

Himachal Pradesh Subtropical Horticulture, Irrigation & Value Addition Project (HPSHIVA)

Detailed Project Report



Table of Contents

Executive Summary	9
1. Introduction	23
1.1. About Himachal Pradesh	23
1.2. Brief Description of Horticulture Sector	26
1.3. Brief Description of Irrigation Sector	34
1.4. Challenges in the Sector	37
2. HPSHIVA Project Concept	40
2.1. Project Overview	40
2.2. Project Stakeholders and Beneficiaries	42
2.3. Project Output, Outcomes, and Impact	43
2.4. Project alignment and convergence with Central and State Government and ADB Strategy	45
3. Project Readiness Financing (PRF)	49
3.1. PRF Objectives	49
3.2. PRF Outputs	49
3.3. PRF Key Outcomes	68
3.4. Procurement packages	69
3.5. Farmer Satisfaction Survey	70
3.6. Learnings from PRF	72
3.7. Refined design for Ensuing Main Project	83
3.8. Grievance Redressal Mechanism (GRM)	85
3.9. Significant Milestones	86
3.10. Glimpse of Project Activities during PRF	87
4. Detailed Project Design	88
4.1. Introduction	88
4.2. Cluster and Beneficiary Selection	92
4.3. Output 1	97
4.4. Output 2	109
4.5. Output 3	139
5. Environmental and Social Impact Assessments	151
5.1. Environmental Impact Assessment	151
5.2. Climate Change Impact	166
5.3. Poverty & Social Analysis	172
5.4. Land Acquisition	177
5.5. Resettlement and Rehabilitation	177

6.	Project Cost Estimate and Phasing	178
6.1.	Cost Estimate	178
6.2.	Means of Financing	181
7.	Economic and Financial Analysis	182
7.1.	Introduction	182
7.2.	Rationale for Government involvement	182
7.3.	Goals of the plan	183
7.4.	Without-Project and With-Project Scenarios	183
7.5.	Project Costs	185
7.6.	Methodology and assumptions	185
7.7.	Sensitivity analysis	187
7.8.	Sustainability analysis	187
8.	Project Implementation	188
8.1.	Project Organization Structure	188
8.2.	Roles & Responsibilities	191
8.3.	Implementation support to EAs/IAs	195
8.4.	Project Procurement	197
8.5.	Monitoring & Evaluation	205
8.6.	Implementation Timelines	207
9.	Annexure	209
9.1.	Volume 1 of 5	209
9.2.	Volume 2 of 5: Horticulture and Value Chain	272
9.3.	Volume 3 of 5: Irrigation	272
9.4.	Volume 4 of 5: Safeguards	272
9.5.	Volume 5 of 5: Miscellaneous	272

List of Tables

Table 1: Demographic Profile	24
Table 2: Agro Climatic Zones in the State	28
Table 3: Fruit Production in the State	30
Table 4: Major Development Partners Projects	33
Table 5: Status of Irrigation in the State	36
Table 6: Current challenges in Horticulture Sector in the State	37
Table 7: Expected outputs and activities.....	43
Table 8: PRF Outputs and Activities	50
Table 9: Area of PRF Clusters.....	53
Table 10: Details of Crops for PRF.....	54
Table 11: Procurement packages under the Project.....	69
Table 12: Learnings from PRF	72
Table 13: Plant Mortality in the PRF Clusters	82
Table 14: Outputs for Ensuing Main Project.....	83
Table 15: Action taken on comments of DEA.....	90
Table 16: Clusters surveyed during topography survey.....	95
Table 17: Classification of Cluster as per Irrigation Scheme	105
Table 18: Agro climatic conditions for the proposed crops	111
Table 19: Proposed crops and varieties.....	113
Table 20: Water requirements under drip irrigation system	114
Table 21: Stages of Crop Management	117
Table 22: Nutrient requirements of identified crops	119
Table 23: Major components of Drip Irrigation system.....	121
Table 24: Crop Wise planned nurseries	127
Table 25: Propagation techniques for various crops.....	128
Table 26: Suggested Intercrops	131
Table 27: Marketing efficiency of Citrus among different marketing channels	139
Table 28: Project activities for assessing environmental impacts.....	151
Table 29: Summary of stakeholders and issues discussed	153
Table 30: Impact of projects activities with environmental attributes	160
Table 31: Suggested risk mitigation plan	162
Table 32: Climate Hazard Profile of the Project Districts	167
Table 33: Resilience Building Action Plan.....	171
Table 34: Output wise cost	181
Table 35: Indicative Financing Plan.....	181
Table 36: Crop budget in the Project area	184
Table 37: Sensitivity analysis	187
Table 38: Implementation Timeline	207

List of Figures

Figure 1: Map of Himachal Pradesh	23
Figure 2: GSDP of Himachal Pradesh at Current Prices	24
Figure 3: Per Capita GSDP of Himachal Pradesh at current prices	25
Figure 4: NSDP of Himachal Pradesh at current prices.....	25
Figure 5: Per Capita NSDP of Himachal Pradesh at current prices	26
Figure 6: Horticulture Crops Category Wise in the State (2017 - 2018)	29
Figure 7: Fruits and Vegetables production of Himachal Pradesh (2017 - 2018).....	29
Figure 8: Districts covered under the Project	41
Figure 9: Identification of water source for irrigation	51
Figure 10: Identification of Cluster Areas	52
Figure 11: Procurement of plant material from nurseries.....	54
Figure 12: Site Clearance for plantation.....	55
Figure 13: Field Preparation activity	55
Figure 14: Plantation in Clusters	56
Figure 15: Main water tank & Drip Irrigation System.....	56
Figure 16: Mulch laying in Clusters	57
Figure 17: Intercropping in PRF clusters.....	57
Figure 18: Animal Proof Composite fencing.....	58
Figure 19: Meeting & Training for Capacity Building of CHPMA.....	59
Figure 20: Sorting, Packing and Marketing of produce	60
Figure 21: Monitoring of Facilitator's work progress	62
Figure 22: Snapshot of the Web GIS page	63
Figure 23: GIS Dashboard for PRF Clusters.....	63
Figure 24: Analysis of farmer's satisfaction survey	71
Figure 25: Honorable PM Shri Narendra Modi ji visiting HPSHIVA exhibition at Mandi...	86
Figure 26: Laying of Foundation stone by Honorable CM Shri Jai Ram Thakur ji.....	86
Figure 27: Plantation activities by Ministers, MLAs & Public Representatives	86
Figure 28: Schematic flow diagram of Upper Beri scheme	100
Figure 29 Flow Diagram of existing LIS scheme.....	100
Figure 30: Flow diagram of LIS Bakarti scheme	102
Figure 31: Flow diagram of proposed scheme for Bakarti Cluster.....	102
Figure 32: Flow diagram of scheme of Jakhota & Dhanot Cluster.....	104
Figure 33: Approach for Cluster mapping	117
Figure 34: Drip Irrigation system	121
Figure 35: Solar Fencing	123
Figure 36: Cluster of GIS tagging	124
Figure 37: Advantages of organic fertilizers	134
Figure 38: Various steps of CHPMA Cooperative Society Development	137
Figure 39 Organization chart of APEX Body	145
Figure 40: IPCC AR5 vulnerability assessment framework	166
Figure 41: Observed Average Annual Mean Temperature (1901 - 2020)	168
Figure 42: Observed Average Annual Mean Precipitation (1901 - 2020).....	169
Figure 43: Project Mean Temperature (2020 - 2039).....	169
Figure 44: Trend in the arrival of Sweet Orange in the markets of Himachal Pradesh ..	238

Figure 45: Mean of Modal Price Trend for Sweet Orange INR per KG	238
Figure 46: Trend in the arrival of Guava in the markets of Himachal Pradesh.....	243
Figure 47: Trend in the arrival of Litchi in the markets of Himachal Pradesh	251
Figure 48: Mean of Modal Price Trend for Litchi INR per KG	252
Figure 49: Trend in the arrival of Plum in the markets of Himachal Pradesh	261
Figure 50: Trend in the arrival of Mango in the markets of Himachal Pradesh	267
Figure 51: Mean of Modal Price Trend for Mango INR per KG.....	267

List of Abbreviations

Details	Description
AIF	Agriculture Infrastructure Fund
APR	Actuarial Premium Rate
ATMA	Agricultural Technology Management Agency
B2B	Business to Business
B2C	Business to Customer
BCT	Block Chain Technology
CHPMA	Community Horticulture Produce Marketing Association
DIPH	Department of Irrigation & Public Health
DIU	District Implementation Unit
DOH	Department of Horticulture
FAO	Food and Agriculture Organization
FLD	Front Line Demonstration
FPO	Farmer Producer Organization
FYM	Farmyard Manure
GIS	Geographic Information System
GoC	Group of Clusters
GoHP	Government of Himachal Pradesh
GRM	Grievance Redressal Mechanism
HP	Himachal Pradesh
HDO	Horticulture Development Officer
HEO	Horticulture Extension Officer
HPSHIVA	Himachal Pradesh Subtropical Horticulture Irrigation and Value Addition
ICS	Individual Consultant Selection
IFC	Integrated Facility Centers
IRR	Internal Rate of Return
JSV	Jal Shakti Vibhag
MDT	Main Delivery Tank
MFE	Micro Food Enterprises
MMNPY	Mukhya Mantri Nutan Polyhouse Yojana
MOVCDNER	Mission Organic Value Chain Development in Northeast Region
MSME	Micro, Small and Medium Enterprises
NABARD	National Bank for Agriculture and Rural Development
NBHM	National Beekeeping and Honey Mission
NICE	Networking, Interaction, Common Interest and Experience
NMSA	National Mission of Sustainable Agriculture
NPOF	National Project on Organic Farming

Details	Description
NPV	Net Present Value
OHS	Occupational Health and Safety
PAC	Project Appraisal Committee
PAM	Project Administrative Manual
PIU	Project Implementation Unit
PKVY	Paramparagat Krishi Vikas Yojana
PMFBY	Pradhan Mantri Fasal Bima Yojana
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PMU	Project Management Unit
PoP	Package of Practices
PRA	Procurement Risk Assessment
PRF	Project Readiness Financing
RCOF	Regional Centers of Organic Farming
RWBCIS	Restructured Weather Based Crop Insurance Scheme
SBD	Standard Bid Document
SFAC	Small Farmers' Agribusiness Consortium
SHC	Soil Health Card
SPS	Safeguard Policy Statement
SRFP	Standard Request for Proposal
WUA	Water User Association
WUE	Water Use Efficiency

List of Annexures

Annexure No.	Detail of Annexure
Volume – 1 General	
Annexure 1.1	Detailed project costing
Annexure 1.2	Technical drawing of project components
Annexure 1.3	Cluster wise Crop Mapping
Annexure 1.4	Crop Specification and Market Trends
Volume – 2 Horticulture & Value Chain	
Annexure 2.1	Package of Practices
Annexure 2.2	Value Chain Assessment Report
Annexure 2.3	Nursery Development Action Plan Report
Annexure 2.4	Note on Intercropping
Annexure 2.5	Note on Beekeeping
Annexure 2.6	Note on Digital Agri-tech Solutions
Annexure 2.7	Cluster Selection and Ranking Criteria
Volume – 3 Irrigation	
Annexure 3.1	Irrigation Scheme Feasibility Analysis
Annexure 3.2	Detailed Designed Report - Functional Scheme
Annexure 3.3	Detailed Designed Report - Non - Functional Scheme
Annexure 3.4	Detailed Designed Report - New Scheme
Annexure 3.5	Topography Maps
Volume – 4 Safeguard	
Annexure 4.1	HPSHIVA Summary Poverