pragatisheel Organic Producer Company Ltd.	NA	14.01.2019	185			Agriculture	R&G	
146	Panipat			THE NEW PANIPAT CO-OP VEGETABLE & FRUITS GROWERS MKT SOC.LTD	ITSL/SFAC	28.03.2013	752		R&G	Horticulture		
	Rewari	Bawal	CRW-01									
284	Rewari	Rampuri	CRW-02	Hariagri Jaivik PCL	SFACH	29.01.2020	160			Horticulture		
285	Rewari	Rampuri	CRW-02	Agrirocks Farmer PCL	SFACH	31.08.2020	190		R&G	Horticulture		
283	Rewari	Dhawana	CRW-03	Dhawana Herbs PCL	SFACH	05.02.2019	340	CCDP	R&G	Horticulture		
286	Rewari	Bassduda	CRW-04	Manethi Farmer PCL	SFACH	31.10.2019	210			Horticulture		
291	Rewari	Gudiani	CRW-05	Bhuriyawas Farmer PCL	SFACH	22.02.2019	180			Horticulture		
293	Rewari		CRW-05	Jatusana Fed Vegetable Producer Company Limited	NAFED	11.09.2016	500			Horticulture		1
288	Rewari	Kuhard	CRW-06	Saraswati Baghwani PCL	SFACH	28.11.2018	180		R&G	Horticulture		
287	Rewari	Bharangi	CRW-07	Dharam Baghwani PCL	SFACH	05.12.2018	202		R&G	Horticulture		
294	Rewari		CRW-07	Naharwadi Fed Farmer Producer Company Limited	NAFED					Horticulture		1
290	Rewari	Mumtajpur	CRW-08	Sudesh Bagavani PCL	SFACH	20.02.2019	10			Horticulture		
289	Rewari	Baboli	CRW-09	Digicross farmer producer company limited	NA	16.07.2020	210			Agriculture	R&G	
282	Rewari	Dahina	CRW-10	Dahina Vegetable PCL	SFACH	01.07.2019	170	CCDP	R&G	Horticulture		
	Rewari	Dahina	CRW-11									
	Rewari	Sundroj	CRW-12									
	Rewari	Dhakia	CRW-13									
292	Rewari	Piwara	CRW-14	Piwara Farmer PCL	SFACH	31.10.2019	10			Horticulture		
295	Rewari			Kishan Phal Avam Sabji Utpadak Society.	ITSL/SFAC	31.12.2014	10			Horticulture		
296	Rewari			Shri Ram Sabji Utpadak Samiti	ITSL/SFAC	NA	10			Horticulture		
393	Rohtak	Meham	CR-01	Sisarkhas Farmers Producer Company Ltd.	SFACH	12.02.2019	42			Horticulture		
398	Rohtak	Meham	CR-01	SRI MEHAMCHOBISI FARMER PRODUCER COMPANY LIMITED	SP					Horticulture		
454	Hisar	Meham	CR-01	Sri MehmaChobisi FPO	SP					Horticulture		
391	Rohtak	Madina	CR-02	Chaubisi Ayurvedic Farmer PCL	SFACH	15.02.2019	25		R&G	Horticulture		
400	Rohtak	Madina	CR-02	MEHAM Horticulture FARMERS PCL	SP	17.07.2018	50		R&G	Horticulture		
404	Rohtak	Mokhra	CR-03	Mokhra Mushroom Farmer PCL	SFACH	08.04.2019	10			Horticulture		
336	Jhajjar		CR-04	Dhaur Farmers Producer Company Limited	NA	30.03.2019	10			Agriculture	R&G	
	Rohtak	Kansala	CR-05									
394	Rohtak	Rohtak	CR-06	HEALTHY FIELDS PCL	SFACH	17.10.2020	25		R&G	Horticulture		
401	Rohtak		CR-06	ROHTAK VEGETABLE PCL	SP					Horticulture		
392	Rohtak	Kalanaur	CR-07	JINDRAN KALAN FARMER PCL	SFACH	13.02.2019	10			Horticulture		
399	Rohtak		CR-08	Bahuakbarpur Farmer PCL	SP	01.04.2019	10			Horticulture		
395	Rohtak		CR-08	ROHTAK REAL HORTICULTURE FED PRODUCER COMPANY LIMITED	NAFED	27.01.2022	10			Horticulture		1
405	Rohtak	Marodhi	CR-08	Green Kisan Producer Compnay Limited	SP	18.05.2021	25		R&G	Horticulture		
397	Rohtak		CR-09	HASSANGARH FARMERS PCL	SFACH	29.04.2019	10			Horticulture		
	Rohtak		CR-10									
	Rohtak		CR-11									
	Rohtak	Samchana	CR-12									
403	Rohtak		CR-13	Sarvochh Unnat Farmers Producer Co. Ltd.	SP	10.09.2020	10		R&G	Horticulture		
396	Rohtak			Sampla Farmer Producer Company Limited	SFAC	22.10.2021	175			Horticulture		1
402	Rohtak			ATAIL FARMER PCL	SP				R&G	Horticulture		
	Sirsa	Santnagar	CS-01									
	Sirsa	Damdama	CS-02									
	Sirsa	Amaritsar Kalan	CS-03									
485	Sirsa	Meleka	CS-04	M/s Agrimint farmer producer Company Ltd	SFACH			CCDP	R&G	Horticulture		
	Sirsa	Khari Sureeran	CS-05									
514	Sirsa	Ellenabad	CS-06	Ellenabad Agro Farmer Producer Company Ltd.	SFACH	17.06.2020	10			Horticulture		
498	Sirsa		CS-06	Ellenabad Bagwani Producer Company Limited	NABARD	07.06.2021	10			Horticulture		1
491	Sirsa	Bani	CS-07	SIRSA UNIQUE FPCL	NABARD	04.11.2017	150	CCDP	R&G	Horticulture		
499	Sirsa		CS-07	Rania Vishnu Shakti Vegetable Producer Company Limited	NABARD	26.07.2021	304			Horticulture		1
493	Sirsa	Bacher	CS-08	Baba Khaterpal Fruit FPCL	SFACH	30.07.2020	40	CCDP	R&G	Horticulture		
506	Sirsa	Bacher	CS-08	JHORAR FPCL	SP					Horticulture		
512	Sirsa	Bacher	CS-08	Jhorar Farmer Producer Co. Ltd	SP	10.19.2020	50			Horticulture		
490	Sirsa	Rania	CS-09	SIVRAJ FPCL.	SFACH	04.03.2019	90	CCDP	R&G	Horticulture		
	Sirsa		CS-10									
	Sirsa		CS-11									
	Sirsa		CS-12									
492	Sirsa	Kharia	CS-13	ATALVEER FPCL.	SFACH	02.11.2020	80		R&G	Horticulture		
505	Sirsa	Kharia	CS-13	SIRSA FARMMES PCL.	ISAP/SFAC	18.02.2016	744	CCDP	R&G	Horticulture		
	Sirsa	Kalanwali	CS-14									
489	Sirsa	Ghukanwali	CS-15	LAXITA FPCL	SFACH	01.08.2020	75		R&G	Horticulture		
	Sirsa	Mithri	CS-16									
483	Sirsa	Tajakhera	CS-17	Tejakhera Fruit Farmer Producer Company Ltd.	SFACH	15.06.2020	10			Horticulture		
509	Sirsa	Chautala	CS-18	Tau Kamera Farmer Producer Co. Ltd.	SP	08.02.2021	30			Horticulture		
502	Sirsa	Ashakahera	CS-19	MOUJAGARH FPCL	SP					Horticulture		
503	Sirsa	Laluana	CS-20	JUNGLE JUICE FPCL	SP	28.10.2020	100	CCDP		Horticulture		
481	Sirsa	Godikan	CS-21	Sadbawan Organic Farmer Producer Company	SFACH	03.06.2019	80		R&G	Horticulture		
510	Sirsa	Mangiana	CS-22	Nuti-G Agro Food Producer Co. Ltd	SP	13.04.2021	110			Horticulture		
497	Sirsa		CC-22	Mandi Dabwali Kinnu Seva Kendra Producer Company Limited	NABARD	30.07.2021	238			Horticulture		1
	Sirsa	Goriwala	CS-23									

Sr.	District	Cluster Name	Cluster Code	FPO Name	Supported by Govt. for handholding and Management	Date of Registration	Number of Shareholders	Sacntioned under CCDP including completed projects	Under R&G	Category	Additional R&G	10,000 FPO Scheme
	Sirsa	Mathdadu	CS-24									
	Sirsa	Jandwala Bishanoian	CS-25									
496	Sirsa	Shergarh	CS-26	DABAWALI FARMERS PCL.	NABARD	22.12.2016	160			Horticulture		
	Sirsa	Desujodha	CS-27									
482	Sirsa	BIJUWALI	CS-28	Risalia Farmer Producer Company Ltd.	SFACH	05.06.2020	55	CCDP	R&G	Horticulture		
487	Sirsa	RAMPURA DHILLON	CS-29	Sureran Kissan Farmers PCL	SFACH	13.02.2019	80	CCDP	R&G	Horticulture		
504	Sirsa	DARBA KALAN	CS-30	SHREE KARNI KIRPA FPCL	SP				R&G	Horticulture		
511	Sirsa	DARBA KALAN	CS-30	Shree Karni Kirpa Farmer Producer Compnay Limited	SP	18.09.2020	75			Horticulture		
513	Sirsa	JODHAKAN	CS-31	Sirsa Kalpna Farmer Producer Company Ltd.	SFACH	29.06.2020	10			Horticulture		
508	Sirsa	Nathusari Kalan	CS-32	Yajnarup Farmer Producer Co Ltd,	SP	18.02.2021	125		R&G	Horticulture		
486	Sirsa	CHOUBURJA	CS-33	JAI GANESHA FPCL	SFACH	22.04.2019	10		R&G	Horticulture		
488	Sirsa	DHUKRA	CS-34	SIRSA JAMIDARA FPCL	SFACH	03.09.2020	160	CCDP	R&G	Horticulture		
	Sirsa	NEZIA KHERA	CS-35									
480	Sirsa	Kalanwali	CS-36	HAZUR SAHIB FPCL	SFACH	08.05.2019	160			Horticulture		
501	Sirsa	Bhagsar	CS-37	BATISH AGRO PCL	SP	24.04.2019	170	CCDP	R&G	Horticulture		
479	Sirsa	Badaguda	CS-38	Acrefarm Farmer Producer Company	SFACH	05.10.2019	80	CCDP	R&G	Horticulture		
494	Sirsa	Sikanderpur	CS-39	Darbi Farmer PCL	SFACH	27.03.2019	10			Horticulture		
507	Sirsa	Sikanderpur	CS-39	Faithfull FPO	SP	12.06.2018	170		R&G	Horticulture		
515	Sirsa	Baruwall	CS-40	THINK EARTH FPCL	SP	21.10.2020	50			Horticulture		
500	Sirsa		CS-40	Apna Sirsa GK Fruit Farmer Producer Company Limited	NABARD	26.07.2021	161			Horticulture		1
	Sirsa	Shamshabad Patti	CS-41									
484	Sirsa			Kharisureran Farmer PCL	SFACH	22.02.2019	160	CCDP	R&G	Horticulture		
495	Sirsa			SIRSA MAHILA Diary PCL	NA	13.10.2020	10			Dairy	R&G	
195	Sonipat		CSN-01	BSC AGRO PCL	SP	22.07.2019	164	CCDP	R&G	Horticulture		
	Sonipat		CSN-02									
194	Sonipat		CSN-03	Bega Farmers Producer Company Limited	SFAC					Horticulture		1
184	Sonipat		CSN-04	FERMIER AGREE CRAFT PCL	SFACH	25.09.2020	50			Horticulture		
196	Sonipat	Murthal	CSN-05	M/s Munnisthal Agro Producer Co, Ltd,	SP	09.02.2021	128		R&G	Horticulture		
190	Sonipat		CSN-05	Murthal Farmers Vegetable Producer Company	NABARD	17.07.2021	240			Horticulture		1
	Sonipat		CSN-06									
182	Sonipat		CSN-07	HARSANA KALAN FARMERS PCL	SFACH	30.05.2019	50			Horticulture		
183	Sonipat	Khewra	CSN-08	Khewra Farmers Producer Company Ltd.	SFACH	24.01.2020	10		R&G	Horticulture		
177	Sonipat	Palra	CSN-09	PALRA BAGHWANI PCL	SFACH	22.03.2019	50		R&G	Horticulture		
168	Sonipat	MANOLI	CSN-10	MANAULI GRAM SAMPDA FARMERS PCL	NABARD	10.08.2016	180	CCDP	R&G	Horticulture		
169	Sonipat	MANOLI	CSN-10	SONIPAT MUSHROOM FARMERS PCL	NABARD	11.02.2016	181	CCDP	R&G	Horticulture		
170	Sonipat	MANOLI	CSN-10	ATERNA ORGANIC FARMERS PCL	NABARD	12.02.2016	509	CCDP	R&G	Horticulture		
189	Sonipat		CSN-10	SONIPAT VEGETABLE FARMERS PCL	ITSL/SFAC	06.01.2014	921		R&G	Horticulture		
192	Sonipat		CSN-10	Sonipat Bagwani Producer Company Limited	NABARD	26.08.2021	10			Horticulture		1
193	Sonipat		CSN-10	SONIPAT HORTICULTURE FED KRISHI KENDRA PRODUCER COMPANY LIMITED	NAFED	27.01.2022	10			Horticulture		1
172	Sonipat	JANTI KALAN	CSN-11	JANTI KALAN BAGHWANI PCL	SFACH	08.02.2019	50		R&G	Horticulture		
	Sonipat	AKBARPUR BAROTA	CSN-12									
174	Sonipat	Rohat	CSN-13	HARYANA GAURAV FARMERS PCL	NABARD	21.12.2016	200			Horticulture		
181	Sonipat	Pipli	CSN-14	Pipli Kisan PCL	SFACH	07.06.2019	25		R&G	Horticulture		
176	Sonipat	Pipli	CSN-14	Kharkhoda Baghwani PCL	SFACH	29.01.2019	25		R&G	Horticulture		
188	Sonipat	NASIRPUR CHOLKA	CSN-15	Barona Kharkhoda Vegetables Farmers PCL	SFACH	15.06.2020	42		R&G	Horticulture		
	Sonipat	SISANA-I	CSN-16									
	Sonipat	FARMANA	CSN-17									
175	Sonipat	Puthi	CSN-18	PUTHI BAGHWANI PCL	SFACH	18.02.2019	25		R&G	Horticulture		
186	Sonipat	Puthi	CSN-18	Sarva Vikas Krishak Samooh PCL	NABARD	03.08.2020	235		R&G	Horticulture		
	Sonipat	BAROTA	CSN-19									
173	Sonipat	Lath	CSN-20	JAULI BAGHWANI PCL	SFACH	29.01.2019	25		R&G (Repeat)	Horticulture		
171	Sonipat	WAZIRPURA	CSN-21	GOHANA BAGHWANI PCL	SFACH	13.02.2019	25			Horticulture		
187	Sonipat	Khanpur	CSN-22	BABA SARBANGI AGRO PCL	SFACH	24.11.2020	160	CCDP	R&G	Horticulture		
	Sonipat	CHATEHARA	CSN-23									
	Sonipat	Bichpuri	CSN-24									
185	Sonipat	Banwasa	CSN-25	Dishant FPC Limited, Sonapat	SFACH	21.10.2020	25		R&G	Horticulture		
	Sonipat	Bhawar	CSN-26									
178	Sonipat			THE RUKHI KISAN COOPERATIVE MULTIPURPOSE SOCIETY LIMITED	SFACH	29.05.2019	11			Animal Husbandary	R&G	
179	Sonipat			THE SISANA KISAN COOPERATIVE MULTIPURPOSE SOCIETY LIMITED	SFACH	18.08.2019	11			Animal Husbandary	R&G	
180	Sonipat			THE MUNDLANA KISAN COOPERATIVE MULTIPURPOSE SOCIETY	SFACH	06.09.2019	11			Animal Husbandary	R&G	
191	Sonipat			Tamater Rai Vegetable Farmer Producer Company	NABARD	19.07.2021	300			Horticulture		1
197	Sonipat			The Dada Sai Kisan CoOp Multipurpose Society Ltd	SFACH					Horticulture		
574	Sonipat			CHHIRSAGAR Diary PCL	NABARD					Dairy	R&G	
43	Yamuna Nagar	Sadhaura	CY-01	SADHAURA FPC LTD.	NABARD	16.06.2017	280		R&G	Horticulture		
62	Yamuna Nagar		CY-01	Sadhaura Dairy Farmer Producer Company Ltd	NABARD	06.09.2020	10			Horticulture		
52	Yamuna Nagar	Salempur	CY-02	Salempur Farmers PCL	SFACH	13.03.2019	20			Horticulture		



Sr.	District	Cluster Name	Cluster Code	FPO Name	Supported by Govt. for handholding and Management	Date of Registration	Number of Shareholders	Sacntioned under CCDP inculding completed projects	Under R&G	Category	Additional R&G	10,000 FPO Scheme
49	Yamuna Nagar	Rajpura	CY-03	Sarawan Farmers Producer Company Ltd.	SFACH	16.06.2020	195	CCDP	R&G	Horticulture		
	Yamuna Nagar	Rampurraiya	CY-04									
	Yamuna Nagar	Nagal Khalsa	CY-05									
	Yamuna Nagar	Talakaur	CY-06									
46	Yamuna Nagar	Mustafabad	CY-07	Mustafabad Farmer PCL	SFACH	27.03.2019	18	CCDP	R&G	Horticulture		
50	Yamuna Nagar	Jamalpur	CY-08	Jamalpur Farmer Producer Company Ltd.	SFACH	18.07.2020	151	CCDP	R&G	Horticulture		
	Yamuna Nagar	Kalesar	CY-09									
	Yamuna Nagar	Chahcuralli	CY-10									
45	Yamuna Nagar	Safilpur	CY-11	Safilpur Farmers PCL	SFACH	28.03.2019	42			Horticulture		
	Yamuna Nagar	Mussimble	CY-12									
51	Yamuna Nagar	Buria	CY-13	Bhoomitattva FPCL	SFACH	13.09.2020	50		R&G	Horticulture		
	Yamuna Nagar	Damala	CY-14									
42	Yamuna Nagar	Fatehgarh	CY-15	Gumthala Farmer PCL	SFACH	19.03.2019	65	CCDP	R&G	Horticulture		
59	Yamuna Nagar	Fatehgarh	CY-15	Pureagro Farmer Producer Co. Ltd	SP	12.05.2020	25			Horticulture		
41	Yamuna Nagar	Radaur	CY-16	Sili Kalan Farmer PCL	SFACH	27.03.2019	110	CCDP	R&G	Horticulture		
60	Yamuna Nagar	Potli	CY-17	Radour Farmers PCL	SFACH	13.05.2017	570	CCDP	R&G	Horticulture		
44	Yamuna Nagar	Nagal	CY-18	Viom Farmers PCL	SFACH	26.04.2019	58	CCDP	R&G	Horticulture		
47	Yamuna Nagar	Alahar	CY-19	Alahar Farmers PCL	SFACH	25.04.2019	30			Horticulture		
58	Yamuna Nagar	Nagal	CY-20	PARYAS AGRO FPC LTD.	SP	13.09.2019	160		R&G	Horticulture		
48	Yamuna Nagar	Lakarmai	CY-21	Lakarmai Farmers Producer Company Ltd.	SFACH	23.03.2020	15			Horticulture		
	Yamuna Nagar	Leda	CY-22									
55	Yamuna Nagar		CY-23	Partap Nagar FPC Ltd.	SFAC-HR	11.10.2021	270			Horticulture		1
56	Yamuna Nagar		CY-24	Shakumbhari FPC Ltd.	SFAC-HR	17.10.2021	233			Horticulture		1
54	Yamuna Nagar		CY-25	Damla Annapurana FPC Ltd.	SFAC-HR	11.01.2022	10			Horticulture		1
61	Yamuna Nagar		CY-25	Rattangarh Vegetable Farmer Producer Company Limited	NABARD	07.09.2020	10			Horticulture		
53	Yamuna Nagar		CY-26	Kapal Mochan FPC Ltd.	SFAC-HR	03.1.2022	26			Horticulture		1
57	Yamuna Nagar		CY-27	Thaska FPC Ltd.	SFAC-HR	23.10.2021	10			Horticulture		1

Source: DOH

### Attachment 7.5.1 Procurement Plan for Each Activity

Work Item		Procurement Method	Activity Executed by	Supported by
<b>1. Support for crop diversification into horticultural crops and Reinforcement of production support</b>				
<b>1.1 Formation and strengthening of PGs</b>				
(1)	Procurement of Technical Support Group	Local Competitive Building (LCB)	DOH	
	1) PG identification	-	TSG	PMU/PMC
	2) Sensitization and Mobilization of farmers and registration of PGs/ Sensitization the potential PGs and individual farmers	-	TSG	PMU/PMC
	3) Orientation for TSGs engaged at the DPMU level	-	DPMU	PMC/PMU
	4) Organisational capacity building for PGs	-	TSG	PMC/PMU/Support Institution
	5) Market survey (with SHEP)	-	PG	TSG
	6) Business planning	-	PG	TSG
	7) Training needs analysis and provision of technical training	-	TSG	PMC/PMU/Support Institution
	8) Implementation of business plan, eligible PGs	-	PGs	TSG/PMC/PMU/Support Institution
<b>1.2 Water-harvesting and Micro irrigation system</b>				
(1)	Ponds and Solar Pumps	-		
	Detailed planning	-	DPMU	PMU/PMC
	Pre-construction activities (Cost estimate, tender)	LCB	DPMU	PMU/PMC
	Construction	-	Contractor	PMU/PMC
(2)	Micro Irrigation Systems	-		
	Detailed planning	-	DPMU	PMU/PMC
	Pre-construction activities (Cost estimate, tender)	LCB	DPMU	PMU/PMC
	Construction	-	Supplier	PMU/PMC
	4) Others	-		
<b>1.3 Horticulture guidance</b>				
(1)	Visual aid training material preparation collaboration with training institutes	-	PMU/TSG	PMC
(2)	Climate-smart horticulture on vegetables (general)	-	PMU/TSG	PMC
(3)	Climate-smart horticulture on fruits	-	PMU/TSG	PMC
(4)	Climate-smart horticulture on exotic vegetables	-	PMU/TSG	PMC
(5)	Climate-smart horticulture on fruits for focal areas (Sirsa, Hisar, Biwani)	-	PMU/TSG	PMC
(6)	Cultivation techniques on floriculture in focal areas (Gurugram, Faridabad)	-	PMU/TSG	PMC
(7)	Cultivation techniques on spices, medicinal and aromatic plants in focal areas (Ambala, Kaithal, Palwal, Bhiwani, Mahendragarh, Yamunanagar)	-	PMU/TSG	PMC
(8)	Cultivation techniques on mushrooms in focal areas (Sonipat, Panipat, Kurukshetra)	-	PMU/TSG	PMC
(9)	Beekeeping techniques in focal areas (Sonipat, Gurugram) at Center of Excellence	-	PMU/TSG	PMC
(10)	Nursery raising techniques@PG	-	PMU/TSG	PMC
(11)	Food processin	-	PMU/TSG	PMC
(12)	Training for efficient using of Farm Machinery	-	PMU/TSG	PMC
	Installation of Farm Machinery	Direct Undertaking (DU)	Supplier	PMU/PMC/TSG
(13)	Nutrition improvement	-	PMU/TSG	PMC
	1) Nutrition Improvement Program	-	PMU/TSG	PMC
	2) Sensitization of nutrition sensitive intervention	-	PMU/TSG	PMC
	3) Dissemination of kitchen garden for nutrition improvement	-	PMU/TSG	PMC
	4) Dissemination of recipes using nutritious ingredients	-	PMU/TSG	PMC

### Attachment 7.5.1 Procurement Plan for Each Activity

Work Item		Procurement Method	Activity Executed by	Supported by
<b>1.4 Pilotfarm Establishment and Public-private partnerships</b>				
(1)	Pilotfarm Establishment under Centre of Excellence	LCB		
	Detailed planning		PMU	KVK/University/COE/PMC
	Pre-construction activities (partner identification)		PMU	KVK/University/COE/PMC
	Construction (Facility and Equipment)		Supplier	PMU/PMC
(2)	Village of Excellence	LCB		
	Detailed planning		PMU	KVK/University/COE/PMC
	Pre-construction activities (partner identification)		PMU	KVK/University/COE/PMC
	Construction (Facility and Equipment)		Supplier	PMU/PMC
(3)	Industry-Government-Academia Collaboration	-		
	Detailed planning	-	PMU	KVK/University/PMC
	Preparation of pilot farm at Maharana Pratap Horticultural University, Karnal	-	Maharana Pratap Horticultural University	PMU/PMC
<b>2. Support for building value chains and Promotion of private sector partnerships</b>				
<b>2.1 Infrastructure development for building value chains</b>				
(1)	Integrated horticulture complex (Fullfillment Centres): 3 units	LCB	SPV	PMU/PMC
	Detailed planning		PGs	PMU/PMC
	Pre-construction activities (partner identification)		PMU	PMC
	Construction		Contractor	PMU/PMC
(2)	Lead Pack Houses (Integrated Logistic Hub): 4 units	-		
	Detailed planning	-	Federation of PGs	PMU/PMC
	Pre-construction activities (partner identification)	-	Federation of PGs	PMU/PMC
	Construction	DU	Contractor	PMC
(3)	Feeding Packhouse (500 units)	-		
	Detailed planning	-	PGs	PMU/PMC
	Pre-construction activities (partner identification)	-	PGs	PMU/PMC
	Construction	DU	Contractor	PMC
(4)	Retail Outlets	-		
	Detailed planning	-	PMU	PMU/PMC
	Pre-construction activities (partner identification)	-	PMU	PMC
	Construction	-	Contractor	PMC
<b>2.2 Building an E-market Place and a information sharing platform</b>				
(1)	e-Marketplace Build a platform to promote collaboration and information sharing among PGs	DU		
	Detailed planning		PMU	PMC
	Pre-construction activities (partner identification)		PMU	PMC
	Construction		Contractor	PMC
<b>2.3 Branding</b>				
(1)	Development of Branding Strategy	-	PMU	PMC
(2)	Development of Sales Strategy	-	PMU	PMC
(3)	Development of Promotion Strategy	-	PMU	PMC
(4)	Building Partnerships		PMU	PMC

### Attachment 7.5.1 Procurement Plan for Each Activity

Work Item		Procurement Method	Activity Executed by	Supported by
<b>3. Strengthening the functions of the State Horticulture Department</b>				
<b>3.1 Installation of PMU and DPMU</b>				
(1)	Recruitment of PMU Staff (Out-Source)	LCB	PMU	-
(2)	Recruitment of DPMU Staff (Out-Source)	LCB	PMU	-
(4)	Recruitment of PMC	ICB	PMU	
(5)	Recruiting Technical Support Group	LCB	PMU	PMU/PMC
<b>3.2 Strengthening the capacity of DOH</b>				
(1)	Strengthening the capacity of DOH	-	PMU	PMU/DOH/PMC
(2)	Review of overall project implementation plan and Completion Report	-	PMU	PMU/DOH
(1)	Procurement of Equipment and Tools to PMU			
	1) New building for State PMU in DOH	LCB	PMU	DOH
	2) New building for DPMUs in 22 Districts	LCB	PMU	DOH
	3) Furniture & office-equipment for State PMU 023	DU	PMU	DOH
	4) Furniture & office-equipment for 22 DPMUs 023	DU	PMU	DOH
	5) Procurement of new vehicles: New 6 vehicles (SPMU)	DU	PMU	DOH
	6) Hiring vehicles: 22 nos. (22 DPMUs)	DU	PMU	DOH
<b>3.3 Strengthening the capacity of horticulture extension services</b>				
(1)	State level Workshop of implementation schedule planning, monitoring of implementation schedule and SHEP approach for PMU, PMC,DPMU and Training Institutes from 22 districts	-	PMU	PMU/PMC
(2)	District-PMU level workshop for DPMU, HES (Horticulture Extension Services), MQC (Marketing&Quality Control), I&PGD (Institution and PG Development), IE (Infrastructure Engineer)	-	PMU	PMU/PMC
(3)	Vegetable cultivation techniques for DHO(District Horticulture Officer), HDO (Horticulture Development Officer) field level officers and PG motivators	-	PMU	PMU/PMC
(4)	Overseas Training , Exposure/Study visits of Porject staff and other stakeholders		PMU	PMU/PMC
<b>3.4 Baseline Studies and Impact Assessment</b>				
(1)	Conduct baseline survey	LCB	PMU	PMC
(2)	Conduct mid-line survey	LCB	PMU	PMC
(3)	Conduct endline survey	LCB	PMU	PMC

Source: JICA survey team

Attachment 7.6.1 Project Implementation Schedule

Work Item	Rainy Season												Rainy Season												Rainy Season												Rainy Season												Rainy Season												Rainy Season												Rainy Season												Rainy Season												Rainy Season											
	2023-24			2024-25 (1st)			2025-26 (2nd)			2026-27 (3rd)			2027-28 (4th)			2028-29 (5th)			2029-30 (6th)			2030-31 (7th)			2031-32 (8th)			2032-33 (9th)																																																																																
	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3						
1. Support for crop diversification into horticultural crops and Reinforcement of production support																																																																																																												
1.1 Formation and strengthening of PGs																																																																																																												
(1)	Cluster identification																																																																																																											
(1)	Procurement and activities of Technical Support Group																																																																																																											
(1)	Cluster identification and baseline survey (Conducted by DoH)																																																																																																											
(2)	Sensitization and Mobilization of farmers and registration of PGs/ Sensitization the potential PGs and individual farmers																																																																																																											
(3)	Training to CEOs/BoDs																																																																																																											
(4)	Market survey (with SHEP)																																																																																																											
(5)	Business planning																																																																																																											
(6)	Training needs analysis and provision of technical training																																																																																																											
(7)	Support for implementing business plan																																																																																																											
1.2 Water-harvesting and Micro irrigation system																																																																																																												
(1)	Ponds and Solar Pumps																																																																																																											
(1)	Water harvesting pond and solar pump (large)																																																																																																											
(2)	Water harvesting pond and solar pump (small)																																																																																																											
(2)	Micro Irrigation Systems																																																																																																											
(1)	Screening of the eligible farmers in PGs																																																																																																											
(1)	Mini Sprinkler System (root & leafy vege)																																																																																																											
(2)	Drip Irrigation System (Vegetables)																																																																																																											
(3)	Drip Irrigation System (Fruits)																																																																																																											
(4)	Other (UV Sheet rain shed tunnel (tomato))																																																																																																											
1.3 Horticulture guidance																																																																																																												
(1)	Visual aid training material preparation collaboration with training institutes																																																																																																											
(2)	Climate-smart horticulture on vegetables (general)																																																																																																											
(3)	Climate-smart horticulture on fruits																																																																																																											
(4)	Climate-smart horticulture on exotic vegetables for focal areas																																																																																																											
(5)	Climate-smart horticulture on fruits for focal areas (Sirsa, Hisar, Bhiwani)																																																																																																											
(6)	Cultivation techniques on floriculture in focal areas (Gurgaon, Faridabad)																																																																																																											
(7)	Cultivation techniques on spices, medicinal and aromatic plants in focal areas (Ambala, Kailash, Palwal, Bhiwani, Mahendragarh, Yamunanagar)																																																																																																											
(8)	Cultivation techniques on mushrooms in focal areas (Sonapat, Panipat, Kurukshetra)																																																																																																											
(9)	Beekeeping techniques in focal areas (Sonapat, Gurgaon)																																																																																																											
(10)	Nursery raising techniques																																																																																																											
(11)	Food processing																																																																																																											
(12)	Training for efficient using of Farm Machinery and Installation of Farm Machinery																																																																																																											
(13)	Nutrice improvement																																																																																																											
1.4 Pilotfarm Establishment and Public-private partnerships																																																																																																												
(1)	Pilotfarm Establishment under Centre of Excellence																																																																																																											
(2)	Village of Excellence																																																																																																											
(3)	Industry-Government-Academia Collaboration																																																																																																											
2. Support for building value chains and Promotion of private sector partnerships																																																																																																												
2.1 Infrastructure development for building value chains																																																																																																												
(1)	Fulfillment Centres: 3 units																																																																																																											
(1)	Preparatory work																																																																																																											
(2)	Construction																																																																																																											
(2)	Lead Pack Houses (Integrated Logistic Hub): 4 units (1 Potato, 1 Onion, 2 Multi-crops)																																																																																																											
Batch-1	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
Batch-2	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
(3)	Feeding Packhouse (500 units)																																																																																																											
Batch-1-20 (Category 1: 20)	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
Batch-2-51 (Category 1: 40, Category 2: 3 unit, Category 3: 3, Category 4: 3, Category 5: 2)	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
Batch-3-51 (Category 1: 40, Category 2: 3 unit, Category 3: 3, Category 4: 3, Category 5: 2)	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
Batch-4-60 (Category 1: 40, Category 2: 6 unit, Category 3: 6, Category 4: 6, Category 5: 2)	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
Batch-5-60 (Category 1: 40, Category 2: 6 unit, Category 3: 6, Category 4: 6, Category 5: 2)	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
Batch-6-60 (Category 1: 40, Category 2: 6 unit, Category 3: 6, Category 4: 6, Category 5: 2)	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
Batch-7-60 (Category 1: 40, Category 2: 6 unit, Category 3: 6, Category 4: 6, Category 5: 2)	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
Batch-8-40 (Category 1: 20, Category 2: 6 unit, Category 3: 6, Category 4: 6, Category 5: 2)	Preparatory work including Preparation of application documents (synopsis), Appraisal in Pre-LoI committee at District level, Post Recommendation issue LoI by District Horticulture Office, DPR preparation and Bank appraisal, DPR examination and analysis (2nd level) by State level Project Analysis Committee (SLPAC), DPR examination and Analysis (3rd level) by Executive Committee.																																																																																																											
(2)	Construction																																																																																																											
(4)	Retail Outlets																																																																																																											
2.2 Building an E-market Place and a information sharing platform																																																																																																												
Procurement of Vendor, e-Marketplace																																																																																																												
Build a platform to promote collaboration and information sharing among PGs																																																																																																												
Construction of e-Marketplace																																																																																																												
Build a platform to promote collaboration and information sharing among PGs																																																																																																												
Operation																																																																																																												



### Attachment 7.7.1 Packhouse Management system

#### Management system for packhouses

Item No.	Item	Implementer	Manager
1	Raw Material Procurement	Procurement Officer	Pack House Manager
2	Quality Inspection	Quality Inspector	
3	Processing	Processing Operator	
4	Quality Management	Quality Inspector	
5	Storage	Warehouse Inspector	
6	Distribution	Quality Inspector	
7	HR & Training	HR Officer	
8	Hygiene Management	Warehouse Inspector	
9	Traceability	Warehouse Inspector	

#### Monitoring system for packhouses

Monitoring Method	Responsibility	Management Implementer	Monitoring Frequency	Report to JICA
Regular Quality Checks	To be done by Chartered Accountant or certified agencies (hired by PGs)	PMU/ DPMU/ TSG	Half yearly	Attached with Quarterly basis Project Report (QPR) / Half yearly
Hygiene Audits				
Inventory Audits				
Process Audits				
Employee Training Review				
Financial Audits		Third-Party-Auditor	Financial Audit Report is to be submitted to JICA	

- Manual on Quality management and monitoring system to be shared with PG for self-implementation and monitoring.
- A member will be assigned as Quality supervisor to implement Quality and Monitoring management system.

## **Packhouse Manual**

### **Licenses & Permissions**

- APMC License (Within Mandi/ outside Mandi/ Unified License):
- Weights and Measurement certificate:
- Shop and Establishment Act:
- Insurance
  - Raw Material (Fruits & Vegetable)
  - Transit Insurance
  - Cash Insurance

### **Farmer Communication**

#### Objectives of Farmer Communication

- Spread awareness about the Packhouse in the Command area.
- Motivating farmers to bring their F&V produce to the Packhouse.
- Establish a relationship to render agro technological services.
- To improve quality and productivity through agro-technological interventions.
- Enhance PGs and farmers' profitability.
- Farmer communication will be divided into two phases:
- Pre-launch phase (Phase 1): Creating awareness among farmers and communicating the value proposition of PH as a preferred place for sales of F&V. This will be carried out before PH becomes operational in the selected area.
- Post-launch phase (Phase 2): Agro-technological interventions to improve quality & productivity aiming to increase in profitability of the farmer & company. This will take place after the opening of PH.

### **Prioritizing villages for farmer communications**

- Field surveys of selected villages in the PH catchment area.
- Prioritizing villages in the PH catchment area based on the availability of crops and Need Gap Analysis for a focused approach.
- Survey analysis:



- Area Crop Matrix:
  - Map villages on the basis of crop, acreage their trend and harvesting months, landholding sizes, major places of dispatch and distance, distance, and connectivity from PH.
  - Independent preferences for villages for taking up farm services will be mapped considering the availability and natural flow of the produce from the surveyed villages.
- Need Gap Matrix:
  - Villages will be mapped based on no. of intermediaries operating in the village from farm to sale point, Total intermediation cost and problems faced by the farmers in the area pre-harvest, post-harvest, and Market-related.
  - Independent preferences for villages must be given considering needs and gaps in the villages for taking up farm services.
  - Mapping of villages & prioritization of villages must be done while keeping the sourcing plan in view.
  - Villages will be mapped and short-listed based on
    - Distance from PH
    - Availability of crops (Acreage & Production)
    - Need Gap analysis (Problems faced by the farmers)
- Transaction Documentation: Opening of Masters
  - Farmer’s masters will be opened by the location in charge when the need arises. This will be done in the front-end system.

## **Manage Daily Procurement**

### Procurement Planning

PH In charge will forecast the crops situation in the PH catchment area.

- Collection of updates regarding:
  - Monsoon forecast on a weekly basis as per meteorological departmental reports.
  - Likely cropping pattern in the PH catchment area
- Collect feedback from farmers, vendors, Govt Dept., and officials, etc.

- Utilize information in building a sourcing plan for Packhouse.
- Annual Procurement Forecasting
  - PH In-charges will collect information on availability from the relevant catchment area to ascertain availability.
  - PH In charge will map the daily harvesting plan farmer-wise and crop-wise.
  - PH In charge will forecast annual procurement availability of products from farmers week-wise for the next year.
  - PH In charge will consolidate forecast annual procurement availability of products from farmers for the PH for the next year.

#### Daily Procurement Plan

- PH In charge based on the demand after applying Standard ‘Markup’ on each product. (Quantity markup will take care of any loss during handling and transportation)

## **Pricing**

### **Basis for price fixation**

The price of Fair Average Quality (FAQ) quality and lowest grade in referral mandi (PH location mandi/Mandi that is considered as a benchmark in the PH catchment area) would be used to decide the price at which F&V is to be procured from the farmers.

### **Price Information from Referral Mandi**

As per the quality norms, our FAQ quality & low-grade quality grade will be the lowest grade in the mandi, respectively. Referral mandi price will be collected by the Packhouse team during the peak sale hours of the previous day.

### **Pricing Decisions**

PH In charge is responsible for the price declaration to the farmers based on the price grade. PH In charge will ensure that there is parity of our price declaration of FAQ price/price of the lowest grade in the referral mandi, respectively. PH In charge will decide the exact price that has to be quoted for procurement from farmers so that he is able to procure the desired quantity of required quality.

### **Procurement procedure from farmers**

- Produce from farmers will be accepted/rejected based on the first visual check (the PH In charge will ensure that the produce of the farmer gets rejected only when it is not worth taking. But a fair chance has to be given to the farmer, for a visual check once again, if after rejection, farmers grades and again brings the lot).
- The produce will be kept in crates for grading and sorting.
- The produce will be sorted and graded by contract labour, based on pre-defined 'Quality Specifications' and be classified into quality grades.
- Quantity that gets rejected due to excessive deformities, Cut, Rotten, Pest/disease-infested, over ripen, etc. will be returned to the farmer or material will be disposed of with the consent of the farmer.
- The produce after being classified into "FAQ and non-FAQ" quality grades will be kept in respective crates labelled with "FAQ" and "Non-FAQ" and weighed in front of the farmer. The weight will be recorded in the relevant procurement document under separate A (FAQ) & B (Non-FAQ) heads.
- Farmers will be paid for "FAQ" and "Non-FAQ" grade material supplied by the farmer.

### **Daily Preparedness at PH**

Readiness w.r.t all the processes that influence the daily operational scheme of things at PH has to be ensured by PH In charge & PH Facilitator. PH In charge has to ensure strict adherence & readiness to all the processes that influence the daily operational scheme of things at PH.

### **Operation timings of PH**

Time of procurement at PH will happen in 2 time slots:

- a) Morning purchase to start at 8:00 a.m. and would be completed by about 12:00 noon.
- b) Evening purchase to start at 4:00 pm and would be completed by about 8:00 pm

Checklist for daily operational arrangements

- PH In charge of ensuring that the correct display of prices and Practice materials is done at the Packhouse before the farmers' arrival.
- PH In charge to check the presence of all required instruments and their proper functioning.

- PH In charge to check required dress-up material like gloves, caps etc. are available at the Packhouse as per requirement.
- PH in charge in collaboration with PH facilitator has to organise labour, security, transportation, cash payments, and commercial transactions and data entry operators based on the likely quantum.
- PH In-charge in collaboration with PH facilitator has to ensure that the premises are well maintained and free from all garbage.
- PH In charge will ensure that PH facilitator provides required number of labours in time for handling operations.
- PH In-charge in collaboration with PH facilitator will manage any disputes that arise with farmers & others during sourcing process.
- PH In-charge monitors the Quality Improvement Programme (QIP), sorting & grading operations carried out at PH as per defined quality specifications & processes
- PH In charge ensures proper arrangements are made for parking of both loaded and unloaded vehicles before the arrival of farmers at Packhouse.

### **Calibration of Weigh Scales**

- Calibration of weigh scales should be done at the beginning of every shift.
  - Check Zero
  - Depending on the least count of that weigh scale calibration will be made. For instance, if least count is 500 gm, check the weigh scale for increments of 500 gm.
  - Followed by 1kg, 2 kg, 5 kg, 10kg, 50 kg, 100 kg certified weights.
  - Against each addition, record the incremental reading.
  - If variations are observed correct the reading as per the weigh scale manual
  - Daily Record of weigh scale calibration must be maintained.
  - In case of any abnormal variation which cannot be corrected, do not use the scale and report to maintenance for further action.

### **Crate Management**

#### **Receiving and manual cleaning of the crates**

- Crates received from Lead Pack House (LPH) must be inspected for cleanliness. Segregate all dirty crates.
- Unfold the crates remove all loose debris sticking to the sides manually. Collect the debris in waste bin.
- Check the crate. If unclean & if the dirt is hard and sticky clean the crate manually with brush
- Take physical stock of crate in the PH once in a month. Record and reconcile.

### **Issuing Crates to Farmers**

- Communicate to the farmers who are regularly supplying requisite quantities of F&V at PH that certain percentage amount is deducted weekly from the payments that has to be made.
- Amount will be deducted as security only when the farmer is willing to do so.
- This would be done till the cumulative amount is equal to the cost of the crate. The amount thus deducted will act as security deposit against issue of crate to that particular farmer.
- The number of crates to be issued to the farmer is dependent on the average volume/day brought by the farmer & the amount deposited against security.
- Amount against security deposit will be returned to the farmer on return of the crates in sound condition.
- List of farmers, contact details, No. of issued crates & Obtained security deposit amount must be recorded in a register.
- Replacement of similar number of crates will be done on the day farmers bring the produce to PH.
- Details of returned crates & refunded security amount against particular farmer must be recorded.
- Reconciliation of crates will be carried at least once in a fortnight.

### **Tagging of Crates**

Tagging of crates which carry FAQ grade of F&Vs is required at PH to enable easy traceability of material at PH to be diverted directly for disposing off in Cash & Carry Stores.

The tag will be a Self-adhesive sticker with details -

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1. Name of PH

2. Non-FAQ Grade. (Yellow Colour Sticker)

**Transaction Documentation: Crate accounting**

- Crates will be treated as one more Single Keeping Unit (SKU) in the system.
- Crates will be received at PH against crate movement challan from PH or from originating location.
- On filled crates movement to the PH, a crate movement challan is prepared notifying the number of crates being moved out of PH.

**Hygiene of Packhouse**

- PH In charge to ensure the premises are clean.
- There should be no spillover of produce in the premises. In case of any spill over collect the produce immediately to avoid crushing.
- The premises must be daily swept in every shift.
- Drain covers must be cleaned every day to avoid choking.
- All the waste material will be taken out of the premises to a specified location for dump collection.
- PH Facilitator should ensure that the PH premises are cleaned daily 1 hour before operations begin.

**Process Floor**

- Always ensure the process floor is clean and dry. The floor must be dry cleaned with brush in every shift.
- Floor must be disinfected with phenyl every day. It may be wet cleaned with detergent, brushed, and dried with squeeze once every week.
- There should be no spillover of produce on the floor. In case of any spill over the produce must be collected immediately to avoid crushing
- All the waste stock (stalks, leaves etc. removed during the processing operations) must be taken out of processing hall to a specified location for dump collection.
- Drain covers must be cleaned every day to avoid choking.

### **Sorting lines/ Sorting Tables**

- All sorting lines and tables will be wiped and cleaned with dusters and clean cloth every shift.
- The lines and tables will be disinfected by wiping with cloth dipped in 100 ppm chlorine solution.
- Once every week and whenever required clean all lines and tables with detergents.

### **Pest and Insect Control**

- PH In charge will monitor pest and insect control activities at PH. He will ensure that:
  - Adequate number of Pest – o –flash is provided in the Sorting & Grading process hall. They will be located to cover the complete area.
  - Pest control is done through authorized third party i.e., PH facilitator.
  - All doors should normally be kept close with shutters and doors.
  - All windows should be provided with wire mesh which will be always kept closed.
  - Only methods and chemicals authorized for use in food industry will be used.
  - Housefly will be controlled with chemical and physical means.
  - For Rodent control – Glue pads and baits should be used. There should be specific location for glue pads and baits should be numbered and mapped. Records of glue pads and baits - issued, used and available at mapped location should be monitored.
  - Record must be maintained with details for insect and pest control activities carried out at Packhouses.

### **Employee**

#### **Personal hygiene:**

- All employees & labour will strictly follow code of personnel hygiene. The PH in-charge will check and ensure implementation of personal hygiene code at the beginning of every shift.
  - Report to work in good health, clean and dressed in clean attire.
  - Change aprons, face masks, caps etc. when they are soiled.
  - All employees before entering the processing area will wash their hands with soap. Clean nails with brush. Dip the hands in sanitizer and shake dry.
  - All labour & employees handling produce will wear caps covering hair completely and wear hand gloves.

- All employees including contract labour will undergo medical examination once every six months. Records of such medical examination will be maintained. Any one reported unhealthy to work will be discontinued forthwith.
- The nails of all employees at all times should be trimmed and clean.
- Whenever anyone uses toilet facility, he/ she must wash hands with detergent and sanitize.
- Smoking and spitting are strictly prohibited inside the sorting & grading process hall and storage area.
- All employees must wear shoes covering their toes and heels completely.

### **Washing Hands:**

- Hand washing signs or poster must be posted at all washing sinks, Sorting & Grading process rooms and rest rooms in a language understood by all the employees
- Only designated hand washing sinks will be used for hand washing.
- Running water, soap, means to dry hands and waste container must be provided at each hand washing sink.
- Hands must be washed:
  - Before starting work
  - Before putting on or changing gloves
  - After using the toilet
  - After any clean up activity such as sweeping, mopping or wiping counter.
  - After touching dirty dishes, equipment, or utensils
  - After handling/moving the waste bins/trash
  - Any time when the hands may become contaminated.

### **Managing Frontline**

#### **Farmer Reception & Care**

- PH In charge must ensure that farmers coming to the Packhouse are treated with due respect & dealt properly.
- PH In charge must ensure that on arrival of farmers, labour is available for unloading the material.



- PH In charge must ensure that water is made available at the Packhouse.
- PH In charge will direct the farmers to follow the procedure in the PH.
- PH In charge must ensure that the total operations time of any particular farmer is handled properly so that it is minimized as far as possible.
- PH In charge must ensure that no bias/preference between farmers happens during the entire procedure of PH operations.
- If the farmer insists on repetition of any particular operation, PH In charge must ensure that it happens till he feels satisfied.

### **Receiving of Fruits & Vegetables from farmers**

- Fresh fruits & vegetables will be received from farmers at the Packhouses as per the sourcing schedule.
- All fresh Fruits and vegetables will be received by weight in kilogram.
- All products must be unloaded in sequence & kept in shed/open area avoiding exposure to sun/heat.
- Produce from farmers must be accepted / rejected based on first visual check after complete unloading/crating.
- Farmers will be given tokens for their crates/bags recd.
- Potato and Onion will be put in Gunny bags.
- The produce will be sorted and graded by contract labour, based on pre-defined 'Quality Specification'.
- The sorted and graded products will be put in a different colour crate.
- The produce will be weighed in front of the farmer.
- The value of purchase will be calculated using the pricing grid and the farmer would be paid in cash/bank transfer by PH In-charge.
- Acknowledgment / declaration will be taken from the farmer on the Receipt cum Weighment Slip.
- Tags / Stickers will be pasted on the crates for the purpose of identification.

### **Sorting and Grading**

- Quality standards defined in quality manual to be followed.
-

- Drawing of stocks of farmers for sorting and grading operations must be ensured to be First In First Out (FIFO)
- Produce from farmers will be accepted / rejected based on first visual check.
- Quantity brought by farmer is put in standard crate and weight recorded.
- The produce must be weighed in front of the farmer and the total weight will be recorded in a procurement statement.
- The produce will be sorted and graded by contract labour, based on pre-defined ‘Quality Specification’.
- Sort manually for quality defects.
- Dump the rejects into distinctly marked crates.
- Ensure produce is sorted & graded continuously to achieve desired labour utilization.
- Record the weight of produce transferred to Other Packhouse (LPH)
- Weigh the rejected produce and return to the farmer or store in designated place.
- Record the quantity of produce brought by the farmer, quantity of each grade, quantity of rejection and weight difference.
- In case of capsicum wipe out dirt with a clean cloth
- In case of green leafy vegetables following points must also be ensured:
  - Pick up each bundle from the crate and remove weeds, damaged leaves, infested and rotten leaves.
  - Clear the mud at the roots.
  - If the specification requires trimming of the root/stem – use a sanitized knife to cut the roots to uniform size.
  - Bundle the leafy vegetables to uniform size.
  - Bundle should not be tightly placed in Crates
  - Bundles should be placed vertically up with roots at the bottom and leaves facing the top.
- In case of cabbage and cauliflower following points must also be ensured:
  - Do not accept produce with worms, black spots or infested.
  - Pick up each flower/cabbage.

- In case of cauliflower – check that the curds are tight, white in colour and as per specification laid out in QA manual.
- Knives should be sanitized by dipping into chlorine of 100 ppm.
- Using the sanitized knife to remove/trim the cover leaves to the extent specified in QA manual.
- Trimming of leaves of radish is local specific – to be followed as per SKU master
- Do not wash Okra.
- Beans if washed & brought by the farmer must be dried by spreading out.

### **Payment to Farmers**

- PH In charge will issue procurement statement/Receipt cum weight slip in triplicate after goods grading and price determination with farmer by PH In charge.
- One Copy of the receipt will be given to farmer.

### **Manage Dispatches**

Logistics (PH – LPH)

Logistics requirement planning/ mapping

- PH will get firm consolidated indent of all SKUs 48 hrs in advance, through the system from the LPH.
- PH In charge will map all products with specific type of transport requirements from the Procurement Planning Process.
- Fix all types of requirements to transport all kind of products. (Cold chain, covered, ambient movement, refrigerated vehicles etc).
- Fix rules for minimum valid load from PH sourcing points to destination points for each type of transport.
- Most economical demand / supply mapping and route plan.
- Freeze specifications of the transport vehicles and equipment.
- Location wise requirement of statutory forms for intra / interstate movement.
- Ascertain alternative sources of supply based on total delivered cost.
- Grouping of commodities and their quantities at each PH sourcing location that needs to be transported to LPH on a daily basis.

- Daily route plan from one place to another place including each type of transport requirement.

### **F&V Surplus Management**

- PH In charge will ensure that total non-FAQ quantity to be moved for all SKUs must be placed in crates of different colour and tagged as non-FAQ along with name of PH
- Non-FAQ filled crates will be moved to LPH along with FQA filled crates.
- In case of emergency, PH team will dispose off the material locally at best possible price.

### **Waste Handling & Disposal**

- At the beginning of every shift cleaned Bins for collecting the waste must be available in the Sorting & Grading Space
- Waste, Rejection and surplus sale will be coordinated through inbound gate only
- Ensure that waste bins are always kept covered.
- Wastage generate out of processing operation will be collected in waste bins in the process hall.
- Filled Wastage bins will be periodically taken out of the process hall.
- Waste bins will be cleaned immediately after dumping and sanitized with chlorine solution.
- Removal of Waste from the designated area will be done as & when the wastage bins get filled.
- F&V Waste, being nutritious & biodegradable, can be sold to a farmers/composting/Biofertilizer agency.
- Arrangements with farmers for composting can be looked at for commercialization.

### **Statutory Compliances**

#### **Mandi related (If applicable in the state of Haryana)**

- Necessary Mandi documents will be issued immediately on closure of a purchase deal with a farmer.
- In the given periodicity (week/month), Mandi return will be submitted along with all transactional details and appropriate Mandi fees will be deposited through State Commercial.

- A monthly compliance certificate will be given by each location head as having complied with Mandi requirements and having paid off necessary liability. The same will be sent to the State Commercial for verification.
- Transaction Documentation: Mandi returns:
  - Mandi returns will be submitted to the authorities on a periodic basis (as per the local Mandi rules)
  - Returns are to be made in the prescribed format either printed from the Front-end system or manually prepared.
  - Supporting details will be extracted out of the Front-end system to be attached with the return to give Farmer wise details.
  - Fee payment will have to be paid out of the Pack house.

## **Transaction Documentation**

Bill processing:

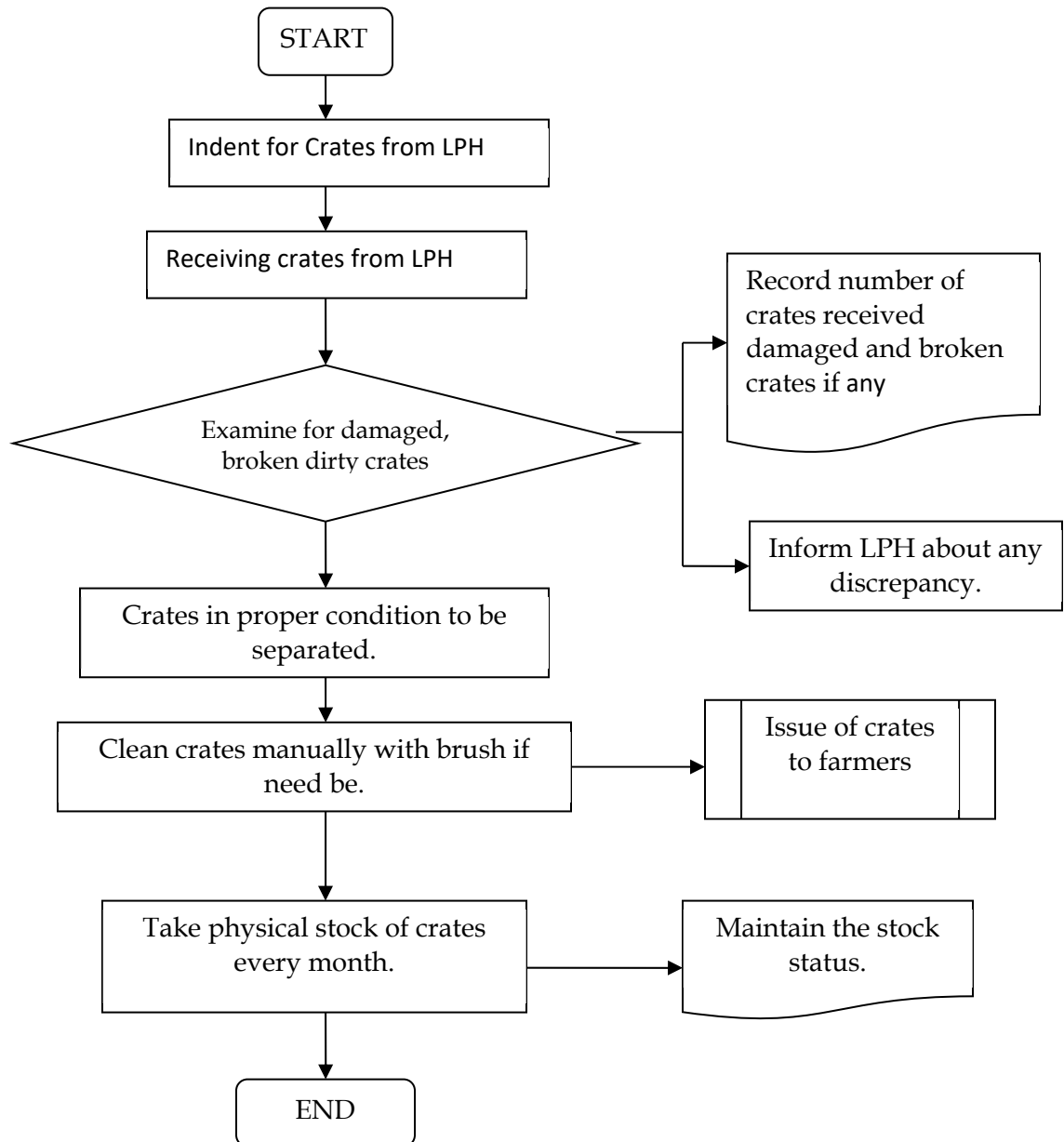
- The following bills will be passed by the PH In charge and forwarded to Board of Director (BOD) In charge team for payment on agreed terms:
  - Transporters
  - Contract labour
  - Commission Agency – commission charges.
  - Out of pocket expenses – imprest (different from Cash payments to farmers)
- These bills will have to be scrutinized based on agreed rates, proper and satisfactory execution of the job including transportation, supporting documents like acknowledgement of receipt, job completion certificates.
- The BOD will process all the bills based on approvals and pay the vendors through electronic transfer / DD / Cheques.
- Cheques will be disbursed to the vendors either through courier or hand delivered at PH.

## **Risk Management**

- Alternate Scenario Planning
  - Review of Current Situation should be done by PH In charge at PH level Take timely action.
- Material has already been received.
  - Continue the PH process & deliver to LPH.
- Material has still not reached.
  - Maintain a telephone directory of lead farmers & vendors to get in touch with them in such situations. Explore possibility talking to these people to hasten up the process of delivery.
  
- Material Shortage
  - Identify critical markets for supplies and enhance activity intensity in that market
- Vendor Advances
  - Proposal for advance payment should be put forwarded by state teams
  - Scrutinizing the proposal/request by Manager (Commercial, MIS & Controls)
  - Payments and settlements will be done as per the standard guidelines.
  
- Sudden jump / drop in market prices.
  - Assess demand-supply scenario and take decision on increase / decrease in our price.
  - The decision must be taken after the analysis of the cost implications under each of the options.
  
- Increase in supply costs of SKUs.
  - Advance booking through vendors
  - Cost reduction measures (direct supplies, re-negotiate margins with vendors, etc.)
  - Explore alternate sources / substitutes.
  - Revise work plan
  
- Low Vendor Rating
  - Identify alternate vendors and introduce into the market gradually, while withdrawing the previous vendor where vendor rating is D.

- In the case of vendors with C grade, alternate vendors need to be identified and readied for supplies during the period of counselling.

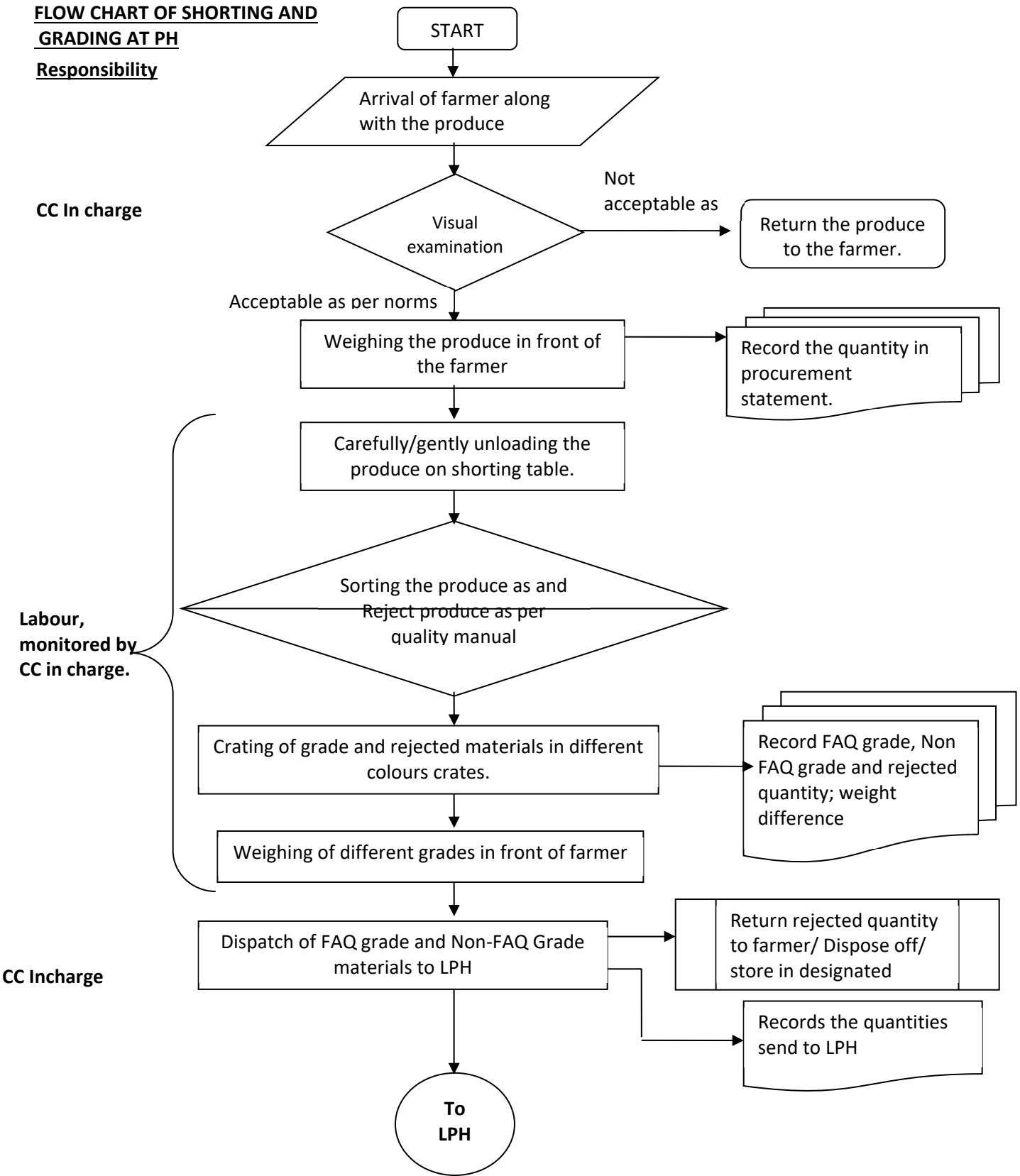
## CRATES MANAGEMENT [Flow Chart]



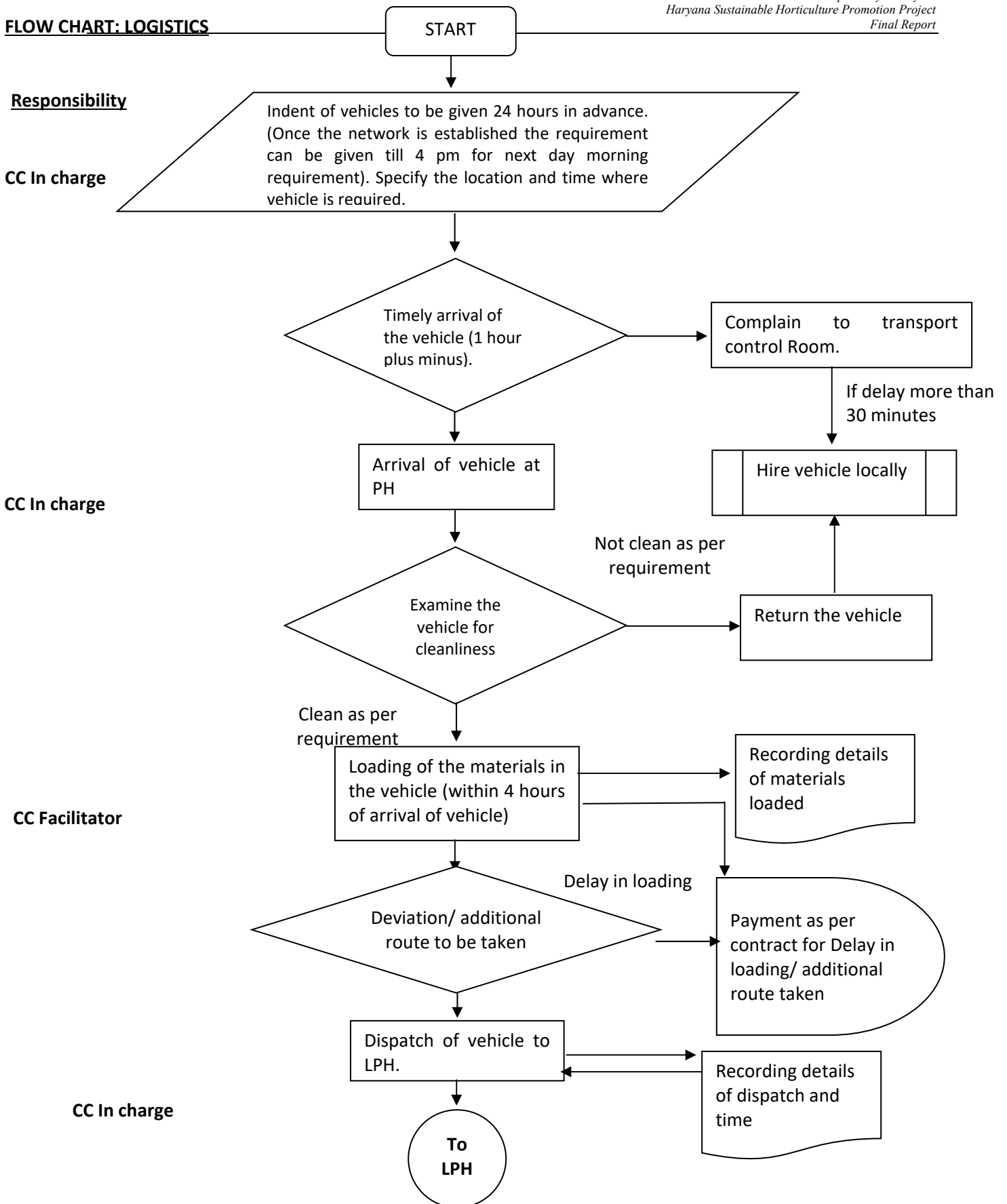


**SUPPLYING CRATES TO FARMERS [Flow Chart]**

**FLOW CHART OF SHORTING AND GRADING AT PH**  
**Responsibility**



**FLOW CHART: LOGISTICS**



Attachment 8.2.1 Cost Breakdown for Package

入札関連情報のため一定期間非公開

**Attachment 8.2.2 Cost Breakdown for the Consulting Services**

入札関連情報のため一定期間非公表

**Attachment 9.3.1 Details of Calculation of IRR**

入札関連情報のため一定期間非公表

**Attachment 9.9.1 Risk Management Framework**

Project Name: Haryana Sustainable Horticulture Promotion Project

Country: India

Sector: Irrigation & Agriculture

Officers in charge:

- Operational staff: To be appointed
- Engineering staff: To be appointed
- Country office staff: To be appointed

Potential project risks	Assessment
<b>1. Stakeholder Risk</b>	Probability: M
(Description of risk)	Impact: H
Risk of the project cancellation or suspension resulting from the low commitment of the state of Haryana	Analysis of probability and impact: The Project is the first time of implementation of Japanese ODA loan scheme for HSHPP. Although PMC needs to support them to manage and operate the Project properly, HSHPP has the strong intention to promote horticulture promotion with establishment of supply chain by cluster approach with accordance of the central government policy of Formulation and Promotion of 10,000 new FPOs.
Appraisal stage / Implementation stage	Mitigation measures: 1) To hold regular high-level policy meeting, Executive Committee to review and approve annual plan of operation and budgetary allocations at the timing of the next fiscal year's budget request. 2) To monitor the policy trends of the central government of India and the position of the Project in the annual plan of the state of Haryana.
	Action during the implementation: 1) To hold regular high-level policy meeting, Executive Committee to review and approve annual plan of operation and budgetary allocations at the timing of the next fiscal year's budget request. 2) To monitor the policy trends of the central government of India and the position of the Project in the annual plan of the state of Haryana.
	Contingency plan (if applicable): N/A
<b>2. Executing Agency Risk</b>	
<b>2.1. Capacity Risk</b>	
(Description of risk)	Probability: M
1) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from the lack of technical capacity of HSHPP or delay in procurement of quality PMC to support PMU	Impact: M
Implementation stage	Analysis of probability and impact: The project is the first time of implementation of Japanese ODA loan scheme for HSHPP. PMC will support them carefully for capacity development and procurement to manage properly with assistance of JICA India Office. In addition, HSHPP can get information from HPCDP project in Himachal Pradesh that has long experiences of JICA projects. On the other hand, for supply chain component, employment of Technical Support Group will be a markable key to the project success to promote horticulture by cluster approach. PMU and PMC has to monitor the progress, otherwise If the risk occurs, it may lead to certain impact of the unachieved development target and delay of the Project.
	Mitigation measures: 1) To support PMU by PMC experts for implementation of all the components. 2) To plan appropriate implementation structure for all of the components. In particular, employment and operation of Technical Support Group shall be taken care of by PMC so that PMU/DPMU could hire Technical Support Group with sufficient experience.
	Action during the implementation: 1) To support PMU by PMC experts for implementation of all the components. 2) To plan appropriate implementation structure for all of the components. In particular, employment and operation of Technical Support Group shall be taken care of by PMC so that PMU/DPMU could hire Technical Support Group with sufficient experience.
	Contingency plan (if applicable): N/A

(Description of risk) 2) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from low project management capacity of HSHPP  Implementation stage	Probability: M
	Impact: M
	Analysis of probability and impact: The project is the first time of implementation of Japanese ODA scheme for HSHPP. PMC will support them carefully to manage properly with assistance of JICA India Office. In addition, HSHPP can get information from HPCDP project in Himachal Pradesh that has long experiences of JICA projects.
	Mitigation measures: 1) To hold Executive Committee regularly to monitor, evaluate and approve financial management and procurement. 2) To support PMU by PMC for application of the guideline and manuals on financial management and procurement.
	Action during the implementation: 1) To hold Executive Committee regularly to monitor, evaluate and approve financial management and procurement. 2) To support PMU by PMC for application of the guideline and manuals on financial management and procurement.
	Contingency plan (if applicable): N/A
(Description of risk) 3) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from low financial capacity of HSHPP  Implementation stage	Probability: L
	Impact: M
	Analysis of probability and impact: The project is the first time of implementation of Japanese ODA loan scheme for HSHPP. However, it is considered acceptable according to budget allocation and financial capacity of Haryana state.
	Mitigation measures: 1) To hold Executive Committee regularly to monitor, evaluate and approve financial management and procurement. 2) To support PMU by PMC for financial management
	Action during the implementation: 1) To hold Executive Committee regularly to monitor, evaluate and approve financial management and procurement. 2) To support PMU by PMC for financial management
	Contingency plan (if applicable): N/A
(Description of risk) 4) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from delay of payment to contractor  Implementation stage	Probability: L
	Impact: M
	Analysis of probability and impact: This project is the first implementation of a Japanese ODA scheme for HSHPP. However, PMC, with the cooperation of the JICA India Office, will assist in ensuring that the project is properly managed. In addition, DOH's CCDP project has a lot of experience in value chain development projects, and HSHPP will be able to obtain information.
	Mitigation measures: 1) To support PMU by PMC for monitoring the construction and payment progress 2) To hold Executive Committee regularly to monitor payment work progress.
	Action during the implementation: 1) To support PMU by PMC for monitoring the construction and payment progress 2) To hold Executive Committee regularly to monitor payment work progress.
	Contingency plan (if applicable): N/A

<b>2.2. Governance Risk</b>		
(Description of risk) 1) Risk of delay of the project resulting from the improper communication of related organizations and the implementation structure.  Implementation stage.	Probability: L	
	Impact: M	
	Analysis of probability and impact: The implementation structure for the Project will be complicated due to a lot of related organizations for the project components. The role, responsibility and relation of each organization shall be made clear at the planning stage. The structure was discussed among HSHPP, JICA and JICA Survey Team to operate smoothly and effectively in the Project.	
	Mitigation measures: 1) To clarify role, responsibility and relationship of each organization before starting the Project. 2) To hold Executive Committee regularly to share and discuss on the progress of the project activities with related organizations. 3) To implement project management component including capacity development with support of PMC.	
	Action during the implementation: 1) To clarify role, responsibility and relationship of each organization before starting the Project. 2) To hold Executive Committee regularly to share and discuss on the progress of the project activities with related organizations. 3) To implement project management component including capacity development with support of PMC.	
	Contingency plan (if applicable): N/A	
	<b>2.3. Fraud &amp; Corruption Risk</b>	
	(Description of risk) 2) Risk of delay of the project implementation schedule from delay of procedure of E/N and L/A by the government  Appraisal stage	Probability: L
Impact: M		
Analysis of probability and impact: The schedule of E/N and L/A procedure has been shared with HSHPP many times, and HSHPP has motivation to implement the Project on time of schedule.		
Mitigation measures: 1) To support Haryana state by JICA to arrange meetings and documents to achieve necessary procedure and approval punctually before project implementation.		
Action during the implementation: -		
Contingency plan (if applicable): N/A		
(Description of risk) Risk of increase of cost and unachieved development target, delay of the project resulting from fraud of procurement of the Project.  Implementation stage.		Probability: L
		Impact: M
	Analysis of probability and impact: The procurement implemented in the Project shall be guided by Haryana government operation. For monitoring of procurement work, Executive Committee will be held periodically and the potential issues will be discussed before the risk occurs.	
	Mitigation measures: 1) To adopt procurement guideline of Haryana state with addition of necessary modification. 2) To monitor proper procurement work through Executive Committee.	
	Action during the implementation: 1) To adopt procurement guideline of Haryana state with addition of necessary modification. 2) To monitor proper procurement work through Executive Committee.	
	Contingency plan (if applicable): N/A	



3. Project Risk	
3.1. Design Risk	
(Description of risk) 1) Risk of delay in the implementation of the Project from the design with too advanced techniques.  Implementation stage	Probability: M Impact: M Analysis of probability and impact: JICA Survey Team reviewed PPR and conducted data collection, then found basically project activities proposed in PPR were relatively reasonable for HSHPP, though quantity and some minor components should have considered again to be matched to project schedule and budget. Along with the proposal, project implementation plan was discussed and finalized to be appropriate plan for the Project. Mitigation measures: 1) To appoint PMC to support PMU to conduct project components especially for value chain and market development component. Action during the implementation: 1) To appoint PMC to support PMU to conduct project components especially for value chain and market development component. Contingency plan (if applicable): N/A
(Description of risk) 2) Risk of unachieved development component in the project implementation from improper project scope and project monitoring system.  Appraisal stage / Implementation stage	Probability: L Impact: M Analysis of probability and impact: Project components are proposed to be planned to cover the whole activities for achievement of the project objective. The implementation structure of each component is organized with various stakeholders and supporting institutions. PMU will manage and monitor the activities efficiently with sharing information. Mitigation measures: 1) To plan proper project components before the Project 2) To hold progress meeting by PMU/DPMU to monitor and share the progress of activities. 3) To hold Executive Committee to monitor the progress of project components. Action during the implementation: 1) To plan proper project components before the Project 2) To hold progress meeting by PMU/DPMU to monitor and share the progress of activities. 3) To hold Executive Committee to monitor the progress of project components. Contingency plan (if applicable): N/A
(Description of risk) 3) Risk of delay of the project implementation schedule from too many number of packages  Appraisal stage	Probability: L Impact: M Analysis of probability and impact: Project packages was considered at the stage of preparatory survey and was concluded appropriate for the Project with addition of some proposal from JICA Survey Team. Mitigation measures: 1) To review the DPR to be prepared based on PPR before the Project. 2) To confirm local situation about constructor's capacity and the quality control before the Project. Action during the implementation: - N/A

(Description of risk) 4) Risk of cancellation or suspension of the project implementation from increase of project cost  Implementation stage	Probability: L
	Impact: M
	Analysis of probability and impact: Price increase rate is relatively stable in India. It is not expected that the risk occurs during the project period, but the contingency shall be prepared in the project cost to be ready for the risk just in case.
	Mitigation measures: 1) To consider the project cost based on economic situation of country and target area before the Project.
	Action during the implementation: -
	Contingency plan (if applicable): N/A
(Description of risk) 5) Risk of decrease of benefit of the project implementation from sudden decrease of market demand of horticultural crops due to external factors.  Implementation stage	Probability: L
	Impact: L
	Analysis of probability and impact: It is difficult to assume the sudden occurrence of decrease of horticultural crops demand during the project period according to the recent demand expansion in entire India and result of marketing survey in the JICA Survey.
	Mitigation measures: 1) To conduct the project economic analysis and confirm the resiliency against demand (benefit) decrease before the Project.
	Action during the implementation: -
	Contingency plan (if applicable): N/A
<b>3.2. Program &amp; Donor Risk</b>	
(Description of risk) Risk of decrease of benefit and delay of the project resulting from delay of the other schemes, other donors' projects or departments conducted in Haryana.  Implementation stage	Probability: L
	Impact: L
	Analysis of probability and impact: Beneficiaries of the Project will be supported by the Project for the purpose of income improvement coming from horticulture promotion with supply chain development. The Project is planned to conduct convergence activities for some components, however financial assist from other schemes is not considered, which can make the risk lower in the Project. Information sharing between relevant departments and organizations in Haryana state is helpful for each other.
	Mitigation measures: 1) To hold information exchange meeting and project coordination meeting with relevant organizations periodically by PMU supported by
	Action during the implementation: 1) To hold information exchange meeting and project coordination meeting with relevant organizations periodically by PMU supported by
	Contingency plan (if applicable): N/A
<b>3.3. Delivery Quality Risk</b>	
(Description of risk) 1) Risk of impossibility to monitor and measure development effect due to lack of the way of data collection.  Implementation stage	Probability: L
	Impact: L
	Analysis of probability and impact: It is possible to collect data related to operational and effect indicators through extension officers' daily monitoring and MIS & GIS facilities to be installed newly. PMC will provide technical assistance to PMU for the new systems.
	Mitigation measures: 1) To support PMU by PMC to collect data properly. 2) To establish a database to integrate the value chain and manage the project through its operation with the support of PMC.
	Action during the implementation: 1) To support PMU by PMC to collect data properly. 2) To establish a database to integrate the value chain and manage the project through its operation with the support of PMC.
	Contingency plan (if applicable): N/A

(Description of risk) 2) Risk of unsecured sustainability for O&M of project resulting  Implementation stage	Probability: M Impact: M Analysis of probability and impact: The plan and responsibility of O&M for facilities shall be handed over to owners such as PG, and Private sectors. In order to operate O&M effectively after the Project also, basically facility owners shall be responsible with maintenance service and instruction of supplier/service provider. PMU and TWG needs to monitor and instruct if necessary with support of PMC periodically. Mitigation measures: 1) To conduct O&M training mainly by supplier with support of PMC. Action during the implementation: 1) To conduct O&M training mainly by supplier with support of PMC. Contingency plan (if applicable): N/A
(Description of risk) 3) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from natural disaster  Implementation stage	Probability: M Impact: L Analysis of probability and impact: For the achievement of project output, work schedule has to be considered based on climate condition. Mitigation measures: 1) To plan construction work schedule to be conducted in Rabi season. 2) To plan and conduct project components in consideration of climate condition with support of PMC. Action during the implementation: 1) To plan construction work schedule to be conducted in Rabi season. 2) To plan and conduct project components in consideration of climate condition with support of PMC. Contingency plan (if applicable): N/A
(Description of risk) 4) Risk of unfair benefit expression of the project resulting for the limited beneficiaries  Implementation stage	Probability: L Impact: L Analysis of probability and impact: Beneficiaries in the project area who are currently unable to join the FPO due to lack of land are also eligible to apply for project support, and activities are planned to actively encourage their participation during the project awareness period. Mitigation measures: 1) To conduct project awareness activities with the support of the PMC and relevant departments. Action during the implementation: 1) To conduct project awareness activities with the support of the PMC and relevant departments. Contingency plan (if applicable): N/A
<b>4. Environmental Risk</b>	
<b>4.1. Climate Change Risk</b>	
(Description of risk) 1) Risk of Green House Gasse Emission from Horticulture  Implementation stage	Probability: L Impact: L Analysis of probability and impact: JICA Survey Team reviewed collected data concerning climate change and found the increase of Green House Gasses such as CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O observed. CO <sub>2</sub> emission is increased along with industrialization and modernization of the society. However horticulture contributes to reduce it. In addition, CH <sub>4</sub> emission is mainly caused by enteric fermentation from livestock. The most influential Green House Gas from Horticulture is N <sub>2</sub> O. Grain production (rice and wheat) contributes most to use synthetic nitrogenous fertilizers. They are the main source of emission of the N <sub>2</sub> O gas. Controlling overuse of nitrogenous fertilizers is a key to reduce this gas. Mitigation measures: 1) To reduce the overuse of nitrogen fertilizer 2) To convert crops from nitrogenous fertilizer consuming one to less use crop. Action during the implementation: 1) To guide proper use of fertilizers 2) To change the varieties not consuming much fertilizer Contingency plan (if applicable): Haryana State Action Plan on Climate Change

(Description of risk)	Probability: M (certain areas H)
2) Risk of precipitation decrease	Impact: M (Certain areas H)
Implementation stage	Analysis of probability and impact: JICA Survey Team reviewed collected data concerning climate change, then found regionally (Parts of Bhiwani, Faridabad, Fatehabad, Gurgaon, Jhajjar, Jind, Karnal, Kurukshetra, Mahendragarh, Rohtak, Sirsa, Sonapat) sufficient consideration should be given to adapt monsoon rainfall pattern change to implement this project smoothly. Delay of onset of monsoon, long dry spell and early withdrawal of monsoon are also predicted. Along with the proposal, project implementation plan was discussed and finalized to be appropriate plan for the Project to reduce these risks.
	Mitigation measures: 1) To identify valuable areas in the state and take suitable amendment action to mitigate this issue.
	Action during the implementation: 1) To select suitable crops for vulnerable areas 2) To apply water saving techniques to this areas 3) On the contrary, some areas are affected increasing rainfall during monsoon, high bed preparation and watershed structures are introduced in a plan.
	Contingency plan (if applicable): Haryana State Action Plan on Climate Change
3) Risk of temperature increase	Impact: L
Implementation stage	Analysis of probability and impact: L JICA Survey Team reviewed collected data on climate change (rising of temperature). The extreme high temperature in summer and low, frost temperature caused by climate change should be counted in enough to be matched to project plan. Project implementation plan was discussed and finalized to be appropriate to mitigate these problems for the Project.
	Mitigation measures: 1) To develop or introduce high temperature adaptable varieties 2) To introduce temperature controllable materials for cultivation
	Action during the implementation: 1) To select suitable crops for vulnerable areas 2) To apply shading materials for cultivation to vulnerable areas
	Contingency plan (if applicable): Haryana State Action Plan on Climate Change
<b>4.2. Other Environmental Risks</b>	
(Description of risk)	Probability: L
Human health risk caused by worsen environments.	Impact: L
Implementation stage	Analysis of probability and impact: Beneficiaries of the Project might be influenced by worsen environment such as air pollution and water contamination.
	Mitigation measures: 1) To intimate farmers on the environmental influence on human.
	Action during the implementation: 1) To hold health promotion campaign with relevant organizations periodically by PMU supported by PMC 2) To promote periodical health check among farmer producers group.
	Contingency plan (if applicable): Haryana State Action Plan on Climate Change
<b>5. Overall Risk Rating</b>	
(Overall comments)	Probability: M
Impact: M This project is the first implementation of the Japanese ODA loan scheme for HSHPP. Although PMC needs to support the project to ensure that it is properly managed and operated, HSHPP has a strong will to promote horticulture promotion by establishing a supply chain with a cluster approach based on the central government policy of forming and promoting 10,000 new FPOs, which already has similarities with this project. The following mitigation measures are considered feasible. The following mitigation measures can be implemented: 1) Regular high-level policy meetings; 2) Monitoring of the Project's position in the annual plan of Project implementation; 3) Establishment of a system to monitor the progress of the Project on a daily basis; and 4) Establishment of a system to monitor the progress of the Project on a regular basis. 5) Considering climate change and other environmental change, climate adaptable agricultural techniques are included in the Project Plan. Proper guidance by the DOH, PMU and PMC are expected.	

### Attachment 10.3.1 Surface Water Quality

#### Water Quality of River Yamuna in Haryana

Station Code	Locations	Year	Temperature °C		D.O. (mg/l)		pH		Conductivity (µ)		B.O.D. (mg/l)		Nitrate-N+		Fecal Coliform		Total Coliform		Fecal Streptoco	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1117	Yamuna at Hathnikund	2020	21	29	7.1	8.5	7.3	8.3	192	620	2.4	6.6	BDL	0.65	200	3200	110	21200		
		2021																		
1496	Yamuna at Kalanaur, Yamunanagar	2020	19	29	6.8	9.3	7.2	8.3	197	608	2.2	5.2	BDL	26	200	49000	3900	1600000		
		2021																		
1119	Yamuna at Sonepat	2020	14	35	7.1	10.6	6.5	8.6	235	683	1.8	5.5	BDL	0.36	110	220000	330	1600000		
		2021																		
10004	Yamuna at Khojipur Panipat	2020	24	26	5.6	8.6	6.9	8.4	230	761	1.5	9.1	BDL	1.95	34	110000	240	540000	9.3	28000
		2021																		
30032	Yamuna at Sonsuli Road, Shamli Border, Panipat	2020			6.9	9	7.1	8.3	175	392	1.2	6.4	BDL	1.01	26	18000	33	330000	4	920
		2021																		
30029	Yamuna at Sonipat, Bhagpat Road	2020			6.7	8.6	7.2	8.6	212	624	2.8	4.4	BDL	1.23	18	49000	92	79000	23	3400
		2021																		
10005	Yamuna at Palla, Sonepat	2020	14	35	5.8	12.5	6.7	8.6	271	682	1.6	5.6	BDL	0.54	170	94000	410	345000		
		2021																		

Source: Central Pollution Control Board  
BDL values for Conductivity (5 µ mhos/cm)

#### Water Quality of Medium and Minor Rivers in Haryana

Station Code	Locations	Year	Temperature °C		D.O. (mg/l)		pH		Conductivity (µ)		B.O.D. (mg/l)		Nitrate-N+		Fecal Coliform		Total Coliform		Fecal Streptoco	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1025	Gaggar GH-1 at Road BRDG. Sirsa, Debwali Road	2020			2.1	6.8	7.9	8.8	1356	3800	16	54	8	26	48000	210000	150000	320000		
		2021			5.1	5.9	8.1	8.3	2030	2240	38	42			90000	220000	210000	320000		
1026	Ghaggar GH-2 at Chandrapur	2020			2.1	7.4	7.6	8.7	1468	3450	18	52	10	34	64000	250000	110000	480000		
		2021			5.2	5.8	8	8.2	2630	2950	30	39			72000	280000	150000	420000		
1884	Kala Amb D/S Markanda River	2020	11	29	1.8	7.9	6.3	8.1	430	1804	4.5	58	0.03	1.14	2100	49000	84000	348000		
		2021			0.3	6.2	7.2	9.1	760	1261	2.8	42	0.1	0.3	800	41000	300	148000		
1885	Gaggar at D/S Surajpur	2020	14	29	6.8	9.2	7	8.8	382	938	2.6	6.8	0.28	0.91	200	34000	1100	278000		
		2021			4.9	7.4	7.7	8.2	392	568	2.8	5.4	0.3	0.88	200	9400	200	42600		
1887	Ghaggar before Ottu Weir (before mixing of Satluj Canal)	2020			0.9	6.4	8	9.1	1318	3830	22	64	6	18	11000	170000	72000	390000		
		2021			5.4	5.9	8	8.2	1850	2280	26	30			94000	210000	220000	390000		
30007	River Markanda at Naraingarh	2020			4.2	5.1	7.5	7.8	135	904	5.3	83	0.53	7.31	2000	1300000	4900	2400000		
		2021	25	33	4.2	5.6	6.9	7.5	439	905	3	29	0.32	1.22	13	3300000	23	4900000		
30014	River Ghaggar at Parwanoo D/S Amravati	2020			7.6	8.3	7.8	8.4	398	501	1	2.9	1.41	2.83	400	6800	11000	240000		
		2021	13	33	5.2	8.1	6.9	8.2	382	575	1.3	13	1.13	2.82	2800	130000	16000	270000		
30017	Ghaggar at Sirsa Dabwali Road	2020			3.8	3.8	7.7	7.7	1014	1040	16	16	3.24	3.24	830	830	4700	4700		
		2021	22	32	4.2	6.7	7.3	7.8	470	1378	4.9	11	1.99	4.98	78	110000	490	210000		
30018	Ghaggar at Chandrapur Siphon	2020			3.5	6.5	7.9	8.1	877	970	5.8	7.9	0.51	2.19	170	450	3300	4900		
		2021	23	33	0.3	5.3	7.3	7.9	498	1307	3	40	1.04	3.59	1300	4900	2300	23000		
30020	Ghaggar at Ottu Weir	2020			3.2	3.2	8.6	8.6	651	651	7.1	7.1	0.83	0.83	17000	17000	46000	46000		
		2021																		

Source: Central Pollution Control Board.

#### Water Quality of Lakes in Haryana

Station Code	Locations	Year	Temperature °C		D.O. (mg/l)		pH		Conductivity (µ)		B.O.D. (mg/l)		Nitrate-N+		Fecal Coliform		Total Coliform		Fecal Streptoco	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
3033	Sohna Lake	2020	5	13	6	6.8	7	7.9	340	920	4	19	2.1	9.3						
		2021	20.4	32	6.5	7.2	7	7.9	860	1360	4	9	0.8	3.2	6600	39000	32000	110000		
1349	Brahmsarovar Lake at Kurukshetra	2020	14	28	7	10.5	7.2	8.1	216	1850	1.6	5.2	0.09	2.3	200	2000	140	11000		
		2021			6.2	7.8	7.2	8	289	812	3.5	4.5	0.14	2.84	100	14100	100	34800		
1392	Sukhna Lake	2020																		
		2021																		
1392	Kausshalaya Lake, Pinjore	2020	14	29	6.7	9.6	7	8.4	329	905	1.2	7.6	0.06	3.14	130	26000	260	233000		
		2021			3.9	7.2	7.6	8.2	329	488	3.2	4.8	0.3	0.88	400	4800	100	12000		
3032	Sultanpur Lake, Delhi	2020					7.7	7.7	300	300	2.1	2.1	7.41	7.41	2	2	2	2		
		2021																		

Source: Central Pollution Control Board

#### Water Quality of Ponds in Haryana

Station Code	Locations	Year	Temperature °C		D.O. (mg/l)		pH		Conductivity (µ)		B.O.D. (mg/l)		Nitrate-N+		Fecal Coliform		Total Coliform		Fecal Streptoco	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
4857	Kurukshetra	2020	24	29	6.8	9.9	7.1	8.3	240	1720	2.2	7.5	0.05	2.38	100	100	110	1400		
		2021			6.3	8	7	7.8	280	785	3.4	4.6	0.18	0.3	100	11800	100	24000		

Source: Central Pollution Control Board

#### Water Quality of Drains in Haryana

Station Code	Locations	Year	Temperature °C		D.O. (mg/l)		pH		Conductivity (µ)		B.O.D. (mg/l)		Nitrate-N+		Fecal Coliform		Total Coliform		Fecal Streptoco	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
4860	Raina Drain meeting discharge of PHED STP, 6 MLD, Raina, Sirsa	2020	7.8	7.8	1.4	8.2	1170	4970	7.8	8.9	7	72	0.76	34	3600	180000	18000	470000		
		2021			5.2	6.1	1720	1870	7.2	7.9	21	28			77000	150000	120000	220000		

Source: Central Pollution Control Board

#### Water Quality of Canals in Haryana

Station Code	Locations	Year	Temperature °C		D.O. (mg/l)		pH		Conductivity (µ)		B.O.D. (mg/l)		Nitrate-N+		Fecal Coliform		Total Coliform		Fecal Streptoco	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1109	Western Yamuna Canal WC-1 (Y.Nagar) 100M D/S after receiving Ind. And Sew. Effl.	2020	20	28	6.7	8.4	7.2	8.1	184	618	1.8	6.5	0.31	0.81	20	3200	390	28000		
		2021			5.7	8.7	6.7	8.1	253	3040	1.8	4.5	BDL	0.5	100	400	100	2700		

### Attachment 10.3.1 Surface Water Quality

1110	Western Yamuna Canal WC-2 (near Karnal Lake) G.T. road, Karnal	2020	27	34	7.1	8.8	6.9	8.1	222	266	3.2	6.2	BDL	BDL	500	3200	1400	14000
		2021			5.9	6	7.4	7.8	222	497	2.4	4.2	BDL	BDL	2300	6300	10900	42600
1111	Western Yamuna Canal C-3 Delhi Branch at R.D. 245250	2020	20	35	6	9.2	7.2	8.7	215	630	2.2	5.8	0.42	0.52	200	1700	170	79000
		2021	27	27	5.4	7.4	7.6	8.1	220	328	2.5	4	BDL	BDL	100	4000	500	17700
1112	Western Yamuna Canal C-4 before entering into Delhi branch R.D. 282628	2020	20	35	6	9.3	7.1	8.6	220	2880	1.9	5.6	0.36	0.66	200	1700	130	17500
		2021	28	28	5.6	8.8	7.4	8.1	224	284	BDL	3.8	BDL	BDL	100	17500	300	34500
1113	Western Yamuna Canal WC-5 Sirsa Branch at Road Bridge, Karnal	2020			7	7	6.5	6.5	233	233	6	6	BDL	BDL	1100	1100	17000	17000
		2021			3.8	6.3	7.3	7.9	221	548	1.4	2.8	BDL	BDL	3300	13000	14100	54200
1114	Western Yamuna Canal WC-6 Sirsa branch at R.D. Bridge Jind Kaithal Road	2020			4	7.2	7.5	7.9	484	985	1.5	8			90	4500	1700	72000
		2021			5.8	6.2	7.8	8.1	858	910	4.5	5			150	280	1800	2100
1115	Western Yamuna Canal C-7 Delhi parallel branch at Khubru fall RD-145250	2020	22	35	6.2	9.4	7.1	8.8	213	895	1.4	6	0.38	0.45	500	1900	210	34500
		2021	25	25	5.5	7.2	7.4	8.1	214	304	1.8	3.2	BDL	BDL	200	4600	400	22100
1116	Western Yamuna Canal WC-4 Delhi parallel branch at Panipat	2020	20	29	7.1	9	6.5	8.5	200	337	1.3	8.6	0.32	8.1	200	2100	900	14800
		2021			6.3	9.6	7.6	8.1	213	316	2	3.8	BDL	0.2	1400	6300	3300	25300
1886	Western Yamuna Canal at Tejawala	2020	20	29	7.1	9	7.3	8.8	192	640	1.4	5.8	0.48	0.8	700	14000	260	160000
		2021			5.8	8	6.2	8.1	199	488	2.4	4.6	BDL	0.12	100	3400	200	14100
2056	Western Yamuna Canal at Damla D/S of Yamuna nagar	2020	28	29	6.9	7.9	6.4	7.9	199	280	2.6	3.4	BDL	BDL	90	800	1400	2700
		2021			6.1	8.5	7.3	7.9	256	330	1.8	5.2	BDL	BDL	500	900	1400	3300
3034	Western Yamuna Canal- Khubru Outfall	2020	21	35	6.1	8.9	7	8.6	217	485	2	5.8	0.31	0.33	70	1400	1100	8400
		2021	26	26	6.2	7.2	7.5	7.9	218	286	3.4	3.5	BDL	BDL	200	4300	700	7900
4858	Agra Canal at Village Mandkola in Nuh District	2020	13	29	5.3	6.8	6.5	7.4	936	2760	3.5	21	1.86	21.2	2200	39000	5800	197000
		2021	16	33	5.1	6.1	7	7.5	1120	2380	15	27			11000	38000	94000	192000
1419	Gurgaon Canal, GC-1, (near Badarpur Border)	2020	25	32	3.4	6.2	6.8	7.4	520	1970	12	26	1.5	6	820	29000	14000	96000
		2021	17	34	4.7	6.1	6.9	7.6	930	1720	15	29			12000	29000	67000	95000
4859	Confluence of Southern Ghaggar Canal, Sheranwali parallel Ghaggar Canal and Hisar Ghaggar Drain	2020			2.3	5.9	7.8	8.8	1530	3930	28	58	30	34	78000	180000	180000	350000
		2021			5.4	5.8	8	8.2	1950	2160	27	30			86000	210000	180000	320000

Source: Central Pollution Control Board  
BDL values for Conductivity (5  $\mu$  mhos/cm)  
Blank Cells indicates - Data not available

### Attachment 10.3.2 Ground water Quality in Haryana

Station Code	Locations	Year	Temperature °C		pH		Conductivity (umhos/cm)		B.O.D. (mg/l)		Nitrate-N+ Nitrite-N (mg/l)		Fecal Coliform (MPN/100ml)		Total Coliform (MPN/100ml)		Total Dissolved Solids (mg/L)		Flouride (mg/L)		Arsenic (mg/L)		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4828	Ground Water at Jhajjar	2020																					
		2021			7.8	7.8	318	796	1	4.5	1	1	490	490	3500	3500	220	478	0.3	0.3	0.001	0	
4829	Hand Pump near Water Works of PHED, Delhi-Rohtak Road, Sampla, Rohtak	2020			8.1	8.6	1361	1626									840	987					
		2021			8	8.1	1380	1510	1	1							840	896					
4830	Hand Pump near JLN Canal near Tilyar Lake at Rohtak	2020			8.6	8.6	2810	2810									1781	1781					
		2021			8.1	8.2	940	990	1	1							568	592					
4831	Borewell in front of CETP HSIIDC Rai, Sonapat	2020	28	28	7.6	7.6	1477	1477			0.88	0.88			500	500	868	868	BDL	BDL			
		2021																					
4832	Borewell in the Premises of CETP, Murthal, Sonapat	2020	28	28	7.9	8.4	944	3410			0.45	1.87			170	900	498	1888	BDL	BDL			
		2021	5.2	5.2	7.4	7.4	810	4330	1.8	5	0.3	5.6	3200	3200	30	8400	464	2360	2.1	2.1			
4833	Borewell in the Premises of DCRUST, Murthal, Sonapat	2020	29	29	8	8.4	940	1140			0.41	1.83			140	700	405	632	BDL	BDL			
		2021			8.3	8.3	973	973	1.4	1.4	0.3	0.3			20	20	530	530	2	2			
4834	Borewell of Star Complex Building near Civil Hospital, Delhi Road, Sonapat	2020	27	27	8.3	8.4	939	995			0.31	1.39			110	700	496	548	BDL	BDL			
		2021																					
4835	Borewell in the Premises of STP PHED, Khorkhoda, Sonapat	2020	28	28	8.3	8.3	933	933			0.33	0.33			700	700	498	498	BDL	BDL			
		2021																					
4836	Tubewell No. 1 near Upstream Ghaggar River, Village Chiali	2020			8.1	8.1	2132	2460									1215	1494					
		2021			7.5	7.8	912	982									510	587					
4837	Tubewell No. 2, near Gurudwara, Village Bhatia	2020			8.1	8.2	2392	2529									1438	1575					
		2021			7.8	8	1150	1240									698	750					
4838	Hand Pump installed near Pir Baba Mandir, Sector - 13, Bhiwani	2020			7.2	7.2	1140	1140									552	552					
		2021																					
4839	Tubewell at Prithala, Palwal	2020			7.3	7.3	2870	2870	5	5							1520	1520	0.4	0.4			
		2021			7.2	7.5	3140	4190	1	1	0.3	0.3					1730	2310	0.7	0.8			
4840	Tubewell at Hathin, Palwal	2020			7.2	7.3	2040	2160									1080	1120	0.3	1.2			
		2021			7.7	7.7	5740	5740	1	1	0.3	0.3					3160	3260	1.2	1.2			
4841	Tubewell at Garhi, Hodal, Palwal	2020			7.2	7.4	2010	2140									1100	1180	BDL	0.6			
		2021			7.2	7.2	4510	4510	1	1	0.3	0.3					2480	2480	0.7	0.7			
4842	Tubewell near Police Station	2020			7.1	7.2	1880	1960									1010	1010	BDL	0.4			
		2021			7.2	7.7	2380	2750	1	1				2	2	2	2	1310	1510	0.2	0.6		
4843	Gepil, Village Pali, Mohabatabad Crusher Zone, Faridabad	2020			6.8	6.9	630	640	5	5							340	350					
		2021	13	23	7.2	7.3	654	1140	1	1				2	2	2	2	360	630	0.2	0.2		
4844	Borewell near POSCO Company, Sector-14, Phase - II, Village Pathuhera, HSIIDC, IMT, Bawal	2020	11	11	7.5	7.5	1820	1820									1100	1100	0.6	0.6			
		2021	33.1	33.1	7.4	7.4	1590	1590					160	160	2100	2100	748	748					
4845	Borewell of HSIIDC Park, Sector - 1, IMT, Manesar, Gurugram	2020	6	9	6.8	7.7	1340	1520									670	670	0.8	0.75			
		2021																					

### Attachment 10.3.2 Ground water Quality in Haryana

4846	Tubewell No. 6 of HSIIDC, near Plot No. 237, Sector 37, Gurugram	2020	7	8	6.9	7.4	1280	2010									610	1210	1	1			
		2021																					
4847	Tubewell No. 4, Haily mandi, Tehsil-Pataudi (PWD), Gurugram	2020	5	9	6.9	7.7	1940	2320									910	1440	0.6	0.6			
		2021																					
4848	Tubewell HSSIIDC, near Plot No. 7, Sector 37, Gurugram	2020	6	8	7	7.5	1430	1540									710	920	1.1	1.1			
		2021																					
4849	Borewell at Entry Gate of Ansal Pioneer Industrial Park, Patheri, Bilaspur, Gurugram	2020	5	9	7	7.1	1040	1120									560	630	0.8	0.8			
		2021																					
4850	Borewell of Water Works, Sector - 35, HSIIDC, NH-8, Gurugram	2020	7	7	7	7.2	1010	1210									520	520	0.3	0.25			
		2021																					
4851	Borewell of PHED Office, Pataudi, Gurugram	2020	6	11	7	7.1	1490	1580									710	930	0.7	0.65			
		2021																					
4852	Tubewell at Fauji Dhaba, GT Karnal Road, Panipat	2020			7.8	0.8	1950	1950												BDL	BDL		
		2021			8.3	8.3	1788	1788	1	1	0.3	0.3			20	20	978	978					
4853	Tubewell near 25 MLD STP, Sewah, Panipat	2020			7.8	7.8	441	441												BDL	BDL		
		2021			8.1	8.1	1655	1655	1.2	1.2	0.3	0.3			20	20	904	904	0.7	0.7			
4854	Tubewell near 20 MLD STP, Village Jattal Road, Panipat	2020			7.7	7.77	1336	1336												BDL	BDL		
		2021			8.3	8.3	1160	1160	1	1	0.3	0.3			10	10	630	630	0.7	0.7			
4855	Tubewell near 5 MLD STP, Samalkha, Panipat	2020	28	28	8	8	1509	1509												BDL	BDL		
		2021			8.3	8.3	1291	1291	1.4	1.4	0.3	0.3			20	20	710	710	0.7	0.7			
4856	Tubewell at Assam Oil Petrol Pump, near Rohtak Road Bypass, Panipat	2020	28	28	8.2	8.2	1424	1424												BDL	BDL		
		2021			8.5	8.5	1156	1156	1.5	1.5	0.3	0.3			30	30	328	328	0.7	0.7			

Source: Central Pollution Control Board

BDL - Below Detectable Limit [values for Conductivity (5 µmhos/cm)]



### Attachment 10.3.3 Ground Water Chemicals

**Range of Chemical Constituents in Groundwater in Haryana State (2021-22)**

S. No.	Districts	No. of Samples	Range	pH	EC in $\mu$ S/cm at 25° C	CO <sub>3</sub>	HCO <sub>3</sub>	Cl	SO <sub>4</sub>	NO <sub>3</sub>	F	PO <sub>4</sub>	Ca	Mg	Na	K	SiO <sub>2</sub>	TH as CaCO <sub>3</sub>	SAR	RSC in meq/L
1	Ambala	15	Min	8	350	0	134	21	0	0	0.12	0	8.4	20	10	0.8	8	126	0	-
			Max	8	280	108	622	305	581	55	0.57	0	59	82	486	11	34	441	11	2.4
2	Bhiwani	34	Min	7	301	0	98	13	0	0	0.16	0	13	2.7	4.9	0	9	88	0.1	-
			Max	8	771	96	782	1892	1304	181	15.2	0	351	344	1037	185	45	1984	28	10
3	Faridabad	10	Min	7	790	0	63	142	19	0	0.04	0	13	48	73	1.6	10	252	1.8	-
			Max	8	567	124	571	1687	306	148	2.76	0	176	210	714	154	31	1216	14	7.1
4	Fatehabad	13	Min	8	321	0	84	13	0	0.25	0.22	0	18	11	10	2	11	153	0.3	-
			Max	8	692	96	391	1266	1424	107	3.59	0	334	306	634	40	24	2093	8.8	2.5
5	Gurugram	25	Min	7	268	0	79	20	0	0	0.11	0	8.3	2.5	5.7	0.8	9	82	0.2	-
			Max	8	861	156	913	2505	729	31	2.61	0.11	438	471	761	60	31	3031	17	14
6	Hissar	38	Min	7	282	0	56	20	0	0	0.11	0	13	2.7	4.5	1.7	14	99	0.1	-
			Max	8	111	164	727	2737	1573	502	13.9	0	354	666	1589	175	29	3014	14	8.4
7	Jhajjar	14	Min	7	267	0	139	13	0	0	0.2	0	13	13	9	0.7	6	109	0.3	-
			Max	8	455	151	741	993	631	194	10.7	0	258	232	471	415	17	1578	11	3.3
8	Jind	19	Min	7	513	0	84	33	0	3.6	0.19	0	8.8	17	34	4	7	109	0.5	-
			Max	8	837	170	950	1077	2631	312	13.9	0	601	421	758	514	15	3100	24	19
9	Kaithal	29	Min	8	230	0	70	13	0	0	0.05	0	4.4	5.3	4	0.8	10	33	0	-
			Max	8	550	120	461	1260	968	63	2.81	0	197	320	779	178	34	1622	18	7.5
10	Karnal	41	Min	7	295	0	70	13	0	0	0.1	0	8.8	2.7	4	0.5	8	33	0	-
			Max	8	270	120	629	306	729	60	1.09	0	158	146	281	18	32	942	11	5.1
11	Kurukshetra	23	Min	8	349	0	98	13	0	0.08	0.19	0	13	5.3	32	0.8	9	66	0.8	-
			Max	8	970	68	390	67	108	32	1.12	0	96	48	132	13	21	330	4.8	4.2
12	Mahendergarh	8	Min	8	535	31	48	14	0	4.8	0.34	0	8	15	53	0.8	10	82	1.6	-
			Max	8	454	140	508	1347	292	29	4.68	0	99	125	780	11	32	742	15	11
13	Mewat	11	Min	7	308	0	63	21	0	3.5	0.05	0	12	19	15	1.2	9	120	0.6	-
			Max	8	240	94	539	5388	4430	228	0.91	0	537	709	3678	92	39	3814	26	0.2
14	Palwal	23	Min	8	915	0	111	71	0	3	0.12	0	8	15	97	2.5	9	130	2.6	-
			Max	8	733	172	713	2084	687	159	3.28	0	72	350	960	520	34	1611	16	10
15	Panchkula	25	Min	8	268	0	48	14	0	0	0.05	0	4	7.3	15	1	10	50	0.6	-
			Max	8	143	109	286	156	109	185	1.14	0	39	61	190	4	24	300	11	5.7
16	Panipat	22	Min	7	396	0	127	13	0	0	0.21	0	8	10	40	2	5	62	1.1	-
			Max	8	436	250	910	1226	508	141	6.41	0	116	255	1050	142	18	1340	50	21
17	Rewari	13	Min	8	818	47	32	57	0	5.1	0.29	0	8.3	10	140	0.4	9	72	4.3	-
			Max	8	416	281	1063	794	846	28	8.16	0.16	91	143	864	4.5	28	742	24	22
18	Rohtak	11	Min	8	891	0	222	35	0	0.7	0.11	0	17	13	68	3.2	0	93	1.6	-
			Max	8	109	82	412	2772	2386	128	5.92	0	70	594	1420	304	32	2619	17	6.9
19	Sirsa	37	Min	7	272	0	56	13	0	0	0.25	0	8.8	8	4.1	0.9	14	88	0.1	-
			Max	8	112	192	838	2292	1974	401	5.02	0	285	586	1264	160	30	3123	25	14
20	Sonapat	35	Min	7	99	0	48	14	0	0	0.04	0	4.4	5.3	7	0.3	4	33	0.2	-
			Max	8	631	109	666	1106	1124	175	2.8	0	158	266	992	197	14	1490	13	8.9
21	Yamunanagar	20	Min	8	245	16	48	7.09	0	0	0.14	0	8	12	7	1.3	9	90	0.2	-
			Max	8	101	62	238	177	239	28	0.76	0	32	54	132	21	19	290	3.8	3.4

Source: Ground Water Year Book of Haryana State (2021-2022).

- pH Potential of Hydrogen
- EC in  $\mu$ S/cm Electrical Conductivity
- CO<sub>3</sub> Carbon Trioxide
- HCO<sub>3</sub> Bicarbonate
- Cl Chlorine
- SO<sub>4</sub> Sulfate
- NO<sub>3</sub> Nitrate
- F Fluorine
- PO<sub>4</sub> Phosphate Ion
- Ca Calcium
- Mg Magnesium
- Na Sodium
- K Potassium
- SiO<sub>2</sub> Silicon Dioxide
- TH as CaCO<sub>3</sub> Total Hardness
- SAR Sodium Absorption Ratio
- RSC in meq/L Residual Sodium Carbonate

## Attachment 10.3.4 Draft Environmental and Social Assessment Framework (ESAF)

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## **Draft Environmental and Social Assessment Framework (ESAF)**

### **1 Background**

The state of Haryana, constitute the Shivalik and Aravali range with a geographical area of about 44,212 km<sup>2</sup> and a population of 25,351,462 out of which 65% live in rural area (Census of India 2011). The state is divided in 22 districts. More than 44% of the total population of Haryana engaged in agriculture. Haryana is rich in history, monuments, heritage, flora and fauna, human resources and tourism with well-developed economy, national highways, and state roads. It is bordered by Himachal Pradesh to the north-east, by river Yamuna along its eastern border with Uttar Pradesh, by Rajasthan to the west and south, and Ghaggar-Hakra River flows along its northern border with Punjab. Haryana is included in the economically important National Capital Region for the purpose of planning and development as it surrounds the national capital Delhi on the three sides (north, west and south). The state is among the wealthiest and most economically developed region in South Asia. Haryana is known as the “Breadbasket of India” and also one of the leading states for Agriculture production in the country.

### **2 Objectives and Scope of ESAF**

Throughout the project’s design and implementation, it is highly important to carefully assess the Environmental and Social vulnerabilities within the society. Environmental vulnerability refers to the state where human activities, natural causes, or a combination of both threaten the coherence of ecosystem over spatial or temporal scales. Vulnerability could possibly increase with the intensity and frequency of human interventions and/or natural hazards. On the other hand, social vulnerability is inability or helplessness of people/ societies to withstand adverse impacts from various stressors they encountered. Often, these vulnerable groups are socially excluded, underprivileged, and face discrimination, limiting their access to development benefits and socio-economic opportunities.

The Environmental and Social Assessment Framework (ESAF) for the “Haryana Sustainable Horticulture Promotion Project (HSHPP)” has been prepared to act as the primary reference document that outlines the Environmental and Social Considerations (ESC) that will be dealt with the Env & Social vulnerabilities in project design and implementation.

#### **2.1 Objectives of ESAF**

The primary objective of the HSHPP is to promote sustainable agriculture in Haryana by supporting crop diversification by introducing horticultural crops such as fruit and vegetables. Also, it seeks to improve facilities and capacity building for value chain development, thereby contributing to the state's socio-economic development by promoting sustainable agriculture and increasing the income that includes small-scale and marginal farmers, through project activities and the

interventions.

While the project is not anticipated to have significant adverse environmental and social impacts, there is a possibility of minor negative environmental and social impacts due to the developmental activities. Therefore, the draft ESAF is prepared to evaluate and safeguard against such impacts, ensuring compliance with JICA's guideline for Environmental and Social Considerations in development projects, as well as relevant national and state regulations.

The project covers multi-sectoral interventions and activities, that would be implemented at several sites/locations, and many of these activities are yet to be defined in absolute details such as site location, coverage, size/scope of the activity. Thus, in these circumstances, it would be inapt at this stage of the project preparation to assess the environmental and social impacts and propose detailed management and mitigation measures. However, the Survey Team has outlined preliminary procedures to manage and mitigate potential risks associated with these activities during project implementation. Accordingly, ESAF has been drafted to provide guidance on the appropriate management and mitigation measures against associated environmental and social risks as the main safeguards instrument based on the existing environmental and social management systems in India, including the state of Haryana, and as per JICA's guidelines for environmental and social considerations.

## 2.2 Target Social Groups of ESAF

ESAF shall cover all communities and people living within the project area. The framework is designed to ensure participation of all in the course of the project implementation and include as beneficiaries of the project. Also, the framework will help in avoiding/mitigation of any negative impacts due to the Project. **Table 1** indicates the key groups identified in ESAF to address environmental and social considerations. It should be noted that an individual or household may be categorised into more than one of the categories below:

**Table 1 Key Targeted Social Groups of ESAF**

Social Groups	Definition/ Description
<b>Small scale and marginal farmers</b>	The terms "small-scale farmers" and "marginal farmers" are used to categorize farmers based on the size of their landholdings. Small scale and marginal farmers tend to cultivate agricultural land with a relatively small landholding. The marginal farmers own less than 1 hectare land while the small farmers occupy 1–2-hectare land. The percentage distribution of number of operational holdings for all social groups in Haryana is 49.29% for marginal farmers and 19.28% for small farmers. In Haryana, 4,50,040 households are below poverty line.
<b>Scheduled Castes (SCs)</b>	In Haryana, Scheduled Castes refers to a specific group of people who have been historically marginalized and disadvantaged due to their social status. These communities were notified as the SCs as per provisions contained in Clause 1 of Articles 341 and 342/ Clause 24 of Article 366 under the Constitution of India which require special consideration for safeguarding their interests and to accelerate their socio-economic development.  In the state of Haryana, there are 36 notified communities belonging to SCs. The Schedule Caste population lives in scattered households or concentrated colonies with people of other caste groups. The SCs comprise about 20.17% of the total population of the state. Highest concentration of SCs population is reported from district Hisar (8%), Sirsa (7.6%), Bhiwani (6.7%) and Karnal (6.6%).

Social Groups	Definition/ Description
<b>Other Backward Classes (OBCs)</b>	<p>Other Backward Class (OBC) is a collective term used by GoI to classify castes which are socially and educationally disadvantaged; the Constitution of India describes OBCs as “socially and educationally backward classes”. All tribal communities and castes deemed under article 341 and 342 of the constitution of India are considered backward classes and there are OBC, which are not scheduled.</p> <p>According to the Directorate of Welfare of Scheduled Caste &amp; Backward Classes, there are 78 communities in Haryana that belong to OBC. However, the Census does not have a separate category for Other Backward Classes (OBCs) as a whole. OBCs are considered part of the general population, and their data is collected along with the general category.</p>
<b>Women and Female Headed Households</b>	<p>Women play distinct and diverse role in terms of agricultural production (e.g. sowing, tending/weeding, marketing/selling produce, collection of NTFPs, craft production). Over time, there has been notable progress in women’s economic growth, literacy, education, and access to communication and banking service. In Haryana, as per 2015-16 estimated figures<sup>1</sup>, the total women farmer population stood at 240,000 (14.89%) in comparison to 1,371,000 (85.10%) of male farmers. The recognition of female-headed households is crucial in understanding and addressing gender-related issues and empowering women in the community.</p>

*Source: Compiled and modified by JICA Survey Team (2023)*

### 2.3 Structure of ESAF

The structure of the ESAF of the Project is summarised below:

- i) **Project Summary Description** will describe the project objectives, proposed Project components and expected outcomes, phasing of Project, etc,
- ii) **Environmental and Social Safeguard Policies of JICA:** Briefly describes JICA’s environmental and social safeguard policies, and clarifies how the Project shall be categorised and what types of measures will be required,
- iii) **Existing Environmental and Social Management Systems:** Outline the legal and policy context for environmental and social safeguard in India as well as in the Haryana state,
- iv) **Environmental and Social Considerations and Potential Impacts:** Details-out the environmental and social considerations within the Project and assessment of positive and negative impacts,
- v) **Environmental and Social Management Measures and Monitoring:** Explains the procedures to be followed to manage and monitor environmental and social aspects, including the procedures for the preparation of environmental management plan and environmental monitoring plan,
- vi) **Institutional Arrangement and Capacity Development for ESAF:** Identifies the recommended institutional arrangement and capacity development and training requirements for effective implementation of ESAF,
- vii) **Public Consultation Mechanism:** Describes the mechanisms for public consultations including Free, Prior and Informed Consent (FPIC) as one of important principles,
- viii) **Grievance Redress Mechanism:** Identifies the available and suggested mechanisms for grievance redress, and

<sup>1</sup> <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1780263>

- ix) **Cost Estimation and Budget Allocation:** Identifies the required cost to implement ESAF, with the estimation of the necessary human resources and capacity development programme, and its budget allocation.

### 3 Project Summary Description

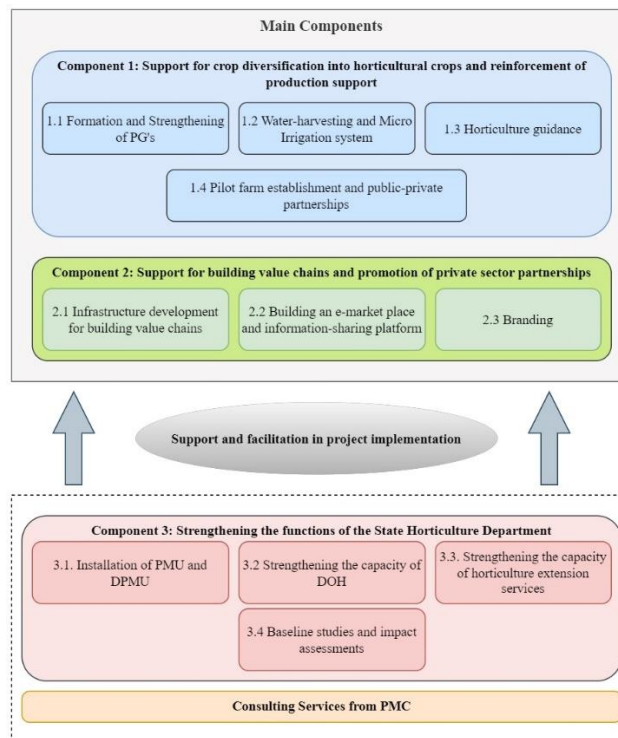
Outline of the project is summarized as follows.

**Table 2 Project Summary Description**

Item	Description
Project Objectives	To promote sustainable agriculture in Haryana by supporting crop diversification by introducing horticultural crops such as fruit and vegetables. Also, it seeks to improve facilities and capacity building for value chain development, thereby contributing to the state's socio-economic development by promoting sustainable agriculture and increasing the income that includes small-scale and marginal farmers, through project activities and the interventions.
Identified Project Area	All 22 districts (Ambala, Bhiwani, Charkhi Dadri, Faridabad, Fatehabad, Gurugram, Hisar, Jhajjar, Jind, Kaithal, Karnal, Kurukshetra, Mahendragarh, Nuh, Palwal, Panchkula, Panipat, Rewari, Rohtak, Sirsa, Sonipat, and Yamuna Nagar)
Proposed Project Components	<p>There are four major project components as described below.</p> <ol style="list-style-type: none"> <li>1) Support for crop diversification into horticulture crops and Reinforcement of production support.               <ol style="list-style-type: none"> <li>1.1 Formation and Strengthening of Producer Groups (PGs).</li> <li>1.2 Water-harvesting and Micro irrigation system.</li> <li>1.3 Horticulture guidance.</li> <li>1.4 Pilot farm establishment and Public-private partnerships.</li> </ol> </li> <li>2) Support for building value chains and Promotion of private sector partnerships.               <ol style="list-style-type: none"> <li>2.1 Infrastructure development for building value chains.</li> <li>2.2 Building an e-market place and an information-sharing platform.</li> <li>2.3 Branding</li> </ol> </li> <li>3) Strengthening the functions of the State Horticulture Department.               <ol style="list-style-type: none"> <li>3.1 Installation of PMU and DPMU</li> <li>3.2 Strengthening the capacity of DOH</li> <li>3.3 Strengthening the capacity of horticulture extension services</li> <li>3.4 Baseline studies and impact assessments</li> </ol> </li> <li>4) Consulting services from PMCs.</li> </ol> <p>Refer figure-1 for details about the components of the project.</p>
Project Implementation Structure	Department of Horticulture, Haryana is the Executing Agency and Project Management Unit (PMU) shall be fully responsible for the project implementation at the state level. After completion of the project, DoH would continue to be responsible for the efficient operation and maintenance of the assets created through the project. The PMU shall have the Governing Council and Executive Committee to take necessary policy decisions. Under

	<p>the DOH, PMU would be established at state level with headquarter at Panchkula for smooth implementation, decision making &amp; budgetary appropriations. At District level, District Project Management Units shall be established for project implementation at the district level and below.</p> <p><i>Project Management Unit (PMU) at Panchkula:</i> The State level PMU at Panchkula shall handle the overall project planning, management, overall project coordination including with JICA, MOA&amp;FW &amp; DEA, overall procurement management, financial management including collecting the expenditure statements from District Project Management Units (DPMUs) and Project Management Unit (PMU) and consolidate these for the reimbursement claims to JICA, monitoring and evaluation preparation, quarterly progress reports and Project Completion Report.</p> <p><i>District Project Management Units (DPMUs):</i> 22 District Project Management Units (DPMUs) shall be established at all 22 districts of Haryana (District Ambala, Bhiwani, Charkhi Dadri, Faridabad, Fatehabad, Gurugram, Hisar, Jhajjar, Jind, Kaithal, Karnal, Kurukshetra, Mahendragarh, Nuh, Palwal, Panchkula, Panipat, Rewari, Rohtak, Sirsa, Sonapat, and Yamuna Nagar). DPMU shall function as the dedicated and extended wing of the PMU for project implementation at the district level and as a subordinate office of the autonomous society. The main function of DPMUs would be to facilitate project implementation at the district level, and to extend all technical inputs and guidance to the PGs.</p>
Implementation Schedule of the Proposed Project	The project duration would be for 8 years starting from January 2024
Reasons for sub-projects and their Target location remaining undecided	Location of Pack House development and Support for crop diversification in the project will be decided after democratic consultation with the PGs and individuals in the larger interest of the small and marginal farmers. Thus, as part of ESAF detailed screening criteria is prepared to avoid/mitigate any probable risk and negative impact arising out of them during the site-specific sub-project selection.

Source: Prepared by JICA Survey Team (2023)



**Figure-1: Main Project Components**

## 4 Environmental and Social Safeguard Policies of JICA

### 4.1 JICA Principles for Environmental and Social Considerations

The environmental and social safeguards policies of JICA are covered within the JICA Guidelines for Environmental and Social Considerations (2022), in which it is committed to ensure that human rights are respected and that environmental issues are seriously considered in its investments, projects and programmes, with the following principles:

- ❖ JICA considers a wide range of environmental and social impacts in its projects.
- ❖ Initiate environmental and social considerations from the project's inception until the monitoring stages.
- ❖ Prioritize impact avoidance, then minimize, reduce, and mitigate when necessary, and consider compensations for significant impacts.
- ❖ Ensure accountability and transparency in implementing cooperation projects.
- ❖ Actively involve stakeholders, incorporate their opinions, and seek consensus in decision-making.
- ❖ Proactively disclose environmental and social considerations to promote accountability and stakeholder engagement.
- ❖ Strengthen organizational capabilities to effectively implement environmental and social



considerations.

- ❖ Address project implementation requests promptly while including environmental and social considerations.

#### 4.2 Key Process Elements as per the requirements of JICA Guideline

Key processes in JICA projects related to environmental and social considerations are summarised below.

##### (1) Categorisation of Projects

Projects are categorised according to the scope/severity of the environmental and social impacts or risks, indicated as follows;

- **Category A:** The projects that likely to have significant adverse impacts on the environment and society, projects with unprecedented impacts that are difficult to assess, or the projects with wide range of impacts or irreversible impacts. (e.g., Large-scale development/infrastructure),
- **Category B:** The potential adverse impacts on the environment and society are less than those of Category A. Generally site-specific impacts, few impacts are irreversible, normal mitigation measures can be designed,
- **Category C:** These projects likely to have minimal/little adverse impact on the environment and society.
- **Category FI (Financial intermediary):** JICA provides funding for these projects to a financial intermediary or executing agency. The financial intermediary agency is mainly responsible for selecting and appraising sub-projects under these initiatives, but this can only occur after JICA's funding approval or project appraisal. Consequently, the specific sub-projects cannot be identified prior to JICA's approval. Additionally, these sub-projects are anticipated to have impacts on the environment and society.

Since the specific sub-projects in the proposed project cannot be identified prior to JICA's approval as mentioned in the JICA guidelines for environmental and social considerations (April 2022), , thus, the project is currently categorised as 'FI' as per the JICA Guidelines (2022).

The proposed Project is not anticipated to have any significant negative /adverse effects on the environment equivalent to Category A rather it is expected to reduce several environmental and social issues related to groundwater usage through crop diversification and water saving techniques for judicious usage of ground water and maintaining soil fertility that is anticipated to help in overall sustainability of agriculture in the project area. Developing supply chain in the form of Packhouse development by involving PGs will ensure longevity of the perishable horticulture produce and better price for the farmers and expected to increase the farmer's income. Other

proposed infrastructure of DoH will further strengthen the agriculture/horticulture sector in the state. While, the exact locations and scales of the sub-projects cannot be determined precisely at the time of JICA appraisal, the project will explicitly avoid including sub-projects that is expected to have significant environmental impacts or risks and falls under “Category A” according to JICA guidelines. The following Table 3 shows projects which are classified as Category A according to JICA guidelines.

**Table 3 Projects Classified as Category-A according to JICA Guidelines**

Category	Sectors and Characteristics
1. Large-scale projects in the sensitive sectors	<ul style="list-style-type: none"> <li>(1) Mining, including oil and natural gas development.</li> <li>(2) Oil and gas pipelines</li> <li>(3) Industrial development</li> <li>(4) Thermal power, including geothermal power.</li> <li>(5) Hydropower, dams, and reservoirs</li> <li>(6) Power transmission and distribution lines involving large-scale involuntary resettlement, large-scale logging, or submarine electrical cables.</li> <li>(7) Rivers/erosion control</li> <li>(8) Roads, railways, and bridges</li> <li>(9) Airports</li> <li>(10) Ports and harbours</li> <li>(11) Water supply, sewage, and wastewater treatment that have sensitive characteristics or that are located in sensitive areas or in their vicinity.</li> <li>(12) Waste management and disposal</li> <li>(13) Agriculture involving large-scale land clearing or irrigation</li> </ul>
2. Project with the sensitive characteristics	<ul style="list-style-type: none"> <li>(1) Large-scale involuntary resettlement (number of Displaced Persons is more than 200)</li> <li>(2) Large-scale groundwater pumping</li> <li>(3) Large-scale land reclamation, land development, and land clearing</li> <li>(4) Large-scale logging</li> </ul>
3. Projects in the sensitive areas or their vicinity	<ul style="list-style-type: none"> <li>(1) National parks, nationally-designated protected areas (including areas for ethnic minorities and cultural heritage, etc. designated by national governments)</li> <li>(2) Areas in danger of large-scale salt accumulation or soil erosion.</li> <li>(3) Areas with a remarkable tendency of desertification.</li> <li>(4) Areas with unique archaeological, historical, or cultural value</li> <li>(5) Areas inhabited by ethnic minorities, with traditional ways of life, and other areas with special social value</li> </ul>

*Source: JICA Environmental and Social Guidelines (2022)*

At the time of selection, finalisation and approval of sub-projects, respective sub-projects will be categorized as either “Category B” or “Category C” according to the scope and severity of the environmental and social impacts or risks.

(2) Potential Impacts Assessment

Various environmental and social impacts and risks are thoroughly considered to maximize positive benefits while simultaneously minimizing negative effects through avoidance and mitigation

measures. **Table 4** indicates the required items to be assessed as potential environmental and social impacts respectively.

**Table 4 Potential impacts to be assessed**

Type of Impact	Items to be Assessed
Environmental Impact	Potential Impact on the natural environment transmitted through air, water & ground water, soils, waste, accidents, water usage, climate change, ecosystem services, biodiversity and trans-boundary impacts
Social Impact	Potential Impact on farmers/people's lands, involuntary resettlement, migration of population, local economy including livelihoods, employment, social institutions, vulnerable groups, gender, indigenous peoples, children, health, cultural heritage, utilization of land and local resources, existing social infrastructures and services, equality of benefits and losses, local conflicts, working conditions, etc.

*Source: Compiled by JICA Survey Team (2023) based on the JICA Guidelines for Environmental and Social Considerations 2022*

### (3) Information Disclosure and Consultation

The Executing Agency (EA) of the Project will be responsible for monitoring the sub-projects according to the Environmental Monitoring Programme (EMoP), which is a requirement for only Category B sub-projects. The information regarding environmental and social impacts of these sub-projects is encouraged to be disclose to all relevant stakeholders. Also, Implementing Agency (IA) will prepare an annual report of the Project, incorporating the relevant ESC report as a dedicated chapter/section.

## 4.3 Compatibility with International Standards

JICA substantiates that its projects align with the World Bank's Safeguard Policies, using them as a benchmark for international development standards. It also references internationally recognized standards, or international standards, treaties, and declarations, and the good practices of developed nations as relevant.

JICA also suggests international policies, procedures, and standards such as of the World Bank and their relevance to the Project.

## 4.4 Requirements as per JICA Guidelines

As per the JICA guidelines, the project implementation is subject to examination based on the following conditions mandated for financial intermediaries or executing agencies:

- a) Ensuring appropriate environmental and social considerations,
- b) Assessing the institutional capacity of the financial intermediary or executing agency to confirm environmental and social considerations and measures to strengthen the capacity, if necessary,
- c) Evaluating potential positive and negative environmental impacts of sub-projects, and implementing appropriate measures to avoid, minimise, mitigate, or compensate for

- potential negative impacts while promoting positive impacts where possible,
- d) Requiring disclosure of the environmental reviews result on the intermediary or executing agency's website after concluding agreement documents, and
  - e) Confirming the results of monitoring items with significant environmental impacts in consultation with project proponents for projects falling under Categories A, B, and FI.

## 5 National and State Level Framework for Environmental and Social management

The following section emphasizes the evaluation of existing environmental and social management systems in India and the state of Haryana and explores the potential approaches for implementing the Project. The Study Team's assessment confirms that the existing legal and regulatory frameworks are aligned with the requirement of both JICA Guideline as well as the World Bank's Safeguard Policies. An overview of the environmental and social legal frameworks, along with institutional arrangements processes and implementation procedures, are presented below.

### 5.1 Existing Environmental Clearance Procedures

India has taken significant steps to address environmental challenges by enacting strict environmental legislation, encompassing various laws, rules, regulations, notifications, and policies. To ensure protection and management of environment, the country has established institutions responsible for monitoring and enforcing these laws.

In the following sections, the processes adopted in India for environmental clearance is described. The projects and activities requiring "Environmental Clearance" (EC) are broadly classified into two categories - **Category A** (hereafter refer to as "Indian EIA Category A") and **Category B** (hereafter refer to as "Indian EIA Category B"). This categorization is based on the potential impacts on natural and man-made resources.

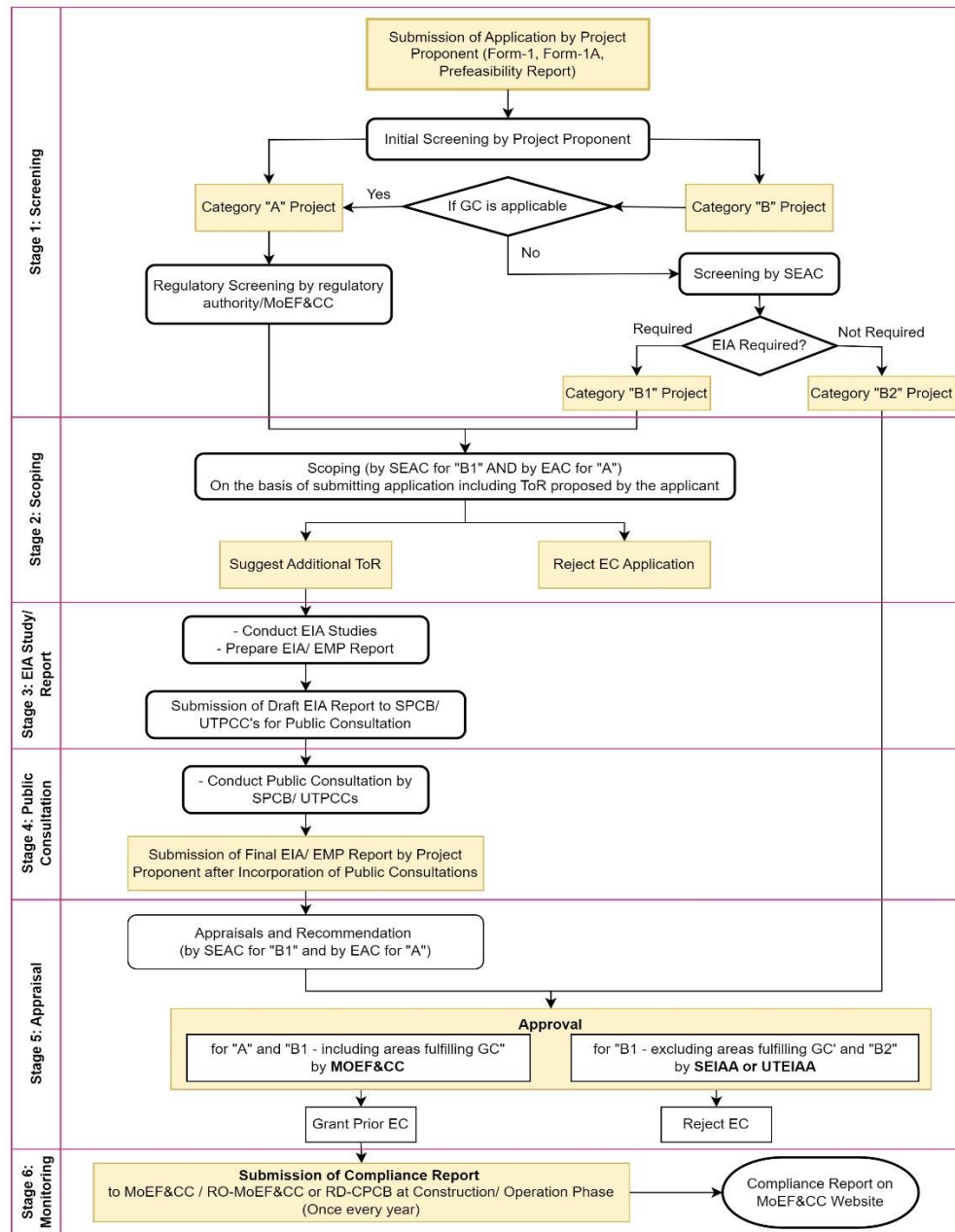
**For Category 'A'** projects, EIA studies and "Public Consultation" are mandatory, following the procedure outlined in the Notification. The environmental clearance is obtained from the Central Government or MoEF&CC.

**Category 'B'** projects fall under the jurisdiction of the state authority as mentioned in EIA notification 2006 and decentralized procedure is done. The Government of India has established the State Expert Appraisal Committee (SEAC) and State Environmental Impact Assessment Authority (SEIAA) committee for to facilitate this process. The category 'B' projects are further divided into **Category 'B1'** (projects that require submitting an EIA report) and **Category 'B2'** (project activities which exempted from EIA report submission).<sup>2</sup>

The environmental clearance procedure, as per EIA notification 2006, consists of six stages: **(Figure 2)** 1) *Screening*, 2) *Scoping*, 3) *EIA Study*, 4) *Public Consultation*, 5) *Appraisal*, and 6) *Monitoring*.

---

<sup>2</sup> Source: EIA Notification 2006



**Note:**  
EAC: Environmental Appraisal Committee  
EIA: Environmental Impact Assessment  
EMP: Environmental Management Plan  
GC: General Conditions  
MoEF&CC: Ministry of Environment and Climate Change  
RO: Regional Office

RD: Regional Directorate  
SPCB: State Pollution Control Board  
SEAC: State Level Expert Appraisal Committee  
SEIAA: State Level Environmental Impact Assessment Authority  
UTEIAA: Union Territory Level Environmental Impact Assessment Authority  
UTPCC: Union Territory Pollution Control Committee

Source: Prepared by JICA Survey Team (2023) based on EPA 1984 and Notification 2006 and Amendments, MoEFCC

**Figure 2 Prior Environmental Clearance Process as per Indian EIA Law**

## 5.2 Existing Social Management Procedures

JICA concerns that development projects are implemented with special attention to vulnerable groups such as the poor, landless/landed poor, indigenous peoples (or STs in India) and women. Rights of local communities and STs should be respected in all interventions. In case of Haryana there is ST population in the state.

The potential negative social impacts are much lower compared with the large infrastructure

projects which involve physical displacement and involuntary resettlement, but still there is a possibility to negatively impacts the local communities on their livelihoods, loss of access, ownership or use rights, and increased conflicts on agriculture lands. Therefore, Relevant Social Policies, Laws and Regulations in India and the state of Haryana have been identified with respect to addressing social issues and concerns, for the types of activities that have been proposed under the Project. The Project will involve the local communities to work through their respective village level implementation bodies in the designated project areas and thus the relevant labour laws are also listed up.

In the following sections, the procedures for land acquisition and involuntary resettlement applied in India are presented.

#### (1) Land Acquisition and Involuntary Resettlement

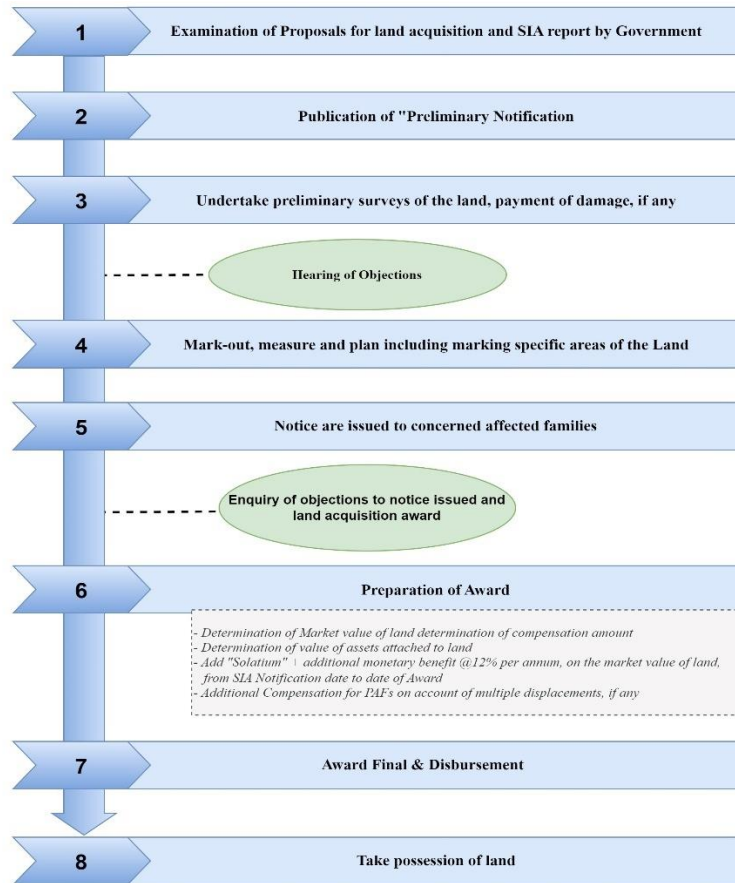
“The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 [No. 30 of 2013] dated 26th September 2013” (RFCTLARR Act 2013), came into force on 01<sup>st</sup> January 2014, is the legal foundation for all matters related to land acquisition and involuntary resettlement in the country.

According to the Act; it ensures “a humane, participative, informed and transparent process for land acquisition for the purpose of industrialisation, development of essential infrastructural facilities and urbanisation, which is in consultation with the local self-government institutions and *Gram Sabhas* established under the Constitution”.

Also, the Act ensures that the negative impacts on the landowners and other affected families shall be minimised with the provision of just and fair compensation to the affected families, leading to an improvement in their socio-economic status for their rehabilitation and resettlement.

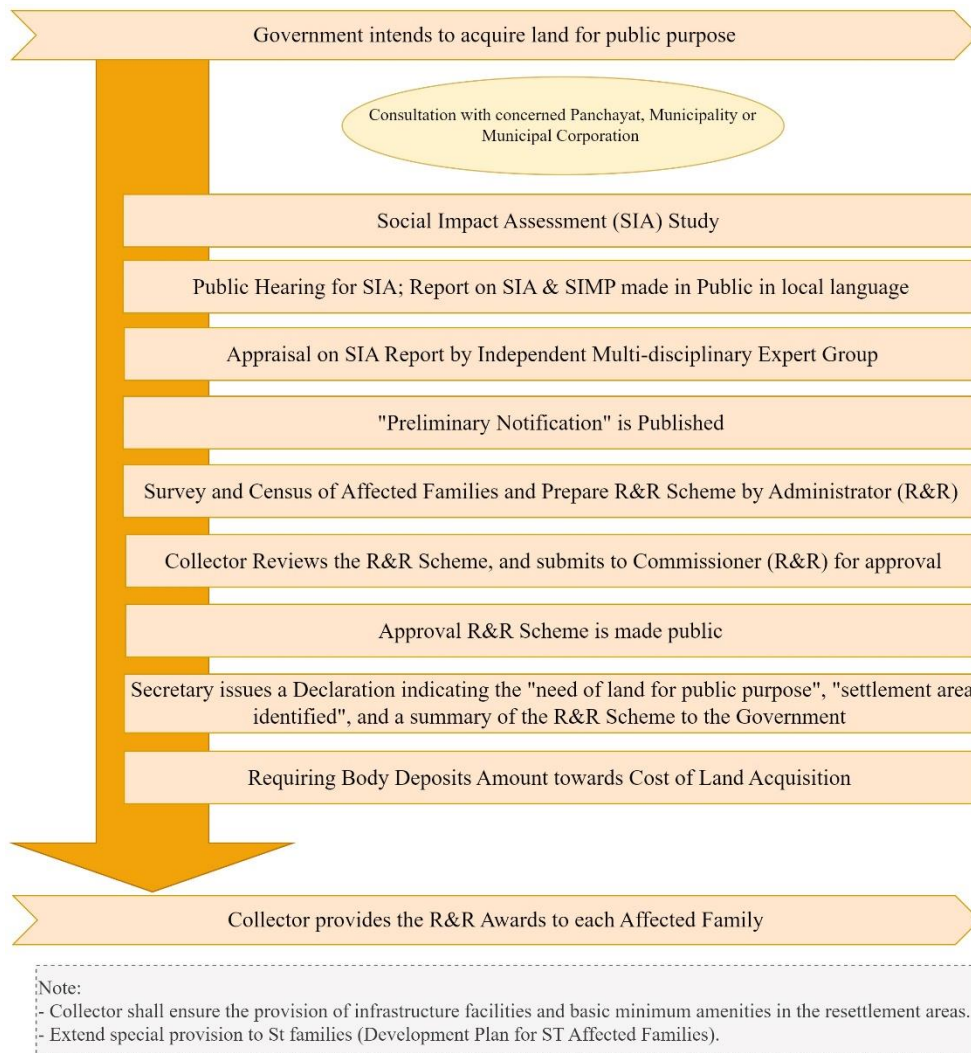
The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement, Rules 2013. The main provisions of the Act include the need to secure the consent of the land owners before any land can be acquired, the payment of compensation to the land owners, the provision of rehabilitation and resettlement of the affected people, the need to ensure that any acquired land is used for a public purpose, and the requirement to undertake an environmental impact assessment before any land is acquired. Further, it provides for the establishment of an Acquisition Authority and requires the state government to set up grievance redressal mechanisms for any affected parties. The Act also provides for the Tribunal for Land Acquisition to hear and decide disputes related to land acquisition in the state. The Land Acquisition Act of Haryana serves to ensure that the rights of the landowners are respected, that the acquisition of land is done in a fair and transparent manner, and that any acquired land is used for a public purpose.

The processes involved in land acquisition and involuntary settlement are depicted in **Figure 3** and **Figure 4** respectively.



Source: JICA Survey Team (2023) based on information from RFCTLARR Act 2013 and subsequent Rules

**Figure 3 Flow Diagram for Land Acquisition Process**



Source: Compiled by JICA Survey Team (2023) based on information from RFCTLARR Act 2013 and subsequent Rules

**Figure 4 Flow diagram for Resettlement and Rehabilitation**

### 5.3 Gaps between JICA Guideline and existing Environment and Social Management System within the Executing/Implementing Agency

The Department of Horticulture, government of Haryana, will be the Executing Agency (EA), and the PMU shall be responsible for the implementation of the entire Project. The PGs will control and support the project activities in their lands from farmer's perspective. The key gaps and shortfalls identified in each institution in comparison to international standards as indicated in the JICA Guidelines are summarised in **Table 5**.

**Table 5 Key Gaps and Shortfalls in Comparison to the Standards in the JICA Guidelines**

Executing Agency/ Body	Key Gaps and Shortfalls	Possible Gap Filling Measures
Executing agency	- Prior consultations with beneficiaries and project-affected communities are limited during the project formulation stages	- Application of ESAF - Implementation of Capacity



Executing Agency/ Body	Key Gaps and Shortfalls	Possible Gap Filling Measures
(DoH)	<ul style="list-style-type: none"> <li>- Insufficient appraisal of environmental and social considerations prior to implementation (weak baseline for impact evaluation)</li> <li>- Restricted procedures for environmental screening and subsequent management of environmental risks associated with small-scale construction and other activities with potential adverse impacts.</li> <li>- Inadequate monitoring of safeguard processes and procedures</li> <li>- Lack of SMS or trained officials on social and environmental safeguards</li> </ul>	<ul style="list-style-type: none"> <li>- Development Plan for Environmental and Social Safeguards</li> <li>- Engagement of Subject Matter Specialist (M&amp;E)</li> <li>- Consultation with Supporting technical institutions, KVKs, COEs, Universities and DOA</li> </ul>
DPMUs/ PGs	<ul style="list-style-type: none"> <li>- Inadequate awareness of potential environmental impacts</li> <li>- Lack of understanding of safeguard processes and procedures</li> <li>- Insufficient appraisal of environmental and social considerations prior to implementation (weak baseline for impact evaluation)</li> <li>- Lack of monitoring of environmental and social safeguards</li> <li>- Lack of trained officials on social and environmental safeguards</li> </ul>	<ul style="list-style-type: none"> <li>- Application of ESAF</li> <li>- Implementation of Capacity Development Plan for Environmental and Social Safeguards</li> <li>- Engagement of Subject Matter Specialist (ESAF)</li> </ul>

Source: JICA Survey Team (2023)

DoH does not have any direct mandate and system for environment and social management, for screening, managing, and monitoring environmental and social risks. Thus, it is recommended to incorporate nodal officer and subject matter specialist to look after the ESC/ M&E. Also, to support the PMU there will be Environmental Monitoring Expert as well as M&E expert (who will also look after the social aspects of ESAF) under PMC to establish and institutionalise ESMS within the project and ESAF compliance. The details are further described in **Section 8** of this document.

## 6 Potential Environmental and Social Impacts and their Mitigation Measures

As mentioned above, it is impracticable at this survey phase to assess the detailed environmental and social impacts and propose management and mitigation measures for each sub-project level which are not yet defined in detail. Therefore, in this section, the potential environmental and social impacts for proposed broad types of activities are assessed and mitigation measures are proposed through ESMS checklist (**Appendix 1**), and component-wise potential deleterious environmental and social impacts assessment (**Table 6** and **Table 7**). The purpose of the initial assessment is to summarise the potential (especially negative) impacts which could be referred when Environmental Management Plans (EMPs) as well as Environmental Monitoring Plan (EMoP) are required to prepare. Also, IA, i.e. PMUs, can refer these documents at the screening and selection stage of sub-projects as reference documents as well as during construction phase/implementation which indicate major points to be concerned from ESC perspective.

### 6.1 Environmental Considerations and its Potential Impacts

#### (1) Environmental Scoping

JICA guidelines indicate a wide range of environmental considerations that are required to be taken into account. Initial scoping identified the following impacts on the natural environment to be assessed.

- ❖ Air, Water, Waste and Soils (resulting from infrastructure activities and agricultural chemical use)
- ❖ Ecosystems (especially fauna and flora, afforestation, sites of importance to biodiversity conservation and protected areas)

The purpose of scoping is to identify the potential environmental and social impacts caused by the Project based on available secondary data and information, and preliminary site reconnaissance.

## (2) Assessment of Potential Environmental Impacts

### i) Positive Environmental Impacts

The proposed Project will achieve crop diversification and value chain creation in Haryana by supporting horticulture developments such as micro irrigation and other infrastructure development, post-harvest and marketing development, strengthening horticulture extension services through capacity development and livelihood development of the farmers. The associated activities are expected to present some environmental benefits, including;

- ❖ Efficient utilisation of water for irrigation
- ❖ Growing a variety of horticultural crops ensures access to diverse and nutritional foods.
- ❖ Planting different crops can improve soil health, reduce pest and disease pressure, and promote biodiversity.
- ❖ New technologies and practices improve post-harvest handling, processing, and transportation.
  - Diversification and value chain activities can encourage the adoption of sustainable agricultural practices, reducing the reliance on harmful chemicals and promoting more eco-friendly approaches.
  
- ❖ DOH to be well equipped and strengthened to manage sound horticulture extension with active participation of an empowered & organized farmers.
- ❖ The project's support for horticulture facilities, micro-irrigation, and water harvesting will lead to increased crop diversity. Farmers will be encouraging to grow a wider variety of crops, reducing their reliance on monoculture and enhancing agriculture resilience.
- ❖ Through the promotion of environmentally friendly cultivation practices such as water-saving techniques, organic farming, and sustainable methods, the project will contribute to preserving natural resources and reducing the environmental footprint of agricultural activities.
- ❖ By promoting the adoption of climate change-adapted crops and encouraging diversification of crops, the project will help farmers adapt to changing climate conditions. This risk management strategy will make agriculture more resilient to climate-related challenges.

### ii) Negative Environmental Impacts

The potential negative environmental impacts associated with each project component is depicted in **Table-6**. The table includes all aspects of implementation components. Specific mitigation measures to the project components and activities are also indicated and these measures will be implemented through ESAF, especially through EMP and EMoP.

## **6.2 Social Considerations and Potential Impacts**

### **(1) Social Scoping**

JICA Guideline specifies a wide range of social aspects to be considered. Initial scoping identified the following social impacts to be assessed:

- ❖ land acquisition
- ❖ Poverty, vulnerability and loss of livelihoods
- ❖ Specific impacts on Scheduled Castes (SCs), Other Backward Classes (OBC), etc.

### **(2) Assessment of Potential Social Impacts**

#### **i) Positive Social Impacts**

The primary objective of the Project is to achieve crop diversification and value chain creation by supporting horticulture development interventions. Another focus area of the project is livelihood development and nutrition improvement of the local communities; thus, it is anticipated to provide various social benefits to the local communities that would include:

- ❖ Participation of marginalised community in decision making process
- ❖ Strengthening of community institutions/PG's
- ❖ Improvement of physical capital for rural communities, including poor, with the help of renovation/ upgraded agricultural infrastructure,
- ❖ Income opportunities from agriculture products would result in enhanced financial capital
- ❖ Well managed agriculture land and marketing would improve livelihood of the farmers,
- ❖ Improve local market opportunities and living conditions of the community,
- ❖ Increase in employment and income levels of people in agriculture and allied activities,

#### **ii) Negative Social Impacts**

The detailed potential negative social impacts or risks associated with each project component are depicted in **Table 7**. Impacts on the social setting often over-weigh the environmental risks associated with the project activities. The project area includes the SCs and other farmers, vulnerable groups including women, widows, destitute, poor, landless, etc., on whom potentially significant social safeguard issues could be linked with respect to their lands and impacts on their livelihoods.

**Table 6 Potential Deleterious Environmental Impacts**

Component/ Sub-Component	Activities	Potential Environmental Concerns	Mitigations Measures/ Suggestions
<b>Component 1: Support for crop diversification into horticultural crops and Reinforcement of production support</b>			
1.1 Formation and strengthening of PG's	(1) Training to CEO/ BoDs in Financial Management, Organizational Management, and Marketing Capacity. (2) Market survey with SHEP concept (3) Business Planning by PGs (4) Implementation of Business Plan (5) Supports for building facilities (necessary hand holding by TSG availing benefits of schemes for micro-irrigation and packhouses and in documentation etc.) (6) Provision of technical training (7) Covering management costs of PG's (8) Provision of equity grant	<ul style="list-style-type: none"> <li>- These activities are to be carefully implemented to ensure that there is no negative impact on the environment.</li> <li>- Ensure democratisation within the group and small and marginal farmer's as well as women farmer's participation and interests are protected so that they adopt sustainable agriculture practices.</li> </ul>	<ul style="list-style-type: none"> <li>- PMU to prepare implementation norms and guidelines on strengthening PGs, including eligible PGs, eligible assistances, application, and selection procedures, etc.</li> <li>-</li> </ul>

Component/ Sub-Component	Activities	Potential Environmental Concerns	Mitigations Measures/ Suggestions
1.2 Water harvesting and Micro Irrigation system	(1) Water Harvesting facilities (2) Micro Irrigation	<ul style="list-style-type: none"> <li>- Increased water usage for micro-irrigation and water harvesting may lead to a high demand for water resources, potentially putting strain on local water supplies, especially in regions facing water scarcity.</li> <li>- Water harvesting facilities may alter the natural flow of water bodies, potentially affecting aquatic ecosystems and habitats.</li> <li>- The use of fertilizers and pesticides in horticultural practices can lead to chemical runoff, polluting nearby water sources and harming aquatic life.</li> <li>- The expansion of horticultural facilities may result in the conversion of natural habitats, potentially impacting local biodiversity.</li> <li>- Micro-irrigation might increase demand for electricity/ diesel based pump sets that can have negative environmental impact</li> </ul>	<ul style="list-style-type: none"> <li>- Provision for creation of ponds would ensure storage of rainwater and reduce dependency on groundwater extraction</li> <li>- Implement efficient water management practices to optimize water use, such as drip irrigation and rainwater harvesting techniques.</li> <li>- Employ erosion control measures, such as contour farming and mulching, to prevent soil erosion and runoff.</li> <li>- Adopt integrated pest management practices to minimize the use of harmful chemicals and reduce the impacts on the environment.</li> <li>- Regularly monitor the environmental impacts of horticultural facilities and take corrective actions when necessary. Micro Irrigation methods are proposed that includes sprinklers and drip irrigation and this will help in judicious usage of water.</li> <li>- Less ground water draft and higher water productivity from use of efficient irrigation technologies</li> <li>- Crop diversification from water intensive crops to water efficient horticulture crops.</li> <li>- Trainings to the farmers on judicious water usage.</li> <li>- Regulation among PG's for judicious usage of irrigation water</li> <li>- Effective ground-based monitoring of the irrigation water use regularly by PG's members</li> <li>- Provision of installation of solar powered pumps will reduce dependency on electricity/diesel pumpsets and is environmental friendly.</li> </ul>

Component/ Sub-Component	Activities	Potential Environmental Concerns	Mitigations Measures/ Suggestions
<p>1.3 Horticulture guidance</p>	<p>(1) Visual aid training material preparation and Collaboration with institutes that provide trainings in horticulture                      (2) Climate smart horticulture training                      - Vegetables                      - Fruits (general fruits)                      - Exotic vegetables for focus areas                      - Fruits (peach)                      - Cultivation techniques in floriculture                      - Cultivation techniques on spices, medicinal and aromatic plants                      - Cultivation techniques on mushroom                      - Apiculture/ Beekeeping techniques                      - Nursery raising techniques                      - Food processing for women                      - Provision of Farm machinery                      - Nutrition Improvement</p>	<ul style="list-style-type: none"> <li>- Intensive cultivation, even in diversified cropping, can impact soil health if not managed sustainably, leading to soil erosion, nutrients depletion, and decreased soil fertility.</li> <li>- The expansion of agriculture, even when promoting climate-adapted and diversified crops, may lead to the conversion of natural habitats and loss of biodiversity.</li> <li>- Training programs and workshops, especially if involving travel and equipment, can result in increased energy consumption and greenhouse gas emissions.</li> <li>- Workshops and training sessions may generate waste, such as printed materials and disposable items, contributing to waste production and pollution.</li> </ul>	<ul style="list-style-type: none"> <li>- Promote soil conservation practices, like cover cropping and reduced tillage, to maintain soil health and fertility.</li> <li>- Incorporate measures to protect and enhance biodiversity, such as maintaining buffer zones and conserving natural habitats.</li> <li>- Opt for energy-efficient methods, like using renewable energy sources for workshops and training sessions.</li> <li>- Encourage waste reduction, recycling, and responsible waste management during workshops and training activities.</li> <li>- Provide training and create awareness about Integrated Pest Management and Integrated Nutrition Management.</li> <li>- Promotion of climate resilient varieties and their nursery raising</li> </ul>
<p>1.4 Pilot farm Establishment at Centre of Excellence and public-private partnerships</p>	<p>(1) Pilotfarm establishment under Centre of Excellence                      (2) Village of Excellence                      (3) Industry-Government-Academia collaboration</p>	<ul style="list-style-type: none"> <li>- The construction and operation of agricultural facilities may generate waste materials, which could lead to improper waste management and environment pollution.</li> <li>- Workshops and on-site training sessions may generate waste, such as disposable items, contributing to waste production and pollution.</li> <li>- On-farm experiments may potentially lead to pest infestation and risks can be minimised by proper planning and management.</li> </ul>	<ul style="list-style-type: none"> <li>- Implement sustainable farming methods that promote soil health, reduce water usage, and minimize the use of chemicals.</li> <li>- Optimize the use of land, water, and energy to minimize environmental impacts.</li> <li>- Implement proper waste management practices, such as segregation, recycling and composting, to reduce waste and its environment impact.</li> <li>- Implement IPM strategies within the experimental plots. This approach involves using a combination of cultural, biological, and chemical control methods to manage pests effectively while minimizing environmental impact.</li> </ul>
<p><b>Component 2:</b> Support for building value chains and promotion of private sector partnerships</p>			

<p>2.1 Infrastructure development for building value chains</p>	<p>Construction of :</p> <ol style="list-style-type: none"> <li>(1) Feed packhouse</li> <li>(2) Lead packhouse</li> <li>(3) Fulfilment centers</li> <li>(4) Retail Outlets</li> </ol> <p>Categories and approximate area of the infrastructure :</p> <ol style="list-style-type: none"> <li>1. Category-1 (Built-up Area: 200 sq. m)</li> <li>2. Category-2 (Built-up Area: 400 sq. m)</li> <li>3. Category-3 (Built-up Area: 1500 sq. m)</li> <li>4. Category-4 (Built-up Area: 3,500 sq. m)</li> <li>5. Category-5 (Built-up Area: 4,000 sq. m)</li> <li>6. Lead Packhouse (Built-up Area: 4,000 sq. m)</li> <li>7. Fulfilment Centre (Built-up Area: 6,000 sq. m)</li> </ol>	<ul style="list-style-type: none"> <li>- Construction works may lead to air and noise pollution.</li> <li>- Construction works may lead to smoke and dust from construction sites.</li> <li>- Water mixed with concrete, oil from construction equipment may contaminate nearby agriculture lands, water sources and channels, agricultural fields, etc.</li> <li>- Construction worker's labour camps may lead to deterioration of environment.</li> <li>- Digging top soils for construction of facilities might lead to soil erosion</li> <li>- The construction of these facilities may require the conversion of agricultural land or natural habitats, leading to potential loss of biodiversity and disruption of ecosystems.</li> <li>- The construction process may consume significant resources, including energy, water, and materials, potentially contributing to environmental pressures and resource depletion.</li> <li>- Construction activities can generate construction waste, which, if not properly managed, could lead to improper disposal and environmental pollution.</li> <li>- Transportation of materials and goods to and from construction sites and facilities can contribute to greenhouse gas emissions and air pollution.</li> <li>- The operations of these facilities may require water for cleaning, and other purposes, potentially affecting local water resources and causing runoff issues if not properly managed.</li> <li>- The operational phase of these facilities may require significant energy consumption, especially for</li> </ul>	<ul style="list-style-type: none"> <li>- Construction equipment to be serviced regularly and installed with noise mufflers and resonators.</li> <li>- Sprinkling of water in the construction sites and nearby areas</li> <li>- Ensure proper storage of and control on spillage of diesel, machine lubricants, and other oils.</li> <li>- Judicious use of water and containment of water from construction site</li> <li>- Proper disposal of solid wastes from labour camps</li> <li>- Proper disposal of wastewater from labour camps</li> <li>- Provision of fuel for cooking and heating to avoid cutting from forests.</li> <li>- Ensure construction will be avoided in monsoon. The excavated soil will be used/stabilized immediately after the excavation or debris should be sent to disposal site at the earliest.</li> <li>- Conduct thorough environmental impact assessments before construction to identify potential environmental risks and develop mitigation plans.</li> <li>- Implement green building practices to reduce resource consumption and waste generation during the construction phase.</li> <li>- Adopt proper waste management and recycling practices to minimize waste generation and ensure proper disposal.</li> <li>- Integrate energy-efficient technologies and renewable energy sources in the design and operation of these facilities to reduce energy consumption and carbon emissions.</li> <li>- Implement water-efficient practices, such as rainwater harvesting and water recycling, to reduce water usage and runoff issues.</li> <li>- Incorporate measures to protect and enhance biodiversity, such as creating green spaces and preserving natural habitats around these facilities.</li> </ul>
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Component/ Sub-Component	Activities	Potential Environmental Concerns	Mitigations Measures/ Suggestions
		refrigeration and climate control, leading to higher carbon emissions if not efficiently managed.	
2.2. Building an e-market place and an information sharing platform	(1) The call centres (2) Data Centre setup (3) Dx Portal (Software module)	- E-market place is not expected to have any major environmental negative impact	- There is no major negative environmental impact anticipated due to the sub-project activities
2.3 Branding [Promotion of the brand 'Haryana Fresh' (vegetables produced in Haryana) and its sales promotion]	(1) Development of branding strategy (2) Development of Sales Strategy (3) Development of Promotion strategy (4) Building Partnerships	- Empowering local farmers will not have a negative impact on the environment. -	- Recommendation to promote farmers for Environment Friendly produce/ organic produce and creating Environment friendly brand
Component 3: Strengthening the functions of the State Horticulture Department			
3.1 Installation of PMU and DPMU	Establish and effective PMU (1) and DPMU (22)	- The establishment of Project Management Unit (PMU) and District Project Management Units (DPMUs) with inexperienced staff lacking desired skill sets may cause lapses in the adoption of the required technical processes that might cause environmental impact.	- Detailed ToR and role and responsibility chart is prepared. - Ensure the recruitment is done based on the merit and experienced and skilful candidates are selected by a committee.



Component/ Sub-Component	Activities	Potential Environmental Concerns	Mitigations Measures/ Suggestions
3.2 Strengthening the capacity of DOH	(1) Strengthening the capacity of DoH (2) Review of overall project implementation plan (3) Procurement of Equipments and tools for PMU [including new buildings for PMU and DPMU's]	<ul style="list-style-type: none"> <li>- As confirmed by DoH, the new buildings for PMU and DPMU would be constructed within the existing DoH, Govt of Haryana complexes, so land acquisition/procurement is not required.</li> <li>- Noise/ Air/ Land pollution due to construction activity of PMU and DPMU buildings</li> </ul>	<ul style="list-style-type: none"> <li>- Advocate for the adoption of integrated pest management practices to reduce reliance on chemical pesticides and promote natural pest control methods.</li> <li>- Support the adoption of climate-smart agriculture techniques to reduce carbon emissions and enhance climate resilience.</li> <li>- Crop diversification from water intensive crops to horticulture crops would result in reduction in groundwater usage and would be environment friendly.</li> <li>- All laid down procedures for construction work need to be diligently followed as per the</li> <li>- Construction equipment to be serviced regularly and installed with noise mufflers and resonators.</li> <li>- Sprinkling of water in the construction sites and nearby areas</li> <li>- Ensure proper storage of and control on spillage of diesel, machine lubricants, and other oils.</li> <li>- Judicious use of water and containment of water from construction site</li> <li>- Proper disposal of solid wastes from labour camps</li> <li>- Proper disposal of wastewater from labour camps</li> <li>- Provision of fuel for cooking and heating to avoid cutting from forests.</li> <li>- Ensure construction will be avoided in monsoon. The excavated soil will be used/stabilized immediately after the excavation or debris should be sent to disposal site at the earliest.</li> </ul>
3.3 Strengthening the capacity of horticulture extension services	Enhancing DOH staff capacity in the horticulture sector through training and specialist knowledge development	<ul style="list-style-type: none"> <li>- Capacity building would not pose environmental concerns as it is expected that the objective would be on sustainable agriculture techniques</li> </ul>	-
3.4 Baseline studies and impact assessment	Evaluate sub-project performance and strengthen agriculture data collection and analysis	<ul style="list-style-type: none"> <li>- The recording of the information and the type of tools used if not done properly may not give true picture of the actual information/impact of environmental parameters.</li> </ul>	<ul style="list-style-type: none"> <li>- Impact of crop diversification and water saving irrigation techniques on the groundwater regime, crop production, air pollution, soil health, and farmers income need to be scientifically collected and well documented.</li> </ul>
Component 4: Consulting services			

Component/ Sub-Component	Activities	Potential Environmental Concerns	Mitigations Measures/ Suggestions
4.1 Employment of PMCs	Establish an effective PMC	- Employment of PMCs are not expected to have a negative impact on the environment.	- Timely deployment of PMC would ensure crucial support during the preparatory stage of the project as well that would include development of guidelines/ manuals, environmental screening, capacity building etc. which is very crucial for the project.

Source: Compiled by JICA Survey Team (2023)

**Table 7 Potential Deleterious Social Impacts**

Component/ Sub-Component	Activities	Potential Social Concerns	Mitigations Measures/ Suggestions
<b>Component 1: Support for crop diversification into horticultural crops and Reinforcement of production support</b>			
1.1 Formation and strengthening of PG's	(1) Training to CEO/ BoDs in Financial Management, Organizational Management, and Marketing Capacity. (2) Market survey with SHEP concept (3) Business Planning by PGs (4) Implementation of Business Plan (5) Supports for building facilities (necessary hand holding by TSG availing benefits of schemes for micro-irrigation and packhouses and in documentation etc.) (6) Provision of technical training (7) Covering management costs of PG's (8) Provision of equity grant	<ul style="list-style-type: none"> <li>- If not implemented carefully, the training and platform-building activities may inadvertently aggravate existing inequalities among PG's members. Some members may benefit more from the training and platform access, leading to disparities in decision-making and resource allocation within the PG's.</li> <li>- Certain members of PG's, such as women, marginalized groups, or those with limited access to resources, may face barriers to participating fully in the training or accessing the platform. This could lead to their exclusion from important decision-making processes and information sharing.</li> <li>- If the training and platform are not designed to foster self-reliance and ownership within PG's, there may be a risk of creating dependency on external support for decision-making and problem-solving.</li> <li>- Training and platform building need to be sensitive to cultural norms and practices within PG's to avoid undermining traditional practices and values.</li> </ul>	<ul style="list-style-type: none"> <li>- PMU to select and contract TSGs to facilitate formation and strengthening of PGs.</li> <li>- Ensure an inclusive and participatory approach to training and platform building, considering the diverse needs and perspectives of all PGs members, including marginalized groups.</li> <li>- Incorporate gender-sensitive strategies to promote the active participation of women in all aspects of activities.</li> <li>- Empower PG's members to take ownership of the activities, emphasizing their leadership and decision-making roles.</li> <li>- Customize the training and platform-building approaches to respect and accommodate the cultural values and practices of the PG's members.</li> </ul>

Component/ Sub-Component	Activities	Potential Social Concerns	Mitigations Measures/ Suggestions
1.2 Water harvesting and Micro Irrigation system	(1) Water Harvesting facilities (2) Micro Irrigation	<ul style="list-style-type: none"> <li>- The installation of horticultural facilities may lead to issues related to land access and tenure, potentially marginalizing small-scale or marginalized farmers who have limited access to land.</li> <li>- The cost of installing horticultural facilities may be prohibitive for some farmers, leading to economic disparities between those who can afford the facilities and those who cannot, potentially widening income gaps.</li> <li>- Gender roles and dynamics within farming communities may influence access to and control over horticultural facilities. Women may have limited decision-making power or access to resources, affecting their ability to benefit fully from these interventions.</li> <li>- The introduction of new technologies and practices may disrupt traditional farming practices and community cohesion, leading to potential social tensions.</li> <li>- The installation of water harvesting facilities may lead to conflicts over water allocation among different users, potentially affecting social harmony.</li> </ul>	<ul style="list-style-type: none"> <li>- Involve all stakeholders, including small-scale and marginalized farmers, in the planning and decision-making processes related to horticultural facility installation.</li> <li>- Provide support mechanisms such as subsidies, credit, or financing options to ensure that all farmers, especially smallholders, can afford the horticultural facilities.</li> <li>- Incorporate gender-sensitive strategies to promote the active involvement of women in decision-making processes and ensure equitable access to resources and benefits.</li> <li>- Conduct extensive community consultations and awareness campaigns to address concerns, build consensus, and maintain social cohesion.</li> <li>- Implement transparent and inclusive water governance systems to address potential conflicts over water allocation.</li> <li>- Provide information/assistance related to different government schemes and subsidies for various items and supporting them in availing the same.</li> </ul>

Component/ Sub-Component	Activities	Potential Social Concerns	Mitigations Measures/ Suggestions
<p>1.3 Horticulture guidance</p>	<p>(1) Visual aid training material preparation and Collaboration with institutes that provide trainings in horticulture</p> <p>(2) Climate smart horticulture training</p> <ul style="list-style-type: none"> <li>- Vegetables</li> <li>- Fruits (general fruits)</li> <li>- Exotic vegetables for focus areas</li> <li>- Fruits (peach)</li> <li>- Cultivation techniques in floriculture</li> <li>- Cultivation techniques on spices, medicinal and aromatic plants</li> <li>- Cultivation techniques on mushroom</li> <li>- Apiculture/ Beekeeping techniques</li> <li>- Nursery raising techniques</li> <li>- Food processing for women</li> <li>- Provision of Farm machinery</li> <li>- Nutrition Improvement</li> </ul>	<ul style="list-style-type: none"> <li>- Farmers with limited access to educational opportunities or training resources may be excluded from participating in training programs and workshops, leading to potential disparities in knowledge and skill development.</li> <li>- Introducing new agricultural practices may challenge traditional farming practices deeply ingrained in local cultures, leading to resistance and social tensions within farming communities.</li> <li>- In some regions, gender norms and roles may influence farmers' access to training programs and decision-making processes, potentially limiting women's participation and benefits from these activities.</li> <li>- The promotion of diverse crops and climate-adapted varieties may impact market access if there is limited demand or inadequate market infrastructure for these crops, affecting farmers' income and livelihoods.</li> <li>- Ensuring effective knowledge dissemination and adoption of sustainable practices can be challenging, especially among small-scale and remote farmers, leading to slow uptake of new techniques.</li> </ul>	<ul style="list-style-type: none"> <li>- Ensure an inclusive approach to training programs and workshops, reaching out to all farmers, including those with limited access to resources and education.</li> <li>- Provide financial support or access to credit for farmers to invest in the transition to environmentally friendly and diversified farming practices.</li> <li>- Tailor training programs to be culturally sensitive, respecting and integrating local knowledge and practices in the adoption of new techniques.</li> <li>- Promote gender equity by providing equal opportunities for men and women to participate in training programs and decision-making processes.</li> <li>- Establish market linkages and value chains for diverse crops to ensure farmers have access to markets and receive fair prices for their products.</li> <li>- Strengthen extension services to facilitate effective knowledge dissemination and ensure farmers receive ongoing support and guidance in adopting sustainable practices.</li> </ul>

Component/ Sub-Component	Activities	Potential Social Concerns	Mitigations Measures/ Suggestions
<p>1.4 Pilot farm Establishment at Centre of Excellence and public-private partnerships</p>	<p>(1) Pilot farm establishment under Centre of Excellence                      (2) Village of Excellence                      (3) Industry-Government-Academia collaboration</p>	<ul style="list-style-type: none"> <li>- The promotion of specific techniques may impact farmers who are accustomed to traditional farming practices. Some farmers may face difficulties in adapting to the new methods, leading to temporary disruptions in livelihoods.</li> <li>- The adoption of new farming techniques may lead to varying levels of success among farmers. Those who successfully adopt the new techniques and technologies may experience improved incomes, while others who struggle to transition may face income disparities.</li> <li>- Farmers with limited access to training and resources may face challenges in adopting new farming techniques and may feel left behind in the changing agricultural practices, leading to a knowledge divide among farmers.</li> <li>- The introduction of new farming techniques may lead to varying levels of interest and participation within the farming community, potentially impacting social cohesion and collaboration among farmers.</li> <li>- The reliance on existing COEs for training and support may create dependency on external assistance, potentially limiting farmers' self-reliance and decision-making autonomy.</li> </ul>	<ul style="list-style-type: none"> <li>- Involve farmers in the decision-making process and encourage their active participation in the planning and implementation of new farming techniques to ensure inclusivity and ownership.</li> <li>- Provide training and capacity-building opportunities for farmers to learn and adopt new farming techniques to ensure that all farmers have access to knowledge and resources.</li> <li>- For farmers who finds it difficult to visit the CoE, village of Excellence is proposed to serve as a localized hub in rural areas, acting as an extension of the pilot farm and bringing the advancements and knowledge right to the doorsteps of farmers.</li> <li>- Tailor support mechanisms to meet the diverse needs of farmers, providing targeted assistance to those who face challenges in adopting the new techniques.</li> <li>- Encourage knowledge sharing and peer-to-peer learning among farmers to bridge the knowledge divide and foster collaboration within the farming community.</li> <li>- Empower farmers to make informed decisions about their agricultural practices, ensuring they have the autonomy to adapt new farming techniques to their specific contexts.</li> </ul>
<p><b>Component 2: Support for building value chains and promotion of private sector partnerships</b></p>			

Component/ Sub-Component	Activities	Potential Social Concerns	Mitigations Measures/ Suggestions
2.1 Infrastructure development for building value chains	Construction of : (1) Feed packhouse (2) Lead packhouse (3) Fulfillment centers (4) Retail Outlets  Categories of Packhouse: 1. Category-1 (Built-up Area: 200 sq. m) 2. Category-2 (Built-up Area: 400 sq. m) 3. Category-3 (Built-up Area: 1500 sq. m) 4. Category-4 (Built-up Area: 3500 sq. m) 5. Category-5 (Built-up Area: 4,000 sq. m) 6. Lead Packhouse (Built-up Area: 4,000 sq. m) 7. Fulfillment Centre (Built-up Area: 6,000 sq. m)	<ul style="list-style-type: none"> <li>- Although the construction of such facilities may require acquisition of land, the project proponent will not be required to acquire the land directly. The sub-projects will be supported for construction of such facilities by the PGs/ private entities who may require to purchase/ lease the land.</li> <li>- The introduction of modern facilities and technology may result in changes to the local labor market. Traditional small-scale farmers and laborers may face challenges in adapting to the new market dynamics, potentially leading to unemployment or underemployment.</li> <li>- The presence of modern facilities may lead to income disparities within the community. Local farmers and vendors might face competition from larger businesses in the retail outlets, affecting their income and economic stability.</li> </ul>	<ul style="list-style-type: none"> <li>- Involve local communities and stakeholders in the planning and decision-making process to address concerns, ensure fair compensation, and design projects that align with the community's needs and aspirations.</li> <li>- Implement measures to support local farmers and laborers during the transition, such as providing training, capacity-building programs, and access to new market opportunities.</li> <li>- Integrate measures to preserve and promote local culture and traditional practices in and around the facilities.</li> </ul>

Component/ Sub-Component	Activities	Potential Social Concerns	Mitigations Measures/ Suggestions
2.2. Building an e-market place and an information sharing platform	(1) The call centers (2) Data Centre setup (3) Dx Portal (Software module)	<ul style="list-style-type: none"> <li>- The implementation of an e-marketplace and platform may widen the digital divide, as not all farmers and FPO members may have access to technology or the skills to use the platforms effectively, potentially marginalizing some farmers and communities.</li> <li>- Collaboration with private companies and markets may lead to an imbalance of power, with larger companies potentially exerting undue influence over smaller PG's, affecting fair pricing and negotiation dynamics.</li> <li>- The use of digital platforms may raise concerns about privacy and data security, especially if sensitive information about farmers or PG's is shared without adequate safeguards.</li> <li>- Exclusion of certain PG's or farmers from the collaboration or platform due to market dynamics or other factors, it could exacerbate social inequalities and leave some farmers without the benefits of the shared information and practices.</li> </ul>	<ul style="list-style-type: none"> <li>- Ensure that all farmers and PG's have access to training and support in using digital platforms effectively, bridging the digital divide.</li> <li>- Promote fair market practices and transparent pricing mechanisms to avoid market power imbalances and ensure fair trade for all stakeholders.</li> <li>- Implement robust data protection measures and privacy policies to safeguard farmers' and PG's' information on the platforms.</li> </ul>
2.3 Branding [Promotion of the brand 'Haryana Fresh' (vegetables produced in Haryana) and its sales promotion]	(1) Development of branding strategy (2) Development of Sales Strategy (3) Development of Promotion strategy (4) Building Partnerships	<ul style="list-style-type: none"> <li>- The promotion of Haryana Fresh may results in market dominance, it may lead to reduced opportunities for other local farmers or smaller producers to compete, potentially impacting their livelihoods.</li> <li>- The benefits of increased market value may not be equally distributed among all farmers, potentially widening income disparities between large-scale and small-scale farmers.</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage local farmers to diversify their marketing channels, including both the Haryana Fresh brand and other local markets, to reduce dependency on a single market.</li> <li>- Promote fair trade practices that ensure equitable returns for all farmers, regardless of their scale of operation or affiliation with specific brands.</li> </ul>
Component 3: Strengthening the functions of the State Horticulture Department			



Component/ Sub-Component	Activities	Potential Social Concerns	Mitigations Measures/ Suggestions
3.1 Installation of PMU and DPMU	Establish and effective PMU (1) and DPMU (22)	<ul style="list-style-type: none"> <li>- When PMUs fails to involve local communities in decision-making and project planning, it can lead to the implementation of projects that do not address the real needs of the people, resulting in ineffective outcomes.</li> <li>- Overly complex PMU and DPMU structures can lead to bureaucratic inefficiencies, delaying decision-making and project implementation, which can negatively impact the timely delivery of services to society.</li> </ul>	<ul style="list-style-type: none"> <li>- It is essential to establish well-structured, transparent, and accountable PMUs and DPMUs.</li> <li>- Involving stakeholders, including local communities, in the decision-making process can help ensure projects align with the actual needs and priorities of society.</li> </ul>
3.2 Strengthening the capacity of DOH	(1) Strengthening the capacity of DoH (2) Review of overall project implementation plan (3) Procurement of Equipments and tools for PMU [including new buildings for PMU and DPMU's]	<ul style="list-style-type: none"> <li>- If the communication between the Department of Horticulture (DOH) and PG's is not inclusive, some farmers or PG's might feel excluded from accessing support measures and information, leading to unequal opportunities and this might jeopardise the project implementation plan.</li> <li>- Facilitating knowledge and technology sharing among stakeholders from different sectors and regions may inadvertently widen the knowledge divide if certain groups or communities have limited access to information-sharing platforms or resources.</li> </ul>	<ul style="list-style-type: none"> <li>- Involve all stakeholders, including small-scale farmers and marginalized groups, in decision-making processes to ensure inclusivity and equitable distribution of resources.</li> <li>- Prioritize knowledge-sharing and capacity-building initiatives, ensuring that all farmers have access to information and training programs to foster agricultural innovation.</li> </ul>

Component/ Sub-Component	Activities	Potential Social Concerns	Mitigations Measures/ Suggestions
3.3 Strengthening the capacity of horticulture extension services	Enhancing DOH staff capacity in the horticulture sector through training and specialist knowledge development	<ul style="list-style-type: none"> <li>- When there are disparities in access to training, it may lead to skill gaps among peers, affecting the overall effectiveness and performance of the department.</li> <li>- Not designing training programs inclusively may result in the exclusion of marginalized groups within the DOH staff, leading to potential social tensions and limited diversity of perspectives within the department.</li> <li>- Training programs that do not address the specific needs and challenges faced by the local horticulture sector may fail to address local issues effectively, leading to limited impact on local communities.</li> </ul>	<ul style="list-style-type: none"> <li>- Ensure that training programs are designed inclusively, taking into consideration the diverse backgrounds and needs of DOH staff.</li> <li>- Identify specific skill gaps within the DOH and tailor capacity-building efforts to address those gaps effectively.</li> </ul>
3.4 Baseline studies and impact assessment	Evaluate sub-project performance and strengthen agriculture data collection and analysis	<ul style="list-style-type: none"> <li>- Failure to employ inclusive data collection methods may result in the underrepresentation or exclusion of marginalized groups from the data, leading to biased analysis and decision-making.</li> </ul>	<ul style="list-style-type: none"> <li>- Ensure that data collection methods are inclusive and representative of all stakeholders, particularly marginalized and vulnerable groups.</li> </ul>
<b>Component 4: Consulting services</b>			
4.1 Employment of PMCs	Establish an effective PMC	<ul style="list-style-type: none"> <li>- If the PMC is not inclusive, it may lead to the exclusion of certain groups or communities from decision-making processes, resulting in a lack of social ownership and potential grievances.</li> </ul>	<ul style="list-style-type: none"> <li>- The proposed PMC consist of experts from diversified areas of expertise that also includes Gender expert who would ensure that the diverse stakeholders, including community representatives, local leaders, and civil society organizations including women participation in decision making at PG's level, to ensure a broader range of perspectives and enhance inclusivity.</li> </ul>

Source: Compiled by JICA Survey Team (2023)

## 7 Consideration for Gender

Generally, women in the remote areas, especially in rural areas, are either excluded or not allowed to participate in natural resource planning and decision-making, more-so due to patriarchal land tenure systems, male-dominated society and cultural beliefs; despite the fact that women are typically more attached to agriculture and more knowledgeable about various aspects of agriculture management.

Gender equality and women's empowerment are crucial for sustainable development. In Haryana, women are the backbone of the rural agricultural economy, participating in agriculture, looking after livestock, bringing up the children, and actively handling the other household chores. However, their contribution to agricultural and rural development is seldom rewarded. Their knowledge and skills related to resource use and management can make important contributions to sustainable management of agriculture. Women's voices and opinions are often overlooked in local discussions and decisions. Towards inclusive project implementation process, appropriate gender considerations shall be made in order to mainstream gender and to ensure equal rights, opportunities and benefits regardless of gender.

**Table 8 Plan of Consideration for Gender**

Activity	Monitoring Indicators of Consideration Measures/ Targets/ Measures for Consideration	Monitoring Method
<b>Planning stage</b>		
PG Formation and Consultation	<ul style="list-style-type: none"> <li>- At least 20% of women are included in general and board members of the target PGs..</li> <li>- At least 5% of the target PGs are women PGs.</li> <li>- If the women have difficulty in participation of the consultation meetings due to societal norms and other reasons, separate consultation or women group is to be held at their convenient time and venue where they feel secure.</li> <li>- .</li> </ul>	<ul style="list-style-type: none"> <li>- PMU/DPMUs prepare the lists of participants of the consultation, and report through the project MIS.</li> <li>- PMU/DPMUs evaluate the criteria during the PG's selection.</li> </ul>
<b>Implementation stage</b>		
Regular meetings/ General activities of the PGs	<ul style="list-style-type: none"> <li>- About 50% of women members participate in regular meetings of the target PGs.</li> <li>- About 20% of participants for market survey of the target PGs are women members.</li> <li>-</li> <li>- Equal pay for equal work</li> <li>- In order to provide the equal work opportunity for women, work environment/ conditions are created by various means. For example, gender-wise washroom is established in near the work sites including project units (PMU/ DPMU); Mobility from the community to the work site is to be provided for women; Short-time part work opportunity for those who have limited time for working is offered, etc. As a result, at least 30% of the labourers engaged by the project shall be women.</li> </ul>	<ul style="list-style-type: none"> <li>- PMU/DPMUs reports gender-wise benefit sharing and payment to FPO members through the project MIS.</li> </ul>

Activity	Monitoring Indicators of Consideration Measures/ Targets/ Measures for Consideration	Monitoring Method
Trainings for specific techniques/tasks	<ul style="list-style-type: none"> <li>- About 50% of women members of the target PGs participate in crop-cultivation trainings with using DVDs.</li> <li>- About 70% of women members of the target PGs participate in some of trainings on cultivation of spices/medical/aromatic plants and mushrooms, nursery raising techniques, food processing, nutrition improvement, etc. which mainly target women.</li> <li>- Training venues and duration shall be determined depending on the gender-based preference. When organising women's training, the duration shall be short, and the venue shall be close to their residence. In case of training organised outside of the village, their spouses also need to be informed and consulted for their participation.</li> <li>- Training duration and timing are proposed considering gender-wise timetable. Gender-wise washroom is prepared in the training facility/sites. Mobility of training participation is provided for women groups if required.</li> </ul>	<ul style="list-style-type: none"> <li>- PMU/DPMUs prepare the lists of participants of in the trainings and report through the project MIS.</li> </ul>
Project management	<ul style="list-style-type: none"> <li>- About 70% of officers/staff of PMU, DPMU, concerned officers of DOH, and other concerned persons participate in trainings/workshops for gender sensitization/ mainstreaming. About 70% of women members of the target PGs realize that their knowledge and skills have been improved through PG's activities including technical trainings.</li> <li>- About 50% of women members of the target PGs realize that their involvement in decision-making both in PGs' activities and in their household have been improved through PG's activities including technical trainings.</li> <li>- About 50% of concerned actors (officers/staff of PMU, DPMU, concerned officers of DOH, male members of the target PGs) realize that they have been more aware about gender mainstreaming through PG's activities.</li> </ul>	<ul style="list-style-type: none"> <li>- Comments from TSG/ PG motivators.</li> <li>- Interviews (questionnaire survey) with some of women members of the target PGs..</li> <li>- Interviews (questionnaire survey) with some of concerned actors.</li> </ul>

Source: JICA Survey Team, 2023

## 8 Environmental and Social Management Measures and Monitoring

ESAF has been developed to mitigate any potential adverse environmental and social impacts effects linked to the Project. It aligns with the JICA Guideline as well as relevant policies, laws and regulations of GOI and the state of Haryana. ESAF aims to effectively handle and minimize unfavourable and negative impacts using straightforward procedures to expedite appropriate environmental and social management.

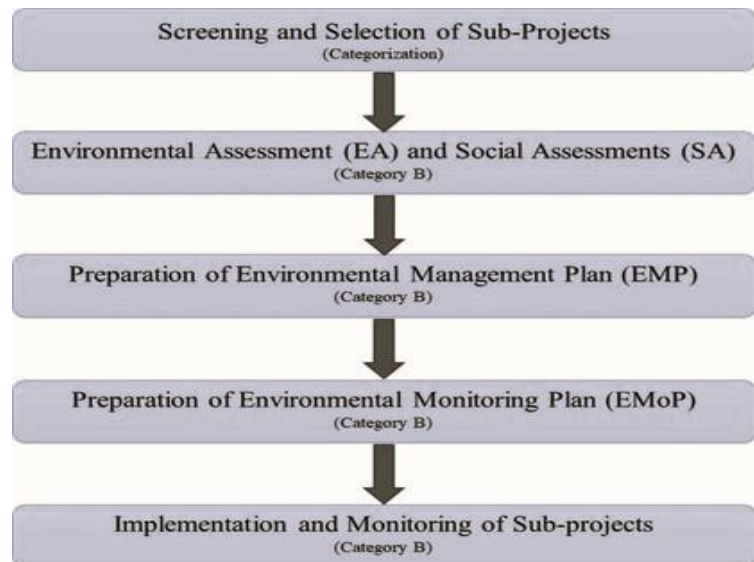
Although the entire project may not necessitate an Environmental Clearance, however, it is essential to assess the environmental and social risk perspective before implementation of

subprojects/ project components. Overall, the proposed project activities, such as minor irrigation schemes and small building/infrastructure development, are not expected to have any significant negative environmental impacts. Moreover, the project area exclusion criterion also says that the sub-project areas will be located outside eco-sensitive zones defined by the Forest Department. In general, the project avoids any activities within ecologically sensitive zones, respecting the boundary of the Wildlife sanctuary/National parks. Furthermore, the project team will collaborate with Forest Department to verify whether the sub-project areas fall within "notified" eco-sensitive zones.

As already mentioned in Section 4.2 (Table-3), all sub-projects will be screened, and Category-A sub-projects would be excluded. Sub-projects categorized as B or C will be implemented and the criteria for classification under Category B and C, as per JICA Guidelines, are elaborated below.

<b>Category B:</b>	Projects with potential adverse impacts on the environment and society are generally considered less severe than Category-A projects. Generally, if any adverse impacts are irreversible, they are generally very few and only site-specific and, in most cases, normal mitigation measures can be designed more readily.
<b>Category C:</b>	Projects that are likely to have minimal or little adverse impacts on the environment and society [with no involuntary resettlement]. Generally, as per JICA’s criteria following conditions to be met in order to be classified as Category-C project, that includes, <ul style="list-style-type: none"> <li>- <i>Environmental and social negative impacts are either minimal or nothing,</i></li> <li>- <i>There is no land acquisition and involuntary resettlement required for the project.</i></li> <li>- <i>The project area does not fall within the “Illustrative list of sensitive areas” written in Appendix 3 of JICA Guidelines.</i></li> </ul>

The following sections further indicates the outline of important procedures/ requirements of ESAF. The different stages of the procedures/requirement of ESAF are depicted in figure 5.



*Source: JICA Survey Team (2023)*

**Figure 5 Flow Diagram of important procedures of ESAF**

## 8.1 Screening and Selection of Sub-Projects

Generally, the guidelines for selecting sub-project aim to align with the primary objectives of the Project. Specific sub-projects will be selected based on the preferences of the farmers/ needs and mandate of the project/ DOH. To ensure flexibility and suitability, the guidelines should avoid being overly prescriptive regarding what farmers/DOH can and cannot do. At the same time, exclusion criteria should be clearly shown to eliminate sub-projects that may cause potentially significant adverse environmental impacts, resulting in the requirement of EIA.

Screening refers to the assessment of whether environmental and social considerations studies are necessary for a given project, taking into account the project's characteristics and site location. JICA employs a classification system with four categories, namely A, B, C, and FI, to categorize proposed projects and determine the need for conducting such studies.

In the state of Haryana the major environmental issues are over exploitation of groundwater for irrigation purpose, mainly for water intensive crops that includes Paddy and Wheat that is causing hydrological imbalance, overuse of fertilizers and pesticides, burning of stubble after harvesting of crops like paddy and wheat causes severe health hazard for millions of population living in the state of Haryana and the neighbouring states. Thus, the main objective is not only to reduce the negative impact but also to enhance positive impact on both environmental and social aspects and to make the agriculture sustainable in the state of Haryana through crop diversification, adoption of water saving irrigation techniques, water harvesting, promotion of horticulture crops, organic farming techniques, resilient and climate change adapted crops, development of supply chain, cold storage and pack house development, support to small and marginal farmers groups etc.

Thus, categorisation (Category B or C) of sub-project as per the JICA Guideline as well as the finalisation of exclusion criteria will be completed by PMU prior to the commencement of the Project or at the early stage of the preparatory work. In accordance with the JICA Guidelines, tentative exclusion criteria have been developed and are summarised in the **Table 9** below:

**Table 9 Sub-project Exclusion Criteria**

Component	Exclusion Criteria for Sub-project
1. Overall	<ul style="list-style-type: none"> <li>- Sub-projects/Activities likely to have major adverse impacts on the environment.</li> <li>- Sub-projects/Activities fall into "Category A" as per the JICA Guideline.</li> </ul>
2. Natural Environment	<ul style="list-style-type: none"> <li>- use of fertilizers and pesticides banned (Aldrin, Benzene Hexachloride, Carbaryl, Endosulfan, Sodium Cyanide, etc.) by WHO [Classes IA, IB and II]</li> <li>- activities conducted inside protected areas such as national parks/ wildlife sanctuaries, Key Biodiversity Area (KBA) and Important Bird and Biodiversity Areas (IBA).</li> <li>- likely to cause damage to wildlife and their habitats.</li> <li>- planting of non-native or invasive or exotic species of trees, shrubs or plants</li> <li>- deteriorate physical environment.</li> <li>- totally eliminate indigenous races of food crop</li> <li>-</li> </ul>
3. Social Environment	<ul style="list-style-type: none"> <li>- activities that promote child labour</li> <li>- activities that could lead to the exploitation of women/ vulnerable groups</li> <li>- acquisition of private land and/or resettlement</li> <li>- cause damage to places of religious importance, historical monuments or cultural properties</li> </ul>

*Source: Compiled by JICA Survey Team (2023)*

## 8.2 Environmental and Social Assessments

Although, the Project is not expected to have significant negative environmental and social impacts, it is suggested to conduct Environmental Assessment (EA) and Social Assessment (SA) for specific sub-project falling under Category-B. The assessment will take place after the screening and selection procedures are completed. DPMU under the guidance/direction of PMU as well as support/ supervise of DOH, will determine the necessity of conducting the assessments. The decision will be based on the potential adverse impacts of the sub-projects. The assessment results will be utilised for the preparation of EMP/EMoP. These plans will outline measures to mitigate and manage any identified environmental and social impacts. The following sections describe the key tasks for the assessments and indicative contents of the reports.

### (1) Environmental Assessment

The main purpose of EA is to gain a comprehensive understanding of the environmental aspects and associated as well as their impacts on the target population. Regular monitoring of environmental parameters such as air and water quality, noise levels, degradation of forests, soil erosion, solid waste disposal, and disposal of sewage, the Project can track the temporal changes in environmental conditions. Through continuous monitoring, the project can identify emerging issues and concerns related to the environment. This data-driven approach allows for the development of short-term and long-term recommendations, strategies, and mitigation measures to effectively address environmental challenges and ensure sustainable practices.

EA plan will be prepared by the IA, assisted by Environment and Social Expert / ESAF hired by PMU providing reasonable details outlining the objectives, contents, methods and schedule for its implementation. **Table 10** specifies key tasks for EA.

**Table 10 Key Tasks for Environmental Assessment**

No.	Tasks	Descriptions
1	Describe Environmental Setting	It will encompass an evaluation of the current environmental conditions, including aspects such as physiography and geology, land-use patterns, dependence on agriculture, ambient air quality, noise levels, water quality, socio-economics, etc.
2	Legal and Regulatory Environmental Consideration	Provides an account of the existing legal and regulatory environment, ensuring compliance with requirements set forth by multilateral funding agencies, such as World Bank, JICA, shortfalls, if any, etc.
3	Impacts Assessment and Mitigation Measures	It will encompass a detailed description of all the activities/ sub-projects that could potentially have adverse environmental impacts. It will conduct an in-depth analysis of various negative impacts associated with these activities or sub-projects and identify potential risks and vulnerabilities. Furthermore, the assessment will offer comprehensive mitigation measures to address and minimize this environmental risk.
4	Devise Strategies to Manage and Monitor Environmental Concerns and Parameters	Provide strategies to manage and monitor potential environmental concerns and parameters. It will outline the roles and responsibilities of key positions, institutions, bodies responsible for controlling and safeguarding environmental aspects throughout the project's preparation and implementation. It also examines the opportunities for community involvement in project preparation and implementation, the existing and proposed framework for property rights/ access, and sustainable management and monitoring of environment.
5	Recommendations for	It will evaluate project design proposal and provide guidance to the implementing agency

No.	Tasks	Descriptions
	Project Design and Implementation Arrangements	on participatory alternatives and institutional strengthening measures appropriate to the environmental characteristics of the project area(s). This will provide a basis for integrating the environmental analysis of the core elements into proposals for implementation arrangements.

Source: Compiled by JICA Survey Team (2023)

For details of the indicative contents that the EA report shall include is given in Table 11 below:

**Table 1 Indicative Contents of Environmental Assessment Report**

No.	Chapter	Descriptions
1	Introduction	Define basic purposes for EA, its scope and a brief outline of report organisation.
2	Sub-Project Description	Provide an outline of the proposed sub-project, its rationale, objectives, area, key activities, the proposed implementation schedule, etc.
3	Approach and Methodology	Describe the study approach and methodology adopted for carrying-out the EA, including collation of quantitative data and information, describe tools for monitoring and management of environmental parameters
4	Environmental Baseline	Provide brief profiles of the target area, existing environmental conditions in these areas, that will serve as a reference for future comparison and monitoring
5	Sub-Project Impacts	Describe sub-projects, its objectives and activities of the sub-projects, explains potential positive and negative impacts as a result of establishment of the sub-projects.
6	Public Consultation and Information Disclosure	Describe the results of public consultations, meetings and other interaction events with the communities.
7	Conclusion and Recommendations	Provide overall conclusions and recommendations, describe precise measures to avoid, minimise and/or mitigate adverse impacts on the environment, communities and particularly vulnerable groups due to sub-project activities, environmental management mechanism and implementation arrangements and monitoring activities and implementation arrangements.

Source: Compiled by JICA Survey Team

## (2) Social Assessment (SA)

The main purpose of the Social Assessment (SA) is to help understand basic social issues and risks, and to determine social impacts on the target population of the proposed sub-projects. By analyzing socio-economic information, the Project can prioritise critical issues and collaborate with stakeholders to develop suitable solutions.

The assessment will (i) establish baseline socio-economic situation of the target farmers in the project area to serve as a reference for measuring project impacts in future, (ii) assess the access to and opportunities for getting benefits of basic social and economic services, (iii) stipulates a basis to identify appropriate interventions for community development and livelihoods under the Project, and (iv) determine short-term and long-term, direct and indirect, positive and negative impacts of the Project on the socio-cultural and economic status of various groups, including women, small scale and marginal farmers, female-headed households, landless, SCs, etc.

To ensure the effectiveness and accuracy of the SA, subject matter experts will be hired to provide assistance and supervision. The SA results will assist the executing agency in reaching-out to the vulnerable and disadvantaged groups, ensuring that the project's objectives aligned with the needs and aspirations of the intended beneficiaries. **Table 12** specifies key tasks for SA.



**Table 12 Tasks for Social Assessment**

No.	Tasks	Descriptions
1	Elucidate Social Setting, Socio-cultural Practices, Institutional, Historical, and Political Contexts	The project's macro-policy context will be examined, taking into account the broader policy framework within which the project operates. The social settings will be described, with an exploration of the extent of socio-cultural fragmentation or homogeneity among the communities involved. Wide-ranging inquiries will be addressed regarding traditional and cultural norms influence the inter-relationships between different stakeholder groups.
2	Legal and Regulatory Social Consideration	Provide a comprehensive overview of the current legal and regulatory framework of the Project. Particular emphasis will be placed on ownership and access arrangements and their implications for different stakeholders, especially the poor and vulnerable.
3	Application of Core Aspects of Social Development to the Project	Outline the possible result of the proposed Project concerning of social opportunities, constraints, impacts, and risks. This includes aspects like socio-cultural diversity, gender, institutions, rules, stakeholder's interests, social risk and vulnerability.
4	Devise Strategy to Achieve Social Development Outcomes	Explore the potential for community involvement in project preparation and implementation, evaluate the current and proposed frameworks for property rights and access, and identify sustainable management strategies to achieve the desired social development outcomes.
5	Recommendations for Project Design and Implementation Arrangements	Assess project design proposal and offer guidance to the implementing agency on participatory alternatives and institutional strengthening measures that align with the socio-cultural characteristics of the project area(s). This will form the foundation for incorporating social analysis into proposal for implementation arrangements of the core element.
6	Development of a Monitoring Plan	For effective monitoring system, local participation is essential in the generation and refinement of indicators throughout the project cycle. The involvement empowers the affected people to have a say in managing their land and system, ensuring a balanced approach that considers their interests.

Source: *Social Analysis Guidelines in Natural Resource Management (2005), World Bank*

SA report shall include at least following contents.

**Table 2 Indicative Contents of Social Assessment Report**

No.	Chapter	Descriptions
1	Introduction	Define basic purposes for Social Assessment, its scope and a brief outline of report organisation.
2	Sub-Project Description	Provide brief outline of proposed sub-project, its rationale, objectives, area, key activities, the proposed implementation schedule etc.
3	Approach and Methodology	Describe the study approach and methodology adopted for carrying-out the assessment, including quantitative and qualitative data and information collation
4	Socio-economic Baselines	Provide brief profiles of the study (target) area
5	Sub-Project Impacts	Describe sub-projects, its objectives and activities of the sub-projects, socio-economic and livelihoods assessment, explain potential positive and negative impacts of the sub-project.
6	Vulnerable Groups:	Identify and describe particularly vulnerable groups within the community and how Project may affect them.
7	Public Consultation and Information Disclosure	Describe the results of public consultations, meetings and other interaction events with the communities.
8	Conclusion and Recommendations	Provide overall conclusions and recommendations.
9	Mitigation Measures	Describe precise measures to avoid, minimise and/or compensate for sub-project activities with adverse impacts on communities and particularly vulnerable groups.
10	Monitoring	Provide the developed monitoring plan including monitoring mechanism and monitoring implementation arrangements

Source: *Compiled by JICA Study Team*

### 8.3 Preparation of Environmental Management Plan

Environmental Management Plan (EMP) will include measures to address environmental concerns during both construction and operation phases. It will be specifically prepared for “Category-B” sub-projects (refer to Figure 2), and it will examine the results of the environmental, social, health, and safety impact assessments.

Although quantifications and mitigation measures for the sub-projects are yet to be determined, indicative EMP is described in **Table 14** below. Any additional costs for the proposed mitigation measures shall be included in the construction cost.

**Table 14 Indicative Environmental Management Plan**

Potential Environmental Impact	Proposed Mitigation Measures	Responsibility
<b>Pre-construction Phase</b>		
Land Acquisition	<ul style="list-style-type: none"> <li>- Ensure that the project does not encroach upon forest land.</li> <li>- In case any selected sub-project entails acquisition of the private land, it should be confirmed that the land surrendered does not exceed 10% of the total holding of the owner.</li> <li>- Obtain verification of the voluntary nature of land donation, such as affidavit or witnessed statements from each donor.</li> <li>- Establish a Grievance mechanism within the PMU to allow stakeholder to voice concerns or claims, ensuring neutral and transparent resolution of issues.</li> </ul>	Contractor/DP MU
Shifting of Utilities and Relocation of Cultural and Religious Properties	<ul style="list-style-type: none"> <li>- Utility services like electric lines, telephone lines, cable line, and pipe lines that may interfere with the project should be brought to the attention of project Engineer. These structures can be shifted in consultation with the PMU before commencement of construction activity, and the concerned departments will be involved in the process.</li> <li>- In case of the religious structures, even though they are not directly part of the project, any small structure that need to be shifted should only be done after obtaining public consensus or approval from the PMU. Relocation should be completed before construction work is initiated.</li> </ul>	Contractor/DP MU
Archaeological structure/ article	<ul style="list-style-type: none"> <li>- The sub-project does not directly or indirectly affect any archaeological structures. However, if any archaeological structures or artifacts are discovered nearby during the construction stage, they shall be promptly reported to the project engineer.</li> </ul>	Contractor /DPMU
Ecological Parks/Sanctuaries etc	<ul style="list-style-type: none"> <li>- The sub-project does not have any direct or indirect impact on ecologically sensitive areas. However, if any such sensitive zones are identified in the vicinity during the construction stage, they will be immediately reported to the project engineer.</li> </ul>	Construction Contractor /DPMU
<b>Construction Phase</b>		
Air Quality	<ul style="list-style-type: none"> <li>- Sufficient dust suppression measures, including regular water sprinkling on construction sites and unpaved roads, especially in proximity to habitation, must be implemented to effectively control fugitive dust. Plantation activities should be carried out at the construction sites.</li> <li>- Workers should be provided with masks to prevent breathing problems.</li> <li>- Trucks carrying soil, sand, and stone should be adequately covered to avoid spilling. Low-emission construction equipment, vehicles, and generator sets should be utilized.</li> <li>- Handling of plants, machinery, and equipment should be done in a manner that minimizes the generation of dust.</li> <li>- All crushers used in construction should adhere to relative dust emission devices.</li> <li>- All vehicles involved in the project shall possess pollution certificates.</li> <li>- Air quality monitoring should be conducted at construction sites.</li> </ul>	Contractor
Noise & Vibration	<ul style="list-style-type: none"> <li>- During construction, utilize modern technologies with low noise emissions.</li> <li>- Ensure that construction equipment and vehicles are in good working</li> </ul>	Contractor

Potential Environmental Impact	Proposed Mitigation Measures	Responsibility
	<ul style="list-style-type: none"> <li>condition, properly lubricated, and well-maintained to keep noise levels within permissible limits.</li> <li>- Install temporary noise barriers at settlements and nearby forest areas if necessary.</li> <li>- Provide workers at the construction site with headphones and earplugs to protect their hearing.</li> <li>- Conduct noise level monitoring throughout the construction phase.</li> <li>- All vehicles, equipment, and machinery used in construction should be fitted with exhaust silencers.</li> <li>- Regularly maintain equipment and use soundproof gadgets as needed.</li> <li>- Provide ear-plugs to operators of heavy machinery.</li> </ul>	
Water Quality	<ul style="list-style-type: none"> <li>- Silt fencing should be installed near water bodies to prevent the spillage of construction material.</li> <li>- Discharge of waste from the construction or labor camp into water bodies must be strictly prohibited.</li> <li>- Construction methodologies that have minimal or no impact on water quality should be adopted. Construction waste should be disposed of at designated sites, and adequate drainage systems must be provided.</li> <li>- Construction activity should be prohibited during the monsoon season.</li> <li>- Ponds near the work site, which serve as habitats for birds and other wildlife, should be protected. Strict measures should be in place to prevent poaching.</li> </ul>	Contractor
Soil Quality/ Sedimentation	<ul style="list-style-type: none"> <li>- Asphalt emulsifiers should be handled with caution, and any detected leakage must be promptly rectified.</li> <li>- Construction work should be avoided during the rainy season to prevent erosion and the spreading of loose materials.</li> <li>- Topsoil removed during excavation work must be stored separately in a bunded area and utilized for plantation or refilling of the excavated area.</li> </ul>	Contractor
Solid Waste	<ul style="list-style-type: none"> <li>- Construction activities should be conducted in a manner that minimizes or eliminates the generation of solid waste at the construction site.</li> <li>- Excess earth material produced should be utilized for refilling borrow areas.</li> <li>- Construction during the rainy season should be avoided to reduce the spread of loose materials.</li> <li>- Solid waste management plans should be developed for camp areas, and dustbins should be provided.</li> <li>- Adequate sanitation facilities must be provided in the camps by the Contractor.</li> </ul>	Contractor
Land Subsidence	<ul style="list-style-type: none"> <li>- Plantation must be carried out to control erosion</li> </ul>	Contractor
Bottom Sediment	<ul style="list-style-type: none"> <li>- Install silt fencing to prevent runoff from entering the river.</li> <li>- Schedule construction activity during the dry season to minimize the spreading of construction materials and reduce the impact on water quality.</li> </ul>	Contractor
Applicability of legislations and statutory requirements	<ul style="list-style-type: none"> <li>- All construction activities must comply with relevant laws and Indian statutory obligations.</li> <li>- Prior permission from the Forest Department is required for cutting down individual trees.</li> <li>- Vegetation that is removed must be appropriately disposed of.</li> </ul>	Contractor
Removal of Trees/ Vegetation	<ul style="list-style-type: none"> <li>- Permission from the Forest Department should be taken prior to cutting down individual trees.</li> <li>- Proper disposal of removed vegetation is required.</li> </ul>	Contractor
Soil	<ul style="list-style-type: none"> <li>- To control erosion, appropriate protection measures incorporating bio-engineering techniques, such as planting grasses, shrubs, and constructing check dams, should be implemented.</li> <li>- The selection of borrow areas should consider the ecological sensitivity of the region.</li> <li>- Agricultural land must not be utilized as borrowed areas, and priority should be given to degraded areas for the excavation of borrowed material.</li> <li>- The project should include rehabilitation plans for the borrowed areas.</li> <li>- Construction activities should be avoided during the rainy season to prevent erosion and the spread of loose materials.</li> <li>- Topsoil removed from agricultural land should be stored separately in bunded areas and later used for plantation or refilling the excavated areas.</li> </ul>	Contractor
Water	<ul style="list-style-type: none"> <li>- Water availability should be ensured for construction activities.</li> <li>- If groundwater is utilized, it must comply with the norms set by the groundwater department.</li> <li>- The Contractor is responsible for providing temporary drainage arrangements during construction, subject to approval from the Project Engineer.</li> </ul>	Contractor

Potential Environmental Impact	Proposed Mitigation Measures	Responsibility
	<ul style="list-style-type: none"> <li>- Silt fencing should be deployed near water bodies to prevent runoff into the water.</li> <li>- Cross-drainage structures must be appropriately designed at canal crossings in consultation with the project Engineer or Irrigation Department.</li> <li>- Adequate drainage planning is essential in the area to prevent water logging.</li> </ul>	
Construction / Labour Camp Management	<ul style="list-style-type: none"> <li>- The construction/labor camp will be situated within the project area during the construction phase.</li> <li>- A well-designed Construction Camp must be established to prevent degradation of the surrounding landscape caused by the camp's location. The contractor is responsible for providing, constructing, and maintaining appropriate living conditions and supporting facilities. These details should be included in the contract documents provided to the contractor.</li> <li>- Ample supply of potable water should be available at the camps and work sites. Sufficient and clean washing and bathing facilities with proper drainage must be provided.</li> <li>- Adequate sanitary facilities should be established within the camp, which must be cleaned daily to maintain strict hygiene standards. Separate latrines should be provided for women.</li> <li>- Sufficient water supply and proper drainage systems should be ensured to prevent the formation of stagnant water bodies.</li> <li>- Every camp must have first aid facilities and suitable transport available to take care of injured or ill personnel and transport them to the nearest hospital.</li> <li>- Adequate fuel supply in the form of kerosene or LPG should be provided to construction laborers to discourage the cutting of trees for cooking and other household activities. Open fires should not be allowed in the camps.</li> <li>- Proper fencing and lighting should secure the construction sites.</li> <li>- The Contractor must store all construction equipment and vehicle machinery separately in a designated yard. Fuel storage and refilling areas should be located at least 500 meters away from water bodies and other cross drainage structures. All construction workers must undergo appropriate training to handle potential occupational hazards and be educated about safety and health practices, including environmental awareness, medical surveillance, engineering controls, work practices, protective equipment, handling of raw and processed materials, and emergency response.</li> <li>- Construction/labor camps should be situated away from forest areas, settlements, cultural heritage sites, historical sites, water bodies, and dry river beds.</li> <li>- The Contractor must ensure that the camp area is cleared of debris and other wastes after the completion of construction.</li> <li>- A readily available first aid box and a trained person should be present at the construction site at all times.</li> <li>- Upon completion of construction, the land should be restored to its original state.</li> </ul>	Contractor
Public Health and Safety	<ul style="list-style-type: none"> <li>- To prevent inconvenience to workers and protect the public, a full-height fence, barriers, and barricades must be erected around the construction site, ensuring compliance with the technical specifications outlined in the Bid Document.</li> <li>- The contractor is responsible for supplying safety goggles, helmets, earplugs, masks, and other necessary safety equipment to the workers and staff.</li> <li>- Adequate precautions should be taken to ensure safety around electrical equipment, and proper lighting and fencing must be provided to protect the public.</li> <li>- All construction machines and equipment used must adhere to the relevant Indian Standards (IS) codes. They should be free from patent defects, in good working condition, regularly inspected, and maintained as per IS provisions.</li> <li>- Workers involved in tasks like mixing asphaltic material, cement, lime mortars, or concrete must be provided with protective footwear and goggles. Welders should be given protective eye shields.</li> <li>- No individuals under the age of 18 or women of any age shall be employed to work with lead-containing paint products. Face masks must be provided to workers when using spray paint or working with surfaces that have been dry-rubbed or scraped with lead paint.</li> <li>- Appropriate measures should be taken to prevent damage to the public from fire, floods, and other potential hazards.</li> <li>- Adequate provisions must be made for prompt first aid treatment in case of</li> </ul>	Contractor

Potential Environmental Impact	Proposed Mitigation Measures	Responsibility
	<ul style="list-style-type: none"> <li>- injuries sustained during work.</li> <li>- The contractor must adhere to all anti-malarial instructions, including filling up borrow pits. Any work that affects side roads and existing accesses should not be undertaken without providing suitable provisions for alternate access.</li> <li>- After completion of the construction, all temporary structures must be cleared, rubbish disposed of, and disposal pits or trenches filled and sealed off effectively, leaving the entire site clean and tidy.</li> <li>- ucks, trolleys, cranes, and trailers on the road, which may obstruct traffic movement, is not allowed.</li> </ul>	
Emergency Preparedness Plan	<ul style="list-style-type: none"> <li>- In compliance with rule 36 of BOCWR, the contractor must develop an Emergency Response Plan encompassing all work sites. The plan should cover the following potential emergencies:</li> <li>- Fire and Explosion incidents</li> <li>- The collapse of lifting appliances and transport equipment</li> <li>- The collapse of building sheds or structures</li> <li>- Gas leakage or spillage of dangerous goods or chemicals</li> <li>- Incidents involving the drowning of workers</li> <li>- Situations where workers may be buried due to landslides, floods, earthquakes, storms, etc.</li> </ul>	Contractor
Accident Reporting	<ul style="list-style-type: none"> <li>- The project engineer must be verbally informed immediately of all accidents and dangerous occurrences.</li> <li>- Detailed reports of all accidents (fatal/injury) and dangerous occurrences must be submitted within 24 hours.</li> </ul>	Contractor
<b>Operation Phase</b>		
Air Quality	<ul style="list-style-type: none"> <li>- It is advisable to conduct Ambient Air Quality (AAQ) monitoring at all sites with the guidance and supervision of the State Pollution Control Board (SPCB).</li> <li>- The project must proactively engage in promoting and generating awareness among farmers regarding the issues of stubble burning, with a specific focus on communicating mitigation measures, government schemes and available subsidies.</li> </ul>	DOH/PMC/Contractor
Water Quality	<ul style="list-style-type: none"> <li>- The prudent utilization of chemical fertilizers, insecticides, and pesticides is carefully managed.</li> <li>- The implementation of biofertilizers and bioinsecticides/ pesticides is introduced.</li> <li>- The Project, through its Farmers Support Program, is actively promoting the following practices: i) the adoption of organic farming, ii) the optimal use of pesticides under Integrated Pest Management (IPM) and biological control of pests and diseases, iii) farming techniques to minimize soil erosion and iv) the appropriate use of farm inputs such as seeds and fertilizers.</li> <li>- It is advised to conduct Water Quality monitoring at all irrigation sites with the guidance and supervision of the State Pollution Control Board (SPCB).</li> </ul>	DOH/PMC/Contractor/ PG's

Source: Compiled by JICA Survey Team (2023)

#### 8.4 Preparation of Environmental Monitoring Plan

Environmental Monitoring Plan (EMoP) is designed to oversee and assess the execution of proposed environmental mitigation measures and considerations. It involves regular monitoring of the environmental conditions in the vicinity during both construction and operation phase. similar to the EMP, EMoP is exclusively prepared for “Category B” sub-projects.

EMoP ensures that the adopted environmental and social safeguards yield the desired outcomes. Therefore, it utilizes indicators related to environmental and social considerations to measure the quality environmental parameters and safeguard processes. **Table 15** illustrates the indicative monitoring items, their corresponding indicators, means of verification, frequency of monitoring and responsible parties tasked with measuring the implemented safeguards. However, these aspects need to be finalised in relation to EMP if it is prepared for some specific sub-projects.

The responsibility for implementing, monitoring, and reporting on safeguards lies with the designated officers from DPMU as an integral part of the project implementation. For site-level planning and execution, these officers ensure the necessary monitoring activities are carried out. Additionally, compliance with environmental and social safeguards during implementation should be closely observed by DPMUs, along with relevant local stakeholders such as PG's, representatives of the FPCs, local NGOs, if any appointed, women's groups, youth groups, etc. The designated officers should conduct periodic visits to confirm that mitigation measures for detrimental impacts are being properly executed by the contractors.

**Table 15 Indicative Environmental Monitoring Programme**

Aspects	Parameters to be monitored	Locations	Method	Frequency	Responsibility
<b>Pre-Construction Phase</b>					
Land acquisition	Land donation ratio and verification	Sub-project areas	Interview	Once in a month	DPMU, Contractor
Shifting of utilities	Shifting of utilities	Subproject areas	Interview	Once in a month	DPMU, Environment and Social Expert/ Contractor
<b>Construction Phase</b>					
Air pollution	Dust, smoke	Sub-project areas	Site visits, visual checks	Twice a week	DPMU, Environment and Social Expert/ Contractor
Noise and Vibrations	Noise of equipment, complaints from local residents	Sub-project areas - Major sources of noise	Sound Level Meter	Once in three months	DPMU, Environment and Social Expert/ Contractor
Ground water quality and Surface water quality * Whenever the Environmental Expert or other Monitoring Officers feel the necessity for carrying out tests during construction. Otherwise, site visits and visual checks only	pH, Electrical conductivity, Turbidity, TDS, TSS, Total Hardness, Alkalinity, Carbonate, BOD, COD, TN, TP, Fluorides, Chlorides, Sulphates, Sodium, Potassium, Calcium, Magnesium, Oil & Grease, Iron, Manganese, Copper, Zinc, Phenolic Compounds, Colour, Cadmium, Chromium, Cyanides, Lead, Total Coliform, Pesticides (to be specified)	Sub-project areas and nearest villages - 10 location	Collected sample to be analysed from DoA Laboratory Or Site visits, visual checks	Once in three months	DPMU, Environment and Social Expert/ Contractor
Solid waste (Waste)	Volume and kind of construction wastes,	Sub-project areas	Site visits and visual checks	Once in three months	DPMU, Environment and Social Expert/ Contractor
	Kitchen and other solid waste generated in labour camp	Sub-project areas	Site visits and visual checks	Once every month	DPMU, Environment and Social Expert/ Contractor
Soil Quality/ sedimentation		Sub-project areas	Site visits and visual checks	Once in three	DPMU, Environment and Social Expert/

Aspects	Parameters to be monitored	Locations	Method	Frequency	Responsibility
				months	Contractor
Soil erosion	Visual inspection of rainwater run-off	Sub-project areas	Site visits and visual checks	Twice in a Year	DPMU, Environment and Social Expert/ Contractor
Disturbance to ecological resources and vegetative cover	Illegal tree felling, wildlife hunting, illegal extraction of forest resources	Sub-project areas	Site visits and visual checks	Twice in a Year	DPMU, Environment and Social Expert/ Contractor
Interactions with local communities	Complaints and grievances, from local residents	Sub-project areas	Site visits and visual checks	Once in three months	DPMU, Environment and Social Expert/ Contractor
Land acquisition (loss of income or loss of access)	Economic condition of households, process of selection of project areas	Sub-project areas	Interviews	Twice in a Year	DPMU, Monitoring and Evaluation Expert/ Contractor
Grievance mechanism	Grievance redress condition	Sub-project areas	Interviews	Twice in a Year	DPMU, Monitoring & Evaluation Expert/ Contractor
Impact of livelihoods	Direct or indirect impacts of livelihoods	Sub-project areas	Interviews	Twice in a Year	DPMU, Monitoring & Evaluation Expert/ Contractor
Health and Safety	Training and health check-ups for workers, fencing, warning signs, emergency evacuation	Sub-project areas	Site visits and visual checks	Twice in a Year	DPMU, Monitoring & Evaluation Expert/ Contractor
Accidents and traffic management	Signage, regular maintenance	Sub-project areas	Site visits and visual checks, record of accidents and training	Twice in a Year	DPMU, Monitoring & Evaluation Expert/ Contractor
<b>Operation Phase</b>					
Ground water quality	pH, Electrical conductivity,	Sub-project areas and nearest villages - 10 location	Collected sample to be analysed from DoA Laboratory	Once in six months	DPMU, Environment and Social Expert/ Contractor
Surface water quality	Turbidity, TDS, TSS, Total Hardness, Alkalinity, Carbonate, BOD, COD, TN, TP, Total Coliform, Pesticides (to be specified)				
Ground water level	Water level of existing well nearby	Sub-project areas	Measurement	Once in three months	Contractor
	Groundwater Draft	Sub-project areas	Measurement	Once in three months	DPMU/ Environment and Social Expert/ Contractor
Impact of livelihoods including income, yield, production from crops	Direct or indirect impacts of livelihoods	Sub-project areas	Interviews	Twice in a Year	DPMU, Monitoring & Evaluation Expert/ Contractor
Accidents due to packhouse machinery.	Direct or indirect impacts of livelihoods	Sub-project areas	Site visits and visual checks, record of accidents and training	Twice in a Year	DPMU, Monitoring & Evaluation Expert/ Contractor
Grievance	Grievance redress	Subproject	Interviews	Twice in a	DPMU, Monitoring &

Aspects	Parameters to be monitored	Locations	Method	Frequency	Responsibility
mechanism	condition	areas		Year	Evaluation Expert/ Contractor

Source: Compiled by JICA Survey Team (2023)

## 8.5 Implementation and Monitoring of Sub-projects

The institutional arrangement for the implementation and monitoring system for EMP and EMoP is similar to the project component monitoring system. However, it is important note that monitoring is specifically focused on the sub-projects identified as Category B as per JICA Guideline.

For detailed information on the monitoring format at this level, refer to Appendix-3. DPMU officer are responsible to compile the monitoring results and conducting regular reviews. They then report these findings to the PMU, which analyse the result and share them with relevant departments in the state government as well as annual report to JICA. A specialist under PMC, and subject matter specialist (M&E) of PMU shall support PMU/ DPMUs for the monitoring related activities which are in line with JICA Guideline.

## 9 Institutional Arrangement and Capacity Development for ESAF

### 9.1 Institutional Arrangement

In the proposed Project, HSHPP, is responsible for overall planned intervention, legal and policy development, ensuring adequate consultation and participation, and inclusion of vulnerable people such as poor households, and women headed households in planning and implementation process. Additionally, they are in charge of ensuring the equitable distribution of benefits associated with site-level project interventions. Other agencies will also be involved in various environment and social safeguard aspects or issues.

The district administration is the designated as the responsible agency responsible for land administration, land acquisition, disbursement of compensation, and providing Resettlement and Rehabilitation (R&R) benefits to the project-affected families.

ESAF will be implemented through the institutional structure of the Project, with director and officers at each administrative level to serve as focal persons for ESAF compliance (Refer Appendix 5). **Table 16** highlights the institutional structure for ESAF with key environmental and social management roles and responsibilities.

**Table 16 Institutional Structure for ESAF Implementation and Monitoring**

Institution	Role in the Project	(Additional) Role and/or Responsibility in ESAF
Department of Horticulture (DOH)	<ul style="list-style-type: none"> <li>- The DoH is the decision-making body.</li> <li>- It lay-down the broad policy framework for functioning of the society.</li> <li>- It will review the society's performance.</li> <li>- The DOH will have all</li> </ul>	<ul style="list-style-type: none"> <li>- The comprehensive oversight of ESAF and its implementation, as well as monitoring and evaluation (M&amp;E).</li> <li>- Facilitation and coordination with different line departments and other agencies.</li> <li>- Offering guidance and advice to PMU and DPMU to ensure the project operates smoothly and efficiently, considering environmental and social</li> </ul>



Institution	Role in the Project	(Additional) Role and/or Responsibility in ESAF
	administrative and financial powers. - The utilisation of funds will be monitored by DOH.	factors. - Regularly conducting checks and due diligence on safeguards reports, monitoring data, and other related aspects.
Project Management Unit (PMU) at State Level	- Project implementation, supervision and monitoring of all activities. - Documentation and reporting	- Owner and implementation of ESAF - Submitting reports on environmental and social considerations to relevant departments in the state government and JICA. Information disclosure through project information brochures and project homepage, etc. - Providing consultation and guidance to DPD/DPMU/PGs and field-level officers regarding information disclosure and consultation processes. - Developing technical guidelines for beneficiary selection and safeguard checks/guidelines for specific activities if deemed necessary. Creating planning and monitoring forms, review of monitoring data, reporting, assistance with evaluations - Concluding the criteria for categorization (Category B or C) in accordance with JICA Guidelines, along with the formulation of exclusion criteria. Review of participatory environmental and social assessments - Performance of due diligence follow-up - Guide, instruct, prepare guidelines, establish and operate M&E, dissemination of project information, hand-holding support in the field for all project activities
APD Engineering Construction (Nodal ESC/ ESAF Officer) supported by SMS (Environment and Social/ESAF)	- Provide support and facilitation to the PMU for project implementation at the state level. Offer technical inputs and guidance to the DPMU level as needed, including through regular review meetings. The frequency of these meetings will be determined during the preparatory phase of the Project.	- Coordinate, monitor, and oversee the ESC/ ESAF activities at the State level. This includes screening and selecting sub-projects and determining the necessary procedures for specific sub-projects, following the guidance and instructions provided by the PMU. Liaise with other line departments at the appropriate level for inter-sector convergence - Provide any specific support required for implementation and monitoring of the Project as per ESAF
District Project Management Unit (DPMU)	- Function as the dedicated and extended wing of the PMU for project implementation at the district level and as a subordinate office of the autonomous society. - Facilitate project implementation at the district level, and would extend all technical inputs and guidance to the PGs.	- Coordinate, monitor and supervise the ESC/ESAF relevant activities at the district level. - Conduct the screening and selection of subprojects and determine the required procedures for specific subprojects following the guidance/instruction of PMU. - Liaise with other line departments at the appropriate level for inter-sectoral convergence. - Provide any specific support required for implementation and monitoring of the Project. - Coordinate with nodal APDs and subject matter experts
District level Specialist, Environment and Social at DPMU	- Provide support and facilitation to the DPMU for project implementation at the district level. Offer technical inputs and guidance to the field-level organizations as needed, including through regular review meetings. The frequency of these meetings will be determined during the preparatory phase of the Project.	- Coordinate, monitor and supervise the ESC/ ESAF relevant activities at District level, including the screening and selection of subprojects and determination of the required procedures for specific subprojects following the guidance/instruction of DPMU. - Liaise with other line departments at the appropriate level for inter-sector convergence. - Provide any specific support required for implementation and monitoring of the Project as per ESAF.
<b>Field Level</b>		

Institution	Role in the Project	(Additional) Role and/or Responsibility in ESAF
PGs	<ul style="list-style-type: none"> <li>- Assist in selecting target beneficiaries.</li> <li>- Clarify local needs and expectations on the Project</li> </ul>	<ul style="list-style-type: none"> <li>- Conceive and raise awareness in the locality on environmental and social considerations.</li> <li>- Provision of support in micro planning activities at the subproject level.</li> <li>- Participating in environmental and social assessments</li> <li>- Support public consultation and due diligence checks.</li> </ul>

Source: JICA Survey Team (2023)

The Project Management Unit (PMU) headed by the Project Director, will have comprehensive responsibilities for project administration, programme management, procurement, financial management, supervision of field units, project implementation, monitoring and evaluation. The PMU will also provide direction and support to the project. The overall responsibility for the implementation of ESAF shall be vested with PMU. Under PMU, one officer [APD Engineering Construction/ ESAF] is required to be given a responsibility to ensure implementation and monitoring and compliance of environment and social safeguards. This officer will act as the nodal ESC/ESAF officer and also provide technical advice on environmental and social safeguard during the project implementation. At DPMU Environment and Social specialist, shall be responsible for ensuring implementation and monitoring of ESAF with a support of PG's at district and field level respectively.

To strengthen organisation and institutionalise ESC within DOH, the SMS-Environment and Social at PMU, supported by one Environment and Social/ ESAF Expert, one Gender Expert (for implementation of Gender Action Plan) in Project Management Consultants (PMC) would not only ensure the compliance of the ESAF and its smooth and efficient implementation but will also act as a resource person in capacity building programs on ESC/ESAF. The details of the proposed positions are as follows.

- ❖ **Additional Project Director, Engineering Construction/ ESAF:** APD would be in charge of the Environmental Safeguards and would be supported by **SMS (Environment and Social/ ESAF)**, who would be hired by the PMU directly. They would assist the PMU in the initiation of the safeguard related actions. They will assist PMU in the matters concerning the overall implementation of ESAF and EMP as well as monitoring of timely implementation of EMoP. They would ensure following aspects related to ESAF implementation, such as:
  - a) To facilitate and coordinate with various implementation and line departments,
  - b) To update and finalise ESAF (if required),
  - c) In consultation with the Environment and Social Expert/ ESAF and M&E expert of the PMC. develop appropriate training materials on environmental and social safeguards, following the requirements in ESAF,
  - d) In consultation with the Environment and Social Expert/ ESAF and M&E expert of the PMC, provide training courses and capacity enhancement at the different levels

of stakeholders who will be designated with the responsibilities to ensure implementation of environment and social safeguards, and

- e) To supervise/ manage the project activities to ensure that the required procedures indicated in ESAF are followed properly. The expert may also be required to follow-up in the field where particular issues are identified and report to the PMU.
- f) To assist in monitoring the environmental aspects (if any) at regular interval

❖ **Environment & Social/ ESAF Expert and Gender Expert (Project Management Consultants):** The specialists are planned to be deployed under the Project Management Consultant (PMC) to assist PMU on ESC issues of the Project. The specialists are expected to support PMU to review the project activities with a focus on the compliance on ESAF, capacity building of PMU/DPMU/PGs in ESC/ESAF, provide guidance and technical advice to PMU/DPMUs for required environment and social safeguard measures, as well as reporting to JICA to ensure smooth and efficient implementation of environment and social safeguard measures.

## 9.2 Capacity Development Programme

To ensure effective implementation of the proposed ESAF and associated safeguards procedures within the suggested institutional arrangement, enhancing the capacity of various agencies and stakeholders is crucial. Capacity development programmes, supported by the above proposed specialist/experts will play a vital role in establishing an effective environmental and social management system. The programs will not only aid in operationalizing environmental and social safeguards but also contribute to their effectively implementation operationalised.

As a guiding principle an indicative capacity development programme has been formulated and depicted in **Table 17** as a reference to formulate a detailed capacity development training programmes related to ESC. The indicative training programmes given below should be revised further by the hired specialist/experts in consultation with the PMU.

**Table 17 Indicative Capacity Development Programme for Environmental and Social Safeguards**

Item	Descriptions
<b>Training 1:</b>	<b>Programme for Management/ Administrative Level</b>
Key Participants:	Designated officials of PMU
Training Programme:	<p><b>Topic 1: General Orientation on ESAF for the Project</b></p> <ul style="list-style-type: none"> <li>✓ Legal framework on environmental and social safeguard of India and JICA</li> <li>✓ Basic introductory concept of safeguard</li> <li>✓ Environmental and social impact assessment: overview &amp; regulations</li> <li>✓ Safeguard issues (vulnerable groups, SCs, Small and Marginal Farmers etc.)</li> <li>✓ ESAF: steps and procedures with respect to the Project</li> <li>✓ Free Prior and Informed Consent (FPIC)</li> </ul> <p><b>Topic 2: Monitoring and Evaluation for Environmental and Social Safeguard</b></p> <ul style="list-style-type: none"> <li>✓ Concept of M&amp;E</li> <li>✓ M&amp;E and reporting procedures</li> <li>✓ Use of M&amp;E results and feedback, including Grievance Redressal Mechanism (GRM)</li> </ul>
Duration:	Two days training (once a year in the first four years at each district)
<b>Training 2:</b>	<b>Programme for Field/ Operational Level</b>

Key Participants	Designated officials and staff of DPMU and field level officers and representatives of PG's
Training Programme	<p><b>Topic 1: General Orientation on ESAF for the Project</b></p> <ul style="list-style-type: none"> <li>✓ Basic introductory concept of safeguard</li> <li>✓ Safeguard issues (vulnerable groups, SCs, Small and Marginal Farmers etc.)</li> <li>✓ Environmental and social impact assessment: overview</li> <li>✓ ESAF: steps and procedures with respect to the Project</li> <li>✓ Environmental protection, EIA and social safeguard regulations (specific)</li> <li>✓ Process of community consultation and public participation</li> <li>✓ FPIC</li> <li>✓ Micro-planning</li> <li>✓ PRA for data collection, analysis and report preparation</li> </ul> <p><b>Topic 2: Monitoring and Evaluation for Environmental and Social Safeguard</b></p> <ul style="list-style-type: none"> <li>✓ Concept of M&amp;E</li> <li>✓ M&amp;E and reporting procedures</li> <li>✓ Use of M&amp;E results and feedback, including GRM</li> </ul>
Duration	Two days training (once a year in the first four years at each district)
<b>Training 3: Farmers Facilitation and Environmental and Social Assessment for ESC</b>	
Key Participants:	Designated field level officers and Representatives of PG's
Training Programme:	<ul style="list-style-type: none"> <li>✓ ESAF: steps and procedures with respect to the Project</li> <li>✓ Role of related organizations</li> <li>✓ Participatory ESA procedures</li> <li>✓ Working with vulnerable groups</li> <li>✓ Conflict resolution/ grievance procedures</li> </ul>
Duration:	One session as part of other community related trainings (Once a year in the first four years/ location and timing shall be determined accordingly)
<b>Training 4: Specific Training for Specific Techniques/Tasks to be Required</b>	
Key Participants:	To be defined according to the main topics of the training programme
Training:: Programme:	<ul style="list-style-type: none"> <li>✓ Appropriate use of chemical fertilizer</li> <li>✓ Use of QPM</li> <li>✓ INM and IPM</li> <li>✓ Water saving technologies such as Drip, polyhouse etc</li> <li>✓ Benefits of water efficient crops for sustainable agriculture</li> <li>✓ Soil conservation methods</li> <li>✓ Environment health &amp; safety standard for construction</li> <li>✓ Occupational health &amp; safety</li> <li>✓ Mitigation planning and implementation</li> </ul>
Duration:	To be defined according to the main topics of the training programme and key participants

Source: Compiled by JICA Survey Team (2023)

## 10 Stakeholder Involvement and Grievance Redressal Mechanism

### 10.1 Stakeholder Involvement

Public consultation and participation are essential regulatory tools employed to improve transparency, efficiency and effectiveness in regulation. They allow for the exploration of regulatory alternatives and the establishment of improved accountability arrangements. Public consultation and participation play a pivotal role in providing to farmers, project-affected persons and other stakeholders relevant to the proposed Project. This process ensures that stakeholders are:

- (i) sufficiently informed about the project's objectives, activities, benefits and risks
- (ii) Given equal opportunities to participate in the Project.
- (iii) Provided with culturally appropriate benefits which are more suited to their interests, capabilities and priorities (*these shall be identified during the course prior to consultations*), and are shared equitably

- (iv) Protected from adverse impacts caused by the Project or its associated activities with appropriate mitigation measures in place.
- (v) Able to raise project-related grievances and make sure required mechanisms are in place to address them.

Consultation and Participation provides an opportunity and platform for people to express and share their views and concerns, allowing them to actively contribute to design and implementation of the programme activities. It enables discussions on sensitive social mitigation measures, ensuring that the perspectives of affected communities are taken into account. Moreover, this engagement fosters a sense of ownership for the Project among stakeholders. In this regard, FPIC is an important process to minimise any negative impacts. The summary of FPIC relevant activities is described in **Table 18**.

**Table 18 Summary of FPIC Activities**

Item	Descriptions
Objective	To establish broad farmer's support and willingness for implementation of the Project
Topic for Consultation:	<ul style="list-style-type: none"> <li>- Disclosure of basic project related information including area, location, purpose/objectives, key activities, stakeholders involved, target beneficiaries.</li> <li>- Expected role and involvement of communities.</li> <li>- An overview of anticipated environmental and social risks.</li> <li>- Identified mitigation measures.</li> <li>- Involuntary Resettlement Plan (if any)</li> </ul>
Participants:	<ul style="list-style-type: none"> <li>- Relevant members of PGs SHG, etc.</li> <li>- Other important key persons (e.g. <i>Sarpanch</i>/ Head of the village)</li> </ul>
Process:	<ul style="list-style-type: none"> <li>a) Before on-set of sub-project implementation, immediately following formations of beneficiary groups, appropriate PG's meetings and consultations that are culturally appropriate and in simple and understandable language.</li> <li>b) Encourage farmer's participation in discussions, meetings and consultations, facilitate participation of women, elders and other vulnerable groups.</li> <li>c) Field level officers will participate in general PG's meetings to discuss concerns, visit individuals who express doubt and/or criticism on any aspect of project implementation.</li> <li>d) Participants to be provided adequate time to assimilate information provided/ shared.</li> <li>e) Opportunity to decide if they do not wish to participate.</li> <li>f) Presentation (use oral or visual methods to explain information to non-literate people) and discussion with stakeholders well represented by all sections including women, small and marginal farmers, SC, poor and disadvantaged.</li> </ul>
Material Required:	<ul style="list-style-type: none"> <li>- Provision of simple/easy to read project brochures in local language.</li> <li>- Consultation and Participation Monitoring Sheets</li> </ul>

Source: Compiled by JICA Survey Team (2023)

The public consultation mechanism is designed to mitigate conflicts between stakeholders, especially by ensuring that vulnerable groups, including the poor, landless, SCs, and women, are properly consulted during site-level project planning. It aims to provide them with opportunities and encouragement to actively participate in the project.

Moreover, public consultation processes can also enhance voluntary compliance for two reasons: (1) Changes and decisions are communicated in a timely manner, giving stakeholders sufficient time to adjust to changes, (2) The sense of legitimacy and shared ownership resulting from consultation motivate affected parties to willingly comply with the project's requirements and recommendations.

## **10.2 Grievance Redress Mechanism**

While existing legal frameworks related to the Grievance Redress Mechanism (GRM) already exist in the country<sup>3</sup>, the Project aims to establish a project-level GRM that will be applicable all sub-projects. This institutionalised mechanism will provide a platform for reporting project-related grievances. Stakeholders can use this mechanism to address various issues, including disputes over locations of infrastructure development, intended farmer's support, beneficiaries of value chain and marketing development, distribution of project benefits, contractor and his workers, project-related staff or consultants, and other relevant concerns. The project-level GRM will serve as direct avenue for addressing these grievances within the project framework.

In this regard, FPO officer, will act as the first level of intervention. All stakeholders' concerns and grievances will be recorded in a project grievance logbook. Individuals will have the options to raise their grievances either in their name or anonymously, or through traditional institutions according to culture and context, as appropriateness. All such grievance will be documented in written form. To facilitate this process, a grievance redress format/template will be devised, tailored to the type and context of each grievance.

FPO officers should resolve all concerns or grievances raised by the communities, beneficiaries, etc. In case an anonymous grievance has been put-up, it shall be addressed through public consultation through a village meeting, retorting generally to the raised point(s) and minutes of the meeting and outcomes shall be recorded. The grievance redress or compliance response is sent to the applicant in written, after resolving the grievance/ concerns.

However, in case the applicant (individual/ group) is not satisfied, she/he may approach to DPMU for further redress, or in case of grievances that are more serious in nature, the FPO officers should forward such grievances to DPMU. PMU officers shall be responsible to redress the grievance in consultation with the FPO officer, concerned applicants. All grievances should be addressed, redressed and resolved at this level.

In case of more serious grievances, then they should be dealt with through the project hierarchy as necessary and any complainant should be made aware of their legal rights according to the relevant legal documents.

## **11 Cost Estimation and Budget Allocation**

ESAF is a tool to provide guidance on how the project activities should be carried out following the requirements of the JICA Guideline. And in many instances, the actions or measures mentioned in ESAF do not necessarily entail additional costs as they are often already identified in the project

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<sup>3</sup> EIA Notification 2006 states that "Public Consultation and Public Hearing" which refers to "the process through which the concerns of local affected persons and others who have plausible stake in the environmental impacts of a project or activity are ascertained with a view to taking into account all the material concerns in the project or activity design as appropriate. All Category 'A' and Category 'B1' projects or activities shall undertake Public Consultation...". Further, the RCTLARRA-2013, involves consultations and redress of concerns of affected persons at various stages. Besides, Department of Administrative Reforms & Public Grievances under the Ministry of Personnel, Public Grievances & Pensions, GoI, has issued a Compilation of Guidelines for Redress of Public Grievances and also operates a web-based portal (<http://pgportal.gov.in/>).

cost estimate. For example, baseline surveys for identification and selection of target sub-project/ intervention areas are already proposed as project activities. Therefore, while there are activities related to ESAF implementation such as SA, Consultation, Information Dissemination, GRM, M&E, etc., these costs are embedded within the budgets of the corresponding project components.

### Attachment 10.3.5 Environmental and Social Management Checklist (ESMS)

No.	Questions (English)	Answer	Improvement Plan
<b>1. Policy (Environmental and Social Policy)</b>			
(1)	Does the executing agency have any formal environmental policy or procedures? If yes, please describe their outlines and provide appropriate documentation. If no, does the executing agency have any plan to set such policy or procedures?	No, the Executing Agency (EA), Haryana Department of Horticulture (DOH) does not have formal environmental policies or procedures of their own to avoid negative impact on the natural and social environment. However, the GoI and the Haryana state government have well defined environmental laws, policies and procedures and all proposed activities under Haryana Sustainable Horticulture Promotion Project (HSHP) will be implemented by EA through the IA in accordance with such policies.	There are well defined existing Indian and Haryana state legal/policy framework in place and are adequate for periodical assessment, monitoring of environmental and social impacts and in eliminating and mitigating any kind of serious adverse impacts. Under the HSHP Project there may be certain sub-projects that may have insignificant environmental impacts (viz., small-scale infrastructure development and constructions). Such activities would not require environmental clearance as per the legislations as the built-up area of each sub-project infrastructure is expected to be well below the threshold limit. Under the HSHP project, Environmental and Social Assessment Framework (ESAF) would be established to define the protocols for screening of sub-projects and periodical monitoring of the environmental and social impacts and mitigation measures.
(2)	Are there any types of subprojects in which the executing agency will not take part due to the environmental and social risks under the Project? (e.g., projects involving handling of hazardous wastes or removal of endangered plants or animals).	Based on the nature and scale of the proposed activities under the project, it is anticipated that there will be no environmental or social risks involved with the sub-projects. No activity under the sub-projects deals with handling of hazardous wastes or endangered plants or animals or any such similar activity that might have severe detrimental social and environmental risks.	N/A
<b>2. Procedures (screening, category classification and review procedures)</b>			
(3)	Does the executing agency have any environmental procedures such as screening, categorization and environmental review? If yes, please describe what procedures will be taken, in detail under the Project.	The GoI and the state legislation system provides detailed environmental safeguard procedures through the Environment Protection Act and EIA Notification 2006. The Environment Department of Haryana is the nodal department responsible for environmental procedures such as screening, categorisation, and	ESAF shall be the principal document, which will clarify the basis for detail procedures for screening, categorisation and environmental review of the Project and its activities. Additional supplemental documents to be prepared during the preparatory stage of the Project.



No.	Questions (English)	Answer	Improvement Plan
		environmental monitoring as per the prevalent laws and regulations	
(4)	Please describe how you ensure that subprojects are implemented in compliance with the national laws and regulations and applicable JICA's requirements, during their planning, construction, and operation stages.	For construction related sub-projects detailed EIA procedures are already defined in EIA notification 2006 and is applicable to all states in India including Haryana. Once FPO is selected, <b>HDoH</b> provide detailed site information with respect to land, its ownership to the Town and Country Planning for getting NOC and Change in Land Use (CLU). <i>[It is learnt that for FPOs projects such requirement for CLU has been exempted]</i> . For all proposed infrastructure development under the sub-projects, contractors would be engaged by following the well-established system of the Government of Haryana. The contractor should comply with local statutory requirement with respect to Building and Other Construction workers Act, 1996 and Environment Protection Act, 1986 and would be responsible for planning and implementing site inspections, audits, examination/testing, construction site safety measures, providing supervision, monitoring, safety surveys, and other legal issues. Adherence to all laid down requirements/norms as per the Water Act 1974 and Air Act 1981 would also be applicable as a set procedure. It is also mandatory for the proponent to obtain No Objection Certificate (NOC) as Consent to Establish (CTE) from respective State Pollution Control Board (SPCB) before commencement of the construction activities on the site as well as compliance and implementation of the conditions of the Consent to Operate (CTO).	ESAF would incorporate the set procedures to ensure compliance in accordance with the GoI/ State rules and latest JICA requirements. To facilitate preparation of DPR for development infrastructure facilities, tendering and procurement as well as Construction supervision would be the responsibility of the APD Engineering/ Construction at PMU.
<b>3. Organization and Staff (institutional framework and staff allocation)</b>			
(5)	Please provide us with the organization chart of the executing agency's Environmental and Social Management System (ESMS).	At the time of the preparation of this report there is no defined ESMS within the EA. The organization chart of the EA is attached in <b>Appendix-4</b> .	Under the project the proposed organisational structure for ESMS has been drafted for smooth implementation of ESAF ( <b>Refer Appendix-5</b> )
(6)	Who is responsible for environmental and social management within the executing agency? (name/role and title)	At present there is no dedicated official directly responsible for environmental and social management within the HDoH.	Within the Implementing Agency, PD would be overall responsible for environmental and social consideration under the project. <b>Additional Project Director (APD), Engineering Construction</b> , assisted by a nodal <b>Monitoring</b>

No.	Questions (English)	Answer	Improvement Plan & Evaluation (Monitoring & Evaluation)/ ESAF official, at PMU would be responsible for implementation, compliance and monitoring of ESAF on day-to-day basis.
(7)	Are there any staff with training for environmental and social considerations in the executing agency? If so, describe them.	There is no staff with training for environmental and social considerations in EA. Thus, in the project a dedicated M&E official would be required who will take care of all aspects of training on environment and social safeguards including Gender issues.	Considering the present situation of lack of experienced official in ESC aspects, environmental expert, and M&E expert (who would also deal with social considerations) has been proposed under PMC to support the project in implementation of ESAF
(8)	What experience, if any, does the executing agency have of hiring or dealing with environmental consultants?	The EA has prior experience of hiring specialized consulting agency for horticulture related sub-projects but do not have experience of hiring or dealing with environmental consultants.	Environmental expert would be hired as part of PMC
(9)	What was the budget allocated to the ESMS and its implementation during a year? Please provide budget details including staff costs and training as well as any actual costs. What was the budget allocated to the ESMS?	There is no specific budget allocated to the ESMS and its implementation per day but various Haryana Government schemes and programs are inclined towards addressing major environmental and social issues in Haryana such as ground water depletion, soil degradation, and enhancement of farmer's income through sustainable agriculture and crop diversification.	All costs associated with matters related to environmental and social safeguard will be covered by addressing relevant issues in the Project's approach under the specific project components through technical methodologies as well as in line with the protocols defined under the GoI/state act and policies, thus, there will be no separate budget requirement. Also, the cost of periodical environmental and social assessment/ monitoring/ reporting would be included under M&E part. However, separate budget provision shall be made towards ESMS under the Project, mainly for developing capacity of the EA and IA in ESC/implementation of ESAF.
<b>4. Monitoring and Reporting</b>			
(10)	Does the executing agency prepare environmental and social monitoring reports for the subprojects?	All kinds of infrastructure development/ construction work under the sub-projects would be executed by specialised contractors following the set procedures as prescribed under law and Environment Protection Act as well as EIA notification 2006. The contractors need to ensure that inherent mechanism for environmental and social considerations and prescribed mitigation measures are adhered to. This is also spelled out clearly in the ToR of the contractors. Public Works Department's (PWD) engineers also do periodical monitoring of the progress of work and ensure laid down safety and other protocols	Environmental and social monitoring of sub-project activities will also be conducted as part of the regular project monitoring and monitoring reports shall be prepared as per the ESAF. At PMU, APD Engineering Construction supported by Infrastructure development official would be placed for Preparation of DPR on infrastructural facilities, Tendering and procurement, Construction supervision etc. These officials will be well supported by the environmental monitoring expert of PMC in preparation of environmental monitoring reports of the sub-projects as per ESAF.

No.	Questions (English)	Answer	Improvement Plan
(11)	Please describe how the executing agency monitors the subprojects' social and environmental performance.	being followed by the contractors. The EA rely on both primary as well as secondary data sources for comparative analysis to monitor and evaluate performance of the sub-project and impact assessment as and when required	A baseline survey would be conducted to record the sub-project site condition details. This baseline data along with other secondary data would be used for monitoring social and environmental performance throughout the construction as well as operation phase as per ESAF.
(12)	Is there an internal process to report on social and environmental issues to senior management?	Periodical departmental meetings and official communication channels are the internal processes to report social and environmental issues. Any issues arising from the field-based programmes are reported to senior management as and when required. Moreover, multi-tier Grievance Redressal mechanism is also in place.	Under the project, procedures based on ESAF would be followed for systematic recording and reporting of environmental and social progress including issues to the senior management.
(13)	Do you prepare any social and environmental reports?  - For other multilateral agencies or other stakeholders - E&S reporting in the Annual Report	EA publish reports on the ill effects of the usage of chemical fertilizers and pesticides from time to time and also organise trainings for awareness creation among the farmers. Exclusive Environmental and social reports per say are not being prepared by EA.	Under the proposed project EA will periodically prepare environmental and social monitoring reports as per the framework of ESAF with the support of the Environmental monitoring expert and M&E experts of the PMC on an annual basis. To understand the long-term impact of the project activities on the environmental and social aspects, bi-annually assessments shall also be conducted, and reports will be prepared.
<b>5. Experience (results of the environmental and social management)</b>			
(14)	Has the executing agency signed any national or international agreements or declarations concerning environmental issues?	No, the EA has not signed any agreement/ declarations concerning environmental issues. Such matters are looked after by the GoI and is applicable to the State of Haryana and the project	N/A
(15)	Has the executing agency ever received any criticism of its environmental record? If so, what was the criticism?	No, EA has not received any such criticism so far.	N/A
(16)	Does the executing agency carry out environmental audits of its properties to analyze health and safety issues, waste disposal, etc.?	The EA itself is not responsible for environmental audit but all protocols as per the Environmental Protection Act and various other acts and rules such as National Building Code -2016 for health and safety of the properties are being followed, wherever applicable	N/A
(17)	Please state any difficulties and/or constraints related to the implementation of the ESMS.	The EA still lacks experience in managing and monitoring environmental and social risks in a systematic way and thus institutional strengthening is required to overcome the gap.	Under the project a designated environmental monitoring consultant and monitoring and evaluation experts would be engaged to establish proposed safeguard frameworks as per ESAF as well as build capacity within the

No.	Questions (English)	Answer	Improvement Plan
			EA to manage and monitor environmental and social risks through specific trainings
<b>6. Need of Capacity Development and Improvement Plan</b>			
Yes, the indicative capacity development programs are proposed in the ESAF.			

APD - Additional Project Director

CLU - Change in Land Use

EA - Executing Agency

HDOH - Haryana Department of Horticulture

SFACH - Small Farmers Agri-Business Consortium of Haryana

### Attachment 10.3.6 Environmental and Social Monitoring Forms

#### Environmental Monitoring Form – A (To be used during Construction)

<b>Name of the Sub-Project:</b>	
<b>ID:</b>	
<b>Period of reporting (Quarter/Month/Fortnight):</b>	
<b>Name and signature of the Reporting Officer:</b>	
<b>Date of reporting:</b>	

#### 1. Monitoring of environmental issues (Field observation)

*(This shall be used in the sites where significant environmental issues are expected. If the Environment Expert/ Monitoring Officer feels the need for 'testing of samples' for environmental pollution then a detailed form – A1 appended to this form may also be used).*

Date and time of site inspection	Subproject/ Location	Issues	Mitigation measures undertaken	Remark
1.1	Air pollution			
1.2	Noise and Vibration			
1.3	Surface water			
1.4	Ground water			
1.5	Construction waste			

1.6	Kitchen and other wastes from labor camp			
1.7	Chemical or hazardous wastes			
1.8	Construction waste			
1.9	Subsidence and sedimentation			
1.10	Soil erosion			
1.11	Disturbance to ecological resources and vegetative cover			

## Environmental Monitoring Form – A1 (To be used during Construction)

*(Note - Whenever the Environmental Expert or other Monitoring Officers feel the necessity for carrying out detailed sample tests for environmental pollution during construction, this form may be used)*

<b>Name of the Sub-Project:</b>	
<b>ID:</b>	
<b>Period of reporting (Quarter/Month/Fortnight):</b>	
<b>Name and signature of the Reporting Officer:</b>	
<b>Date of reporting:</b>	

### 2. Monitoring of environmental issue

#### (1) Groundwater Quality **(Well)**

a) Date of testing:

b) Results:

Parameter	Unit	Measurement (Well)										Average	Limit (E class water)	Remark	
		1	2	3	4	5	6	7	8	9	10				
pH															
EC															
Turbidity															
TDS															
TSS															
Hardness															
Alkalinity															
Carbonate															
BOD															
TN															
TP															
Fluorides															
Chlorides															
Sulphates															
Sodium															
Potassium															
Calcium															
Magnesium															
Oil&Grease															
Iron															
Manganese															
Copper															
Zinc															
Phenolic C															
Color															
Cadmium															
Chromium															
Cyanides															
Lead															

T Coliform														
Pesticides														

Note: Standards set by Central Pollution Control Board as well as BIS-IS:10500, 2012 may be referred.

(2) Groundwater Quality **(Site)**

c) Date of testing:

d) Results:

Parameter	Unit	Measurement (Site)										Average	Limit (E class water)	Remark	
		1	2	3	4	5	6	7	8	9	10				
pH															
EC															
Turbidity															
TDS															
TSS															
Hardness															
Alkalinity															
Carbonate															
BOD															
TN															
TP															
Fluorides															
Chlorides															
Sulphates															
Sodium															
Potassium															
Calcium															
Magnesium															
Oil&Grease															
Iron															
Manganese															
Copper															
Zinc															
Phenolic C															
Color															
Cadmium															
Chromium															
Cyanides															
Lead															
T Coliform															
Pesticides															

Note: Standards set by Central Pollution Control Board as well as BIS-IS:10500, 2012 may be referred.



## Social Monitoring Form – B (To be used during Construction)

<b>Name of the Sub-Project:</b>	
<b>ID:</b>	
<b>Period of reporting (Quarter/Month/Fortnight):</b>	
<b>Name and signature of the Reporting Officer:</b>	
<b>Date of reporting:</b>	

### 1. Monitoring of social issue

Date and time of site inspection	Subproject/ Location	Issues	Mitigation measures undertaken	Remark
1.1	Interactions with local communities			
1.2	Resettlement (loss of income or loss of access)			
1.3	Impact of livelihoods			
1.4	Health and safety			
1.5	Accidents and traffic management			

## Environmental and Social Monitoring Form – C (To be used during Operations and Maintenance)

<b>Name of the Sub-Project:</b>	
<b>ID:</b>	
<b>Period of reporting (Quarter/Month/Fortnight):</b>	
<b>Name and signature of the Reporting Officer:</b>	
<b>Date of reporting:</b>	

### 1. Monitoring of environmental issues/parameters

#### (1) Groundwater Quality (Well)

a) Date of testing:

b) Results:

Parameter	Unit	Measurement (Well)										Average	Limit (E class water)	Remark
		1	2	3	4	5	6	7	8	9	10			
pH														
EC														
Turbidity														
TDS														
TSS														
Hardness														
Alkalinity														
Carbonate														
BOD														
TN														
TP														
T Coliform														
Pesticides														

Note: Standards set by Central Pollution Control Board as well as BIS-IS:10500, 2012 may be referred.

#### (2) Groundwater Quality (Site)

a) Date of testing:

b) Results:

Parameter	Unit	Measurement (Site)										Average	Limit (E class water)	Remark
		1	2	3	4	5	6	7	8	9	10			
pH														
EC														
Turbidity														
TDS														
TSS														
Hardness														
Alkalinity														

Carbonate																	
BOD																	
TN																	
TP																	
T Coliform																	
Pesticides																	

Note: Standards set by Central Pollution Control Board as well as BIS-IS:2296, 1992 may be referred.

**(3) Quantity of Groundwater Draft for Irrigation (Site)**

*Note - To know how much groundwater has been drafted for irrigation purposes 'Ultrasonic Flow Meter' will be installed near the outlet of the tube wells in the identified project sites with horticulture cropped areas as well as in non-horticulture crop sites in all the districts. Depending on the type of instrument the information may also be automatically transferred to the server regularly from the Ultrasonic Flow meter.*

a) Period/ Season of recording:

b) Results:

Geo Location of the tube well	Total Area irrigated through the tube well (hectare)	Season-1 (Crop wise area in ha.)			Seasonal GW draft for Irrigation (Unit .....)	Season-2 (Crop wise area in ha.)			Seasonal GW draft for Irrigation (Unit .....)	Season-3 (Crop wise area in ha.)			Seasonal GW draft for Irrigation (Unit .....)
		Crop-1 (.....)	Crop-2 (.....)	Crop-3 (.....)		Crop-1 (.....)	Crop-2 (.....)	Crop-3 (.....)		Crop-1 (.....)	Crop-2 (.....)	Crop-3 (.....)	

**(4) Rainwater Harvesting (Site)**

*Note – Rainwater harvesting from the infrastructure constructed under the project.*

a) Period/ Season of recording:

b) Results:

Location ID	Geo Location of the Rainwater harvesting site	Area coverage of the Rainwater harvesting structure (sq meter)	Amount of rainwater harvesting (Unit.....)														
			Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec			

## 2. Monitoring of social issues/parameters

Date and time of site inspection	Subproject/ Location	Issues	Mitigation measures undertaken	Remark
1.1	Impact of livelihoods			
1.2	Accidents			

### Attachment 10.3.7 JICA Environmental Checklist (17: Agriculture, Irrigation and Livestock Industry)

**Points to Note:**

1. Answers should not be limited to only Yes/No, but the rationale of the answer and mitigation measures should also be described in the "Confirmation of Environmental Considerations" column.
2. If you have any questions about terminology, etc., please refer to "Japan International Cooperation Agency Guidelines For Environmental and Social Considerations (January 2022)" (the JICA Guidelines) and "Answers to Frequently Asked Questions about the Japan International Cooperation Agency Guidelines For Environmental and Social Considerations (January 2022)" (FAQ).

Category	Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1. Permits and Consultations	(1) Environmental Assessment and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Are the EIA reports written in the official or widely used language of the host country? (c) Have EIA reports been approved by authorities of the host country government? (If not yet approved, write the expected date of the approval in the "Confirmation of Environmental Considerations" column.) (d) Have EIA reports been approved with any conditions? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (e) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government? (f) Do the EIA reports cover the items described in Appendix 2 of the JICA Guidelines? (The scope and detail of the impact assessment may be adjusted according to the impact of the project.) (g) Do the environmental and social consideration confirmation cover the project's whole scope, cumulative impacts, derivative and secondary impacts, as well as impacts of indivisible projects?	(a) N (b) N (c) N (d) N (e) N (f) N (g) N	(a) As per the Environmental Impact Assessment (EIA) notification 2006 of MoEF&CC, GoI mandates: i. Environmental Clearance (EC) for River Valley/ Irrigation Projects with more than 2000 ha Cultivable Command Area (CCA). Under the proposed sub-projects, only water saving irrigation facilities such as drip irrigation, sprinklers etc. are proposed that are beneficial to the environment and are out of the purview of EIA. ii. The building/ construction sub-projects, where built-up area is more than 20,000 sqm, require EC but construction activities under the proposed sub-projects are well below the threshold limit and therefore EC is not required. (b) The EIA notification 2006, mandates EIA reports to be written in English and in the official language of the state/local language. (c) N/A (d) N/A (e) No Objection Certificate (NOC) and Change in Land Use (CLU) would be required from the town and country planning department for building/ construction sub-projects once the project locations are firmed up. (It has been learnt that for Farmer's Producer Organizations (FPOs) NOC for CLU has been waived off). Also, Consent to Establish and Consent to Operate would be required from the SPCB as a set procedure to confirm adherence to environmental considerations as per the EP Act, Water Act, Air Act. (f) N/A (g) In general, overall scope of the project is to promote sustainable agriculture in the state of Haryana and the project is expected to have an overall positive impact on the groundwater (GW) by reducing the GW draft through crop diversification from water intensive crops to water efficient crops.

Category	Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Explanation and Consultation with Local Stakeholders	(a) Are local stakeholders properly analyzed and identified? (b) Does the project provide appropriate explanations to local stakeholders about the content and impact of the project, and gain their understanding, through the process of ensuring meaningful consultation including information disclosure? (c) For local stakeholder consultations, are records of consultations prepared, including the gender and other attributes of the participants? (d) Have comments from local stakeholders (such as local residents) been reflected to the project design, etc.?	(a) Y (b) Y (c) Y (d) Y	(a) General consultation with some of the stakeholders has been conducted to incorporate the comments in the overall project design and to understand the local pressing environmental and social issues and their severity. The detailed stakeholder consultation and information disclosure procedures shall be applied before and during the preparatory phase and their observations will be incorporated into the design of respective sub-projects and activities prior to their implementation by adopting social assessment and consultation processes. Considering the type of activities and their general scale, no sub-project type would require EC as per EIA 2006 notification. (b) EA has done consultations with various stakeholders within and outside the Government that includes farmers, traders, FPOs, private agriculture-based companies, etc. During the preparatory study, the survey team also accompanied EA's consultation process with various above-mentioned stakeholders as well as research institutes, private agriculture-based companies, and officials from other lined departments. (c) Various local stakeholders were consulted from time to time and record of consultations were prepared along with the list of participants also prepared, wherever possible. Detailed consultation will continue during the preparatory stage and throughout the project cycle with concerned local stakeholders. (d) At the project formulation stage inputs from local villagers/ FPO representatives from different regions/ districts were collected through consultation during field visits of the DoH officials as well as during the filed visits of the JICA survey team members and inputs were incorporated in the project design.
	(3) Examination of Alternatives	(a) Is the project/plan's scope of multiple alternatives adequately considered? (b) Are alternatives that are feasible in terms of technical, financial, and environmental and social aspects considered from the view point of environmental and social items and, if necessary, reducing total greenhouse gas emissions? (c) Are comparisons made with the "without project" scenario?	(a) Y (b) Y (c) Y	(a) The details about the project plan/scope of work is broadly identified in the form of overall Project activities but the detailed sub-projects and their site locations would be decided during the preparatory stage of the project (b) One of the main objectives of the project is crop diversification from water intensive crops to water efficient crops. The project also aims to reduce the area under Paddy/ Rice cultivation in the state and that is expected to reduce water draft as well as reduce the amount of methane released from Rice cultivation and make agriculture sustainable in Haryana. (c) Preliminary analysis based on water requirement of different crops shows that, considering the rainfall is near long term normal, if the project can diversify crops from water intensive to water efficient horticulture crops, then the sub-project areas can be made 'zero water deficit areas in comparison to nearly 45% water deficit (rainfall vs draft) in water intensive crops.

Category	Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2. Pollution Control	(1) Air Quality	(a) Are there any impacts from air pollutants (ammonia, methane, etc.) generated by raising livestock? (b) Do air pollutants emitted from the project cause areas that do not comply with the ambient air quality standards of the host country, etc.? (c) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N (b) N (c) N	(a) One of the main objectives of the project is sustainability of agriculture through micro-irrigation and crop diversification from water intensive crops like Paddy/Rice and others to horticulture crops. So, it is anticipated that the project will have overall positive impact in reduction in methane from area under Paddy. (b) No such activity is proposed that would negatively impact the ambient air quality. (c) No infrastructure development/ construction activity is proposed that will have major negative impact on the air quality. All laid down protocols for construction activity would be followed by the sub-contractor as well as would be monitored as per the ESAF under the project.
2. Pollution Control	(2) Water Quality	(a) Are considerations given to prevent water pollution of the surrounding water bodies, such as rivers and groundwater, by effluents or leachates from agricultural land, pasture land and irrigated land? (b) Are adequate use/disposal standards for fertilizers, agrochemicals, and livestock wastes established? Is a framework established to increase awareness of the standards among farmers? (c) Do effluents from the project cause areas that do not comply with the ambient water quality standards of the host country, etc. ? (d) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N (b) Y (c) N (d) N	(a) There is a possibility of use of permissible limit of chemical fertilizers and pesticides for certain crops even though the DoH is promoting Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) and use of vermi composting and organic farming. However, no significant water pollution is anticipated. The SPCB and CGWA regularly monitor the water quality as per their mandate and laid down regulations and take necessary proactive actions to mitigate negative environmental concerns. (b) DoH has issued a guideline on 'crops packages and practices' for farmers to follow as guiding principal on usage of fertilizers and pesticides. DHOs and SMS regularly interact with the farmers and create awareness among them to follow the prescriptions. (c) No such activity is proposed under the project that will have any major negative impact on the water quality. (d) All laid down protocols for construction activity would be followed by the sub-contractor as well as would be monitored as per the ESAF under the project.
	(3) Wastes	(a) Are hazardous wastes containing chemicals such as pesticides properly treated and disposed of in accordance with the laws and regulations of the host country? (b) Is effective use of organic wastes such as crop residues being considered, such as reuse as compost or as a heat source for power generation? (c) Are other wastes properly treated and disposed of in accordance with the laws and regulations of the host country? (d) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N/A (b) Y (c) Y (d) N	(a) There is no manufacturing of pesticides proposed under the project. (b) There are several initiatives taken by the DoA and DoH, for dealing with crop residue and several mechanisms are being promoted for use of residue as compost as well as power generation. (c) There is no major waste is anticipated under the project. Construction waste will be properly disposed off by the contractor as per the SPCB guidelines. (d) Although no large scale construction work is anticipated under the sub-projects but all CPCB/SPCB rules would be followed to minimize any impact as well as monitored as per ESAF.

Category	Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(4) Soil Contamination	(a) Has the soil at the project site been contaminated in the past? (b) Are measures taken to prevent physical and chemical degradation of the soil? (c) Does the project cause the irrigated areas to be harmed by salt? (d) Are adequate measures taken to prevent soil contamination of irrigated lands by agrochemicals, heavy metals and other hazardous substances? (e) Are any agrochemicals management plans prepared? Are any usages or any implementation structures organized for proper use of the plans? (f) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N (b) Y (c) N (d) Y (e) Y (f) Y	(a) Haryana state is in 2 <sup>nd</sup> highest position in per hectare consumption of pesticides. Since at this stage exact project sites are not known and are subject to soil testing, contamination status is not known. But considering the gravity of usage of pesticides in general in the state, under the project optimal use of pesticides under Integrated Pest Management (IPM) will be promoted (b) Crop diversification through horticulture crops is a major step towards maintaining soil fertility. Also, organic farming is being promoted at a wider scale. (c) Under the project micro irrigation will be promoted that would be helpful in maintaining low level of salt concentration. (d) The project will be promoting organic farming and Integrated Nutrient Management (INM) (e) EA will be promoting INM and IPM in the project. Guidelines/standards are there for appropriate usage of fertilizers/pesticides (f) Yes, all laid down protocols for construction activity would be followed by the sub-contractor as well as would be monitored as per the ESAF under the project.
	(5) Noise and Vibration	(a) Do noise and vibrations generated by the facility operations comply with the standards of the host country? (especially processing facilities) (b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) Y (b) Y	(a) No such activity with loud noise/ vibrations are proposed under the project. Processing machines will be serviced regularly. (b) Construction activity may lead to noise pollution. Construction equipment to be serviced regularly.
	(6) Subsidence	(a) Will subsidence occur when large amounts of groundwater are pumped? (b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N (b) N	(a) Under the project minor irrigation in a form of drip irrigation will be promoted that will reduce any negative impact (b) As the majority of the study area consists of plains thus subsidence is not anticipated.
	(7) Odor	(a) If there is an odor source, are adequate odor control measures taken? (b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N (b) N	(a) No such activity is proposed under the project that will have any major negative impact on odor (b) N/A
3. Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties/ conventions? (b) Does the project affect the protected areas? (c) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N (b) N (c) N	(a) No project activity is expected to be located in the protected areas (b) No project activity is anticipated to have any impact on the protected areas (c) No construction activity under the project is anticipated to be carried out inside the protected areas



Category	Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Biodiversity	<p>(a) Does the project site encompass primary forests, natural forests in tropical areas, habitats with important ecological value (coral reefs, mangrove wetlands, tidal flats, etc.)?</p> <p>(b) Does the project site encompass habitats of rare species that require protection under domestic legislation, international treaties, etc.?</p> <p>(c) Are there any concerns about the significant impact on biodiversity by the project, with significant conversion or significant degradation of critical habitats or critical forests? If yes, are appropriate measures taken to address the impact on biodiversity?</p> <p>(d) In the case of livestock projects, does overgrazing cause ecological degradation, such as impacts on wildlife habitats and desertification?</p> <p>(e) Does the amount of water (e.g. surface water, groundwater) used by the project have a negative impact on the surrounding water bodies such as rivers? (Mitigation measures to reduce impacts on aquatic organisms should also be described in the "Confirmation of Environmental Considerations" column.)</p> <p>(f) In the case of constructing weirs for water intake, mainly for irrigation projects, are the structures likely to interfere with the migration of anadromous fish species (salmon, trout, eels, and other species that migrate between rivers and the sea to spawn)? (Measures to reduce the impact on these species should also be included in the "Confirmation of Environmental Considerations" column.)</p> <p>(g) If there are any other concerns about significant impacts on biodiversity, are measures taken to reduce the impacts on biodiversity?</p> <p>(h) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?</p>	<p>(a) N (b) N (c) N (d) N (e) N (f) N (g) N (h) N</p>	<p>(a) The Project sites shall not be located within the primeval forest and natural forests in tropical areas and habitats with ecological value</p> <p>(b) The Project does not involve activities which are going to have huge discharge of wastes and effluents.</p> <p>(c) No project activity is expected to have any substantial impact on critical habitats or critical forests</p> <p>(d) The project mainly deals with crop diversification, water saving irrigation facilities, and infrastructure development for value chain</p> <p>(e) The project objective is to achieve crop diversification from water intensive to water efficient crops. Moreover one of the project component is promotion/development of water saving irrigation facilities. Also, as a monitoring mechanism amount of ground water use in water intensive crop fields and in horticulture crop fields of the project would be monitored to quantify water draft.</p> <p>(f) No such construction activity such as weirs is proposed under the project</p> <p>(g) Through crop diversification from mono cropping to diversified cropping, the project is expected to have a positive impact on biodiversity</p> <p>(h) For construction of pack houses there might be a requirement for change of land use from agriculture to non-agriculture use, but the size of the infrastructure is well within the threshold and not anticipated to have major negative impact on biodiversity.</p>
	(3) Hydrology	<p>(a) Are there adverse effects on surface water and groundwater flows, mainly in irrigation projects, due to changes in the water system caused by the installation of water intake facilities?</p> <p>(b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?</p>	<p>(a) N (b) N</p>	<p>(a) The proposed micro irrigation facilities include water saving irrigation systems such as drip irrigation and are expected to have positive impact on the efficient use of groundwater</p> <p>(b) same as above</p>

Category	Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4. Social Environment	(1) Resettlement and Land Acquisition	<p>(a) Is land acquisition with involuntary resettlement caused by project implementation? If yes, please describe the scale of land acquisition and resettlement.</p> <p>(b) Are efforts made to minimize the impacts caused by the resettlement? Are there any other land acquisition or loss of livelihoods?</p> <p>(c) Is adequate explanation on compensation and livelihood restoration program given to affected people prior to resettlement?</p> <p>(d) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards, developed based on socioeconomic studies on resettlement?</p> <p>(e) Are the compensations paid prior to the resettlement?</p> <p>(f) Are the compensation policies prepared in document?</p> <p>(g) Does the resettlement plan pay particular attention to vulnerable social groups, such as women, children, elderly peoples, people in poverty, persons with disabilities, refugees, internally displaced persons, and minorities?</p> <p>(h) Are the compensation to be agreed are explained to the project affected persons in writing, and are agreements with the affected people obtained prior to resettlement?</p> <p>(i) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p> <p>(j) Are any plans developed to monitor the impacts of resettlement?</p> <p>(k) Is the grievance redress mechanism established?</p>	<p>(a) NA (b) NA (c) NA (d) NA (e) NA (f) NA (g) NA (h) NA (i) NA (j) NA (k) NA</p>	<p>(a) The Project shall not have any activity, which involves involuntary resettlement or relocation of villages/ habitations.</p> <p>(b) Same as above</p> <p>(c) Same as above</p> <p>(d) Same as above</p> <p>(e) Same as above</p> <p>(f) Same as above</p> <p>(g) Same as above</p> <p>(h) Same as above</p> <p>(i) Same as above</p> <p>(j) Same as above</p> <p>(k) Same as above</p>

Category	Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Living and Livelihood	<p>(a) Does the project adversely affect the living conditions of the inhabitants? Are adequate measures considered to reduce the impacts, if necessary?</p> <p>(b) Is proper allotment made for rights to agricultural land use? (Are access rights and conveniences unevenly distributed among residents of a particular region or sector?)</p> <p>(c) Are proper allotments, such as water rights allotment in the project area made? (Are water rights and conveniences related to water use unevenly distributed among residents of a particular sector or region?)</p> <p>(d) Does the amount of water (e.g. surface water, groundwater) used by the project cause adverse impacts to the downstream fisheries and other water uses?</p> <p>(e) Does the project have a negative impact on ecosystem services (provisioning services and regulating services) and affect health and safety of the community (especially indigenous peoples who depend on the services)?</p> <p>(f) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?</p>	<p>(a) N (b) NA (c) Y (d) N (e) N (f) N</p>	<p>(a) The prime objective of the project is to achieve sustainable agriculture through crop diversification from water intensive to water efficient horticulture crops and introduction/ promotion of micro irrigation facilities. This is anticipated to increase the income of the farmers as well.</p> <p>(b) There is no land allotment or land rights to the Project beneficiaries for agriculture purpose. The Project shall target the farmers who already have land. Other infrastructure such as pack houses and processing units would be developed on farmer's own land/community land and other infrastructure such e-market etc. on Government land.</p> <p>(c) Drip irrigation will be promoted/taken up as micro irrigation facility under the project for efficient water usage. The project proposes building strong institutional mechanisms for operation and maintenance that will also ensure the equitable distribution of water through FPOs/farmer's organization.</p> <p>(d) There is no commercial fisheries activity. In Haryana around 54% of ground water and 46% of canal water is used for irrigation purposes. It is expected that efficient water use through micro water irrigation will have a positive impact in reducing groundwater draft.</p> <p>(e) The project is expected to have a positive impact on ecosystem services through water saving irrigation, maintaining agriculture biodiversity through crop diversification, maintaining soil productivity through promotion of organic farming and promotion of INM and IPM</p> <p>(f) The construction of pack houses are expected to help the farmers in post-harvest management of horticulture produce that is perishable in nature and will have a positive impact on sustainability of their livelihood.</p>
	(3) Vulnerable Social Groups	<p>(a) Is appropriate consideration given to vulnerable social groups, such as women, children, elderly peoples, people in poverty, persons with disabilities, refugees, internally displaced persons, and minorities?</p> <p>(b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?</p>	<p>(a) Y (b) N</p>	<p>(a) The project's focus is on increasing incomes of small and marginal farmers through aggregation and development of agri-business by supporting FPOs and individuals.</p> <p>(b) Yes, The construction of pack houses would be on community land.</p>

Category	Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4. Social Environment	(4) Heritage	(a) Does the project damage any archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the laws of the host country? (b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N (b) N	(a) The project activities are not anticipated to damage any archaeological, cultural site. Project will not take up such sub-projects and screening procedures are included in the draft ESAF for the project. (b) Sub-projects would be screened through the screening procedures as per ESAF to avoid heritage sites
	(5) Landscape	(a) Does the project adversely affect landscapes that require special considerations? (b) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N (b) N	(a) The size of the infrastructure proposed under the project is of small scale and no major landscapes would be adversely affected. For drip irrigation mostly pipelines would be laid down and, in many sites, the existing irrigation facilities will be rehabilitated/upgraded. Accordingly significant negative impacts are not predicted with proper management at the construction stage. (b) For drip irrigation mostly, pipelines would be laid down and, in many sites, the existing irrigation facilities will be rehabilitated/upgraded. Accordingly significant negative impacts are not predicted with proper management at the construction stage.
	(6) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected? (c) Is an indigenous peoples plan prepared and published, if necessary? (d) Do the project make efforts to obtain the Free, Prior, and Informed Consent (FPIC) of the affected indigenous peoples? (e) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?	(a) N (b) Y (c) N (d) Y (e) N	(a) There will not be any adverse change in culture and lifestyle of ethnic minorities and their rights due to the project activities. (b) All ethnic minorities of the project area will continue to get the benefits from agriculture system (c) There is no indigenous (ST) population in the project area (d) Project would ensure equal opportunities and FPIC with the local farmer's organization before taking up any sub-project activity in the area. (e) There is no negative impact on ethnic minorities due to the construction activities under the project.
	(7) Working Conditions	(a) Does the project comply with laws related to occupational health and safety of the host country? (b) Are tangible safety considerations in place for individuals involved in the project, such as installation of safety equipment which prevents industrial accidents, and management of hazardous materials, etc.? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as development of health and safety plans, and conducting safety training (including traffic safety and public health) for workers etc.?	(a) Y (b) Y (c) Y	(a) The Executing Agency is responsible for making sure all necessary mechanisms as per law is in place related to occupational health and safety. For construction work the contractor is responsible for following laid down rules and ensuring compliance with the mitigation measures for the health and safety of the workers. (b) For construction work the contractor is responsible for following laid down rules and ensuring compliance with the mitigation measures for the health and safety of the workers. (c) same as above

Category	Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(8) Health, Safety and Security of Local Communities	<p>(a) Are there any negative impacts on health/hygiene of the local community, such as disease outbreaks (including HIV and other infectious diseases) due to the influx of workers, etc. associated with the project? Are there any mitigation measures in place for the impacts?</p> <p>(b) Are there any negative impacts on the safety of the local community, such as deterioration of public safety, due to the influx of workers, etc. associated with the project? Are there any mitigation measures in place for the impacts?</p> <p>(c) When security guards are hired for the project or other personnel are deployed to ensure and maintain the security of the project area as well as the persons related to the implementation of the project during the project preparation and implementation, are any appropriate measures taken for such personnel not to use any force to provide security except for preventive and defensive purposes?</p> <p>(d) Does the construction have negative impacts? Are there any mitigation measures in place for the impacts?</p>	<p>(a) N (b) N (c) Y (d) N</p>	<p>(a) Environment, Health and Safety (EHS) laws are regulations set forth by governments that will be in place to protect the environment, people, and property from potential risks.</p> <p>(b) As a mitigation measure for the safety of the local community, the construction/labor camp will be situated within the sub-project area during the construction phase.</p> <p>(c) Appropriate measures will be taken to ensure that security guards involved in the project do not violate the safety of other individuals involved or other residents.</p> <p>(d) There is no negative impact on local communities predicted due to the construction activities under the project</p>
5. Others	(1) Monitoring	<p>(a) Does the project proponent develop and implement monitoring program for the environmental and social items that are considered to have potential impacts?</p> <p>(b) What are the items, methods and frequencies of the monitoring program?</p> <p>(c) Does the project proponent establish an adequate monitoring framework (organization, personnel, equipment, and budget to sustain the monitoring framework)?</p> <p>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reporting the monitoring results from the project proponent to the regulatory authorities?</p> <p>(e) Is the grievance redress mechanism regarding environmental and social considerations established?</p>	<p>(a) N (b) Y (c) Y (d) N (e) Y</p>	<p>(a) Draft ESAF is prepared for the project to follow as a guiding framework for environmental and social assessment and monitoring</p> <p>(b) Details about the monitoring items, methods, and frequencies are provided in the draft ESAF developed for the project</p> <p>(c) Draft ESAF includes all required details with respect to organizational structure for implementation of ESAF, role and responsibility of the key monitoring personnel, etc.</p> <p>(d) Monitoring by regulatory agencies will not be required as the project activities do not require any environmental clearance. The project will have monitoring requirements that will be entirely for the purposes of the Project.</p> <p>(e) Draft ESAF includes details about the grievance redressal mechanism for ESC.</p>
6. Note	(1) Reference to Checklist of Other Sectors	<p>(a) Where necessary, pertinent items described in the Forestry checklist should also be checked.</p> <p>(b) For the projects including construction of large-scale weirs, reservoirs, and dams, where necessary, pertinent items described in the Hydropower, Dams and Reservoirs checklist should also be checked.</p>	<p>(a)NA (b)NA</p>	<p>(a)NA (b)NA</p>
	(2) Note on Using Environmental Checklist	<p>(a) Where necessary, the impacts to transboundary or global issues should be confirmed (e.g. the project includes factors that may cause problems, such as transboundary waste treatment or global warming).</p> <p>(b) For projects that are expected to generate more than a certain amount of greenhouse gas emissions, is the total amount of the greenhouse gas emissions estimated before the project implementation?</p>	<p>(a)NA (b)NA</p>	<p>(a)NA (b)NA</p>

Acronym:

Ministry of Environment, Forest & Climate Change (MoEF&CC)

Environment Protection Act, 1986 (EP Act)

Water (Prevention and Control of Pollution) Act 197 (Water Act)

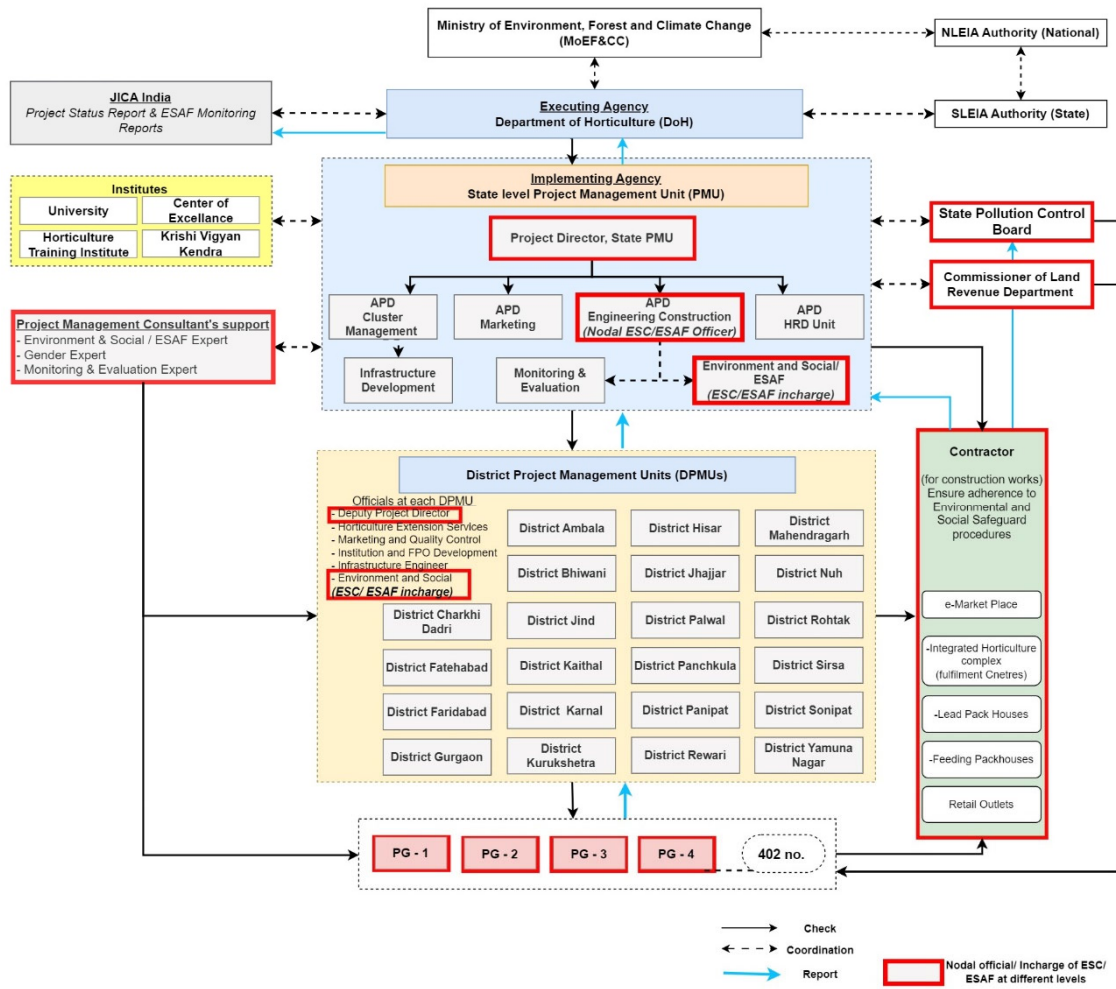
Air (Prevention and Control of Pollution) Act 1981 (Air Act)

State Pollution Control Board (SPCB)

Environmental Clearance (EC)

Haryana Water Resource Authority (HWRA)

### Attachment 10.3.8 Institutional Arrangement for ESAF



APD- Additional Project Director  
 FPO – Farmer Producer Organization

## **Attachment 11.8.1 Gender Mainstreaming Strategy and Action Plan**

### **GENDER MAINSTREAMING STRATEGY AND ACTION PLAN FOR “HARYANA SUSTAINABLE HORTICULTURE PROMOTION PROJECT (HRSHPP)”**

#### **Significance of Gender Mainstreaming-**

“Haryana Sustainable Horticulture Promotion Project (HRSHPP)” aims to increase income of target farmers through promoting sustainable agriculture and sales of horticultural crops with crop diversification (from cereals to horticultural crops), facility development, value chain building and capacity strengthening of concerned actors.

Gender mainstreaming facilitating gender equality and women’s empowerment deals with challenges/needs of concerned actors based on their genders, secures their rights, enhances their capabilities and active participation in activities and decision-making processes for enhancing effects and achieving purposes of the HRSHPP. Gender responsive activities also increase inclusiveness of the Project. Thus, a gender perspective should be incorporated into the designing of proposed HRSHPP.

#### **Gender Related Issues in Agriculture in Haryana-**

Women are the backbone of the rural agricultural economy, participating in agriculture, looking after livestock, bringing up the children, and actively handling the other household chores. However, their contribution to agricultural and rural development is seldom rewarded. Their ownership of and access to socioeconomic resources (e.g., land titles ownership, bank accounts, credits, training, information, etc.) and control power on decision-making are limited. Through survey, challenges for gender mainstreaming are identified as follows:

- While ratio of women working in agricultural sector against total working population is still high, women practicing farming independently are limited and most of them are engaged in farming in supplemental ways with such labor-intensive works as sowing, weeding, harvesting, etc. Shifting from cereals to horticultural (vegetable) cultivation may increase the workload particularly for women who are engaged in such labor-intensive manual farming.
- There are many programs/schemes providing micro-credit services such as through SHGs. Linking farmers/FPO members who need credits to these programs/schemes is still required.
- Under various schemes in agriculture, horticulture, and allied sectors, various training on production (cultivation, post-harvest, processing, etc.) and services (management, book keeping, etc.) are provided for both male and female farmers. It was observed that some female FPO members were motivated to obtain skills and knowledge for improving their production and market channels and to participate in related trainings including those on handling heavy agricultural machinery which is regarded as men’s work. However, female farmers tend to participate in trainings related to post-harvest, preserving and processing and their participation in crop-cultivation related trainings are limited (only male farmers tend to participate in these training) due to reasons of inconvenient venues, timing, understanding by other family members, etc. In addition, it seems that trainings related to gender sensitization and mainstreaming for farmers have not been conducted.
- Gender-wise data related to FPOs and their activities such as gender-wise number of their general and board members, number of women’s FPOs, gender-wise participants for their activities, etc. have not been collected and recorded. Although gender-wise data related to FPOs are not available in Haryana, number of women participating in FPOs seems to be very limited.
- Neither units are set, nor personnel are assigned in DOH for addressing gender mainstreaming issues. Officers of DOH have not received trainings on gender sensitization and mainstreaming; thus, they do not seem very gender conscious.

#### **Gender Mainstreaming Viewpoints-**



To tackle above-mentioned challenges, gender mainstreaming with considering following viewpoints would be promoted in the proposed HRSHP.

- (i) Improve women's access to and control over resources/information/trainings/services.
- (ii) Transform division of works/responsibilities among family members and enhance their work efficiency and productivities.
- (iii) Facilitate women's involvement in decision-making.
- (iv) Facilitate gender awareness of concerned actors.

### **Key strategic interventions to promote gender equality in the HRSHP -**

#### **Women membership in PGs:**

Current number of women members of FPOs seems to be very limited. For increasing number of women members of the target PGs (existing FPOs which have not received supports of "10,000 FPOs" scheme and CCDP, and any groups to be formed and registered by themselves either under Company Act, Cooperative Act, or with local administration body), their number could be considered as one of criteria for priority in selecting target PGs to receive supports (e.g. from Technical Support Group (TSG), financial supports, equity grant, subsidies for building facilities, etc.) under the Project. For this purpose, PGs with 10% women general and board members shall be prioritized for selection.

#### **Formation of women PGs:**

Bawania Women FPO is the only women FPO in Haryana. It was transformed from the existing SHGs engaged in agricultural processing. It could be thought that forming women PGs with common interests and objectives would contribute not only to achieving goals of PGs as business entities but also to improving status of women through facilitating development of women's leadership, change of their consciousness, increase of their incomes, improvement of their relations to other household members, etc. Thus, in parallel with measures to increase women members of PGs, measures to promote forming women PGs would be taken into consideration. At the time of farmer mobilization, TSG and gender expert in PMU shall coordinate with District officers of DOH, KVKs and various training institutes under DOH to check existing women farmer groups including SHGs having potential for forming women PGs and assist their application for supports from the Project. District officers of DOH, KVKs and various training institutes under DOH are expected to recommend women groups suitable for the Project.

Considering the fact that most of women groups are engaged in food processing in Haryana, PGs focusing on food processing are eligible to receive supports under the Project in order to accommodate women PGs. Food processing can contribute to efficient utilization and value addition of vegetable/fruits crops, which eventually promote horticulture sector in the State.

It is assumed that women PGs are supported as PGs under Category 1. PGs under Category 2 to 5 are required to register under the Company Act, however, most of women in Haryana are not Cultivators and thus not eligible for a membership of FPO under the Company Act. To ensure the certain number of the beneficiaries of the Project are women, the Project targets that 10% of PGs under Category 1 shall be women PGs.

#### **Facilitation of women's motivation for participating in activities of PGs:**

Under the Project, TSG will support for strengthening selected target PGs. Measures should be examined and implemented as follows for facilitating female members' motivation for participating in activities of PGs:

- Trainings for CEOs and board members of FPOs would be carried out by TSG. Gender mainstreaming in managing FPOs would be included as one of topics of those trainings.
- Market surveys with participation of board members and selected general members including women ones (it is recommended 20% of participants at minimum should be women) would be conducted to identify potential markets and understand market needs for preparing business plans and motivating member farmers produce target

crops.

- Mechanism to share information on PGs' activities with as well as to capture requests and complaints from female members (e.g. establishing women sub-groups of female members and spouses of members, regular meetings/communications between female board and general members, setting convenient venues and dates/times for regular meetings/activities, etc.) would be considered and taken.

### **Participation of women in technical trainings to obtain knowledge, information, and skills:**

Despite motivations of some female farmers as mentioned, their participation in crop-cultivation related trainings is currently limited. Under the Project, trainings on vegetable and fruits cultivation with using DVDs would be conducted at respective PGs, which make both male and female members easily participate in these trainings. In addition, it would plan technical trainings on cultivation of spices/medical/aromatic plants and mushrooms, which are thought to be relatively easy for women farmers to engaged in. Trainings on nursery raising techniques and food processing as well as on nutrition improvement (including kitchen garden) basically targeting women would be also planned. When trainings are planned, measures for facilitating women's participation (e.g. setting convenient venues, dates/times, and arranging transportation for women, etc.) would be considered. DVDs and training materials would be prepared in consideration of educational level of members particularly women ones.

### **Support to activate women sub-groups in PGs:**

Supports will be provided to women sub-groups established in PGs to facilitate their economic activities. Women sub-groups comprising female members of PGs and spouses of male members of PGs will be established with a purpose of enhancing their involvement in decision-making process as well as improving access to and control over resources. Women sub-groups will prepare their activity plans (Women Sub-Group Activity Plan) after they receive technical training programmes. The Project will provide materials and equipment necessary to implement the Women Sub-Group Activity Plan. Assumed activities include mushroom cultivation, food processing, nursery production, etc.

### **Considering workload of women:**

Topics of gender sensitization such as work life balance in household, tools/methods for reducing workloads of women are included in above proposed trainings on vegetable and fruits cultivation. In addition, provision of farming instruments such as weeder, seeder, etc. is also planned to reduce women's workload in the field.

### **Infrastructure development for building value chains:**

Construction of feeding packhouses is included in the Project. It is assumed that PGs (existing FPOs without receiving supports from CCDP and other registered PGs) themselves would plan and implement construction of packhouses and apply for subsidies in accordance with the guideline to be prepared by the Project. This guideline will stipulate a mandatory consultation process with female members and women relevant with the PG at the time of farmer mobilization by TSG to accommodate needs and requests of women. The guidelines will also include check items to ensure designs of packhouses applied for by PGs are user-friendly particularly for women users (e.g. size of equipment/machinery, setting toilets and locker rooms for women, etc.).

Different types of feeding packhouses depending on size, costs, specifications, eligible applicants, etc. are planned. It is assumed that PGs with small number of members including existing SHGs, women sub-groups to be formed, etc. could apply for small-sized packhouses if they are registered ones. Since these women PGs seem to have needs for processing facilities, packhouses focusing on food processing and/or adding of processing equipment to small-size packhouses are eligible in the Project.

### **Expansion of women's access to other services:**

Through PG activities, women members may be interested in common activities. In such cases, TSG and/or PG motivators could guide them to form groups such as SHGs to access to other services such as credit services, trainings on other topics, etc. which cannot be provided by PGs with supports of the Project. These newly formed groups could

also apply for constructing of above-mentioned feeding packhouses/processing facilities if they are registered.

### **Facilitating gender sensitization of concerned actors:**

It was observed that both FPO members and officers of DOH seemed not to be gender conscious. Thus, gender sensitization of concerned actors of the Project including those persons should be facilitated.

Topics of gender sensitization such as necessity of gender mainstreaming in improving agricultural activities, work life balance in household (current situation of workloads in agricultural works and domestic chores by family members, etc.), tools/methods for reducing workloads of women are included in above proposed trainings on vegetable and fruits cultivation for PG member farmers (both male and female ones).

In addition, topics of gender sensitization and nutrition are also included in Trainings of Trainers (ToT) for officers/staff of PMU, DPMU, concerned officers of DOH, and other concerned persons.

### **Assignment of gender expert in PMC:**

Gender expert is proposed to be assigned in PMC. Duties/responsibilities of the gender expert are:

#### Overall

- Prepare a gender mainstreaming manual including viewpoints, concrete measures, how to implement these measures, etc. for promoting gender mainstreaming in HRSHP.
- Provide proposals and guidance in all stages of the Project activities of planning, implementation, and monitoring/evaluation with viewpoints of gender mainstreaming.

#### Component 1

- Confirm criteria for eligibility and selecting target PGs to receive supports from Technical Support Group (TSG) would include gender viewpoints (e.g. number of women members of PGs, etc.)
- Provide guidance to TSG to include certain ratio of women board and general members into PGs.
- Survey on existing women farmer groups including SHGs having potential for forming women PGs and assist their application for supports from the Project.
- Confirm whether gender mainstreaming measures are considered in planning and implementation stages of market survey and horticulture guidance (trainings) and provide necessary guidance to concerned parties (Technical Support Group, PMU, PMC, etc.).
- Examine and prepare contents of technical guidance's topic of "gender sensitization".

#### Component 2

- Confirm whether the guideline related to construction of feeding packhouses considers user-friendly designs (particularly for women users), criteria for eligibility and selecting target PGs with gender viewpoints, and subsidy application procedures easy to handle even for women groups.

#### Component 3

- Examine items of gender-related data/information to be collected by the baseline survey, mid-line survey and endline survey.
- Collect and storage of gender-related data (e.g. number of women PGs, gender-wise number of members of PGs, participants of trainings/activities, beneficiaries receiving assistances, etc.) for monitoring and evaluation purpose.
- Examine contents of topic of "gender sensitization" for state-level workshops (for PMU, PMC, DPMU, DOH, etc.), district-level workshops (for DPMU, Horticulture Extension Services, etc.), and technical trainings. Provide lectures/trainings related to "gender sensitization" in these workshops and trainings.
- Evaluate achievements of gender mainstreaming for the Project by confirming data/information to be collected in mid-line survey and endline survey.

### **GENDER ACTION PLAN OF “HRSHPP” WITH TIMELINE INDICATORS FOR MONITORING AND EVALUATION**

<b>Action</b>	<b>Responsibility</b>	<b>Indicators</b>	<b>Means of verification</b>	<b>Timeline</b>
1. Facilitate increasing numbers of women members of the target PGs by setting priority criteria in selection criteria as well as providing guidance.	By PMU/PMC for considering selection criteria. By TSG for providing guidance to the target PGs to consider increasing women members.	PGs that more than 10% of the members are women are prioritized in selection.	Basic data of target PGs in an information sharing platform to be developed under the Project.	At the time of sanction of the target PGs, by mid-line and endline.
2. Facilitate women farmer groups to be the target PGs by assisting their application for supports from the Project in coordination with District DOH Officers, KVKs, training institutes, etc.	By gender expert in PMC for assisting their application for supports from the Project (component 1.1&1.3). By TSG for assisting their application for supports from the Project (component 2.1).	At least 10% (28) of the target PGs under Category 1 are women PGs.	Basic data of target PGs in an information sharing platform.	At the time of sanction of the target PGs, by mid-line and endline.
3. Facilitate women’s participation in regular meetings/general activities of the target PGs by providing guidance and establishing mechanism to share information/requests/complaints among women members in the target PGs.	By TSG.	80% of women members participate in regular meetings of the target PGs.	Information on activities of the target PGs stored in an information sharing platform.	At the time of sanction of the target PGs, by mid-line and endline.
4. Facilitate establishing women sub-groups and implementation of their activities.	By TSG.	80% of target PGs establish women sub-groups.  50% of women sub-groups prepare Women Sub-Group Activity Plan.	Information on activities of the target PGs stored in an information sharing platform.	By mid-line and endline.
5. Facilitate women’s participation in market survey to motivate them by providing guidance.	By TSG.	About 20% of participants for market survey of the target PGs are women members.	Information on activities of the target PGs stored in an information sharing platform.	By mid-line and endline.
6. Facilitate women’s participation in technical trainings by considering venues and dates/times convenient for women, using DVDs, and selecting target crops/topics which women are interested in and easily engaged in.	By TSG, PG motivators, and gender expert in PMC.	About 50% of women members of the target PGs participate in crop-cultivation trainings with using DVDs. About 70% of women members of the target PGs participate in some of trainings on cultivation of spices/medical/aromatic plants and mushrooms, nursery raising techniques, food processing, nutrition improvement, etc. which mainly target women.	Information on activities of the target PGs stored in an information sharing platform.	By mid-line and endline.

7. Facilitate user-friendly (particularly for women users) packhouses through consultation with women prior to decision on design of packhouse	By TSG, PG motivators, and gender expert in PMC.	Guideline on application for packhouses stipulates a mandatory consultation process with women.	Information on activities of the target PGs stored in an information sharing platform.	At the time of sanction of the target PGs, by mid-line and endline.
8. Facilitate participation of officers/staff of PMU, DPMU, concerned officers of DOH, and other concerned persons by preparing and implementing these trainings/workshops with appropriate/attractive content.	By gender expert in PMC in coordination with PMU and DPMU.	About 70% of officers/staff of PMU, DPMU, concerned officers of DOH, and other concerned persons participate in trainings/workshops for gender sensitization/ mainstreaming.	Information on activities of the target PGs stored in an information sharing platform. Record in PMC/PMU/DPMU/DOH.	By mid-line and endline.
9. Improve women's knowledge and skills by facilitating their participation in activities of the target PGs and facilitating their participation in trainings.	By TSG, PG motivators, and gender expert in PMC.	About 70% of women members of the target PGs realize that their knowledge and skills have been improved through PG's activities including technical trainings.	Comments from TSG/ PG motivators. Interviews (questionnaire survey) with some of women members of the target PGs.	By endline.
10. Improve women's workload and work efficiency by facilitating their participation in activities of the target PGs and facilitating their participation in trainings.	By TSG, PG motivators, and gender expert in PMC.	About 70% of women members of the target PGs realize that their workload and work efficiency have been improved through PG's activities including technical trainings.	Comments from TSG/PG motivators. Interviews (questionnaire survey) with some of women members of the target PGs.	By endline.
11. Improve women's involvement in decision-making both in PGs' activities and in their household by facilitating their participation in activities of the target PGs and facilitating their participation in trainings.	By TSG, PG motivators, and gender expert in PMC.	About 50% of women members of the target PGs realize that their involvement in decision-making both in PGs' activities and in their household have been improved through PG's activities including technical trainings.	Comments from TSG/PG motivators. Interviews (questionnaire survey) with some of women members the target PGs.	By endline.
12. Enhance awareness of concerned actors about gender mainstreaming by participating in trainings/workshops for gender sensitization/ mainstreaming and through being involved with activities related to PGs under the Project.	By gender expert in PMC in coordination with PMU and DPMU.	About 50% of concerned actors (officers/staff of PMU, DPMU, concerned officers of DOH, male members of the target PGs) realize that they have been more aware about gender mainstreaming through PG's activities.	Comments from TSG, gender expert in PMC. Interviews (questionnaire survey) with some of concerned actors.	At the time of trainings/workshops and by mid-line and endline.

Note:

- Expert on Monitoring & Evaluation and Gender Expert in PMC are responsible for collecting data/information regarding these indicators.
- Although target regarding "women's access to other services" is not set, their cases will be recorded.
- Data on the number of persons (particularly women) employed by the FPOs as workers at their packhouses will be collected for assessing impacts of the proposed project.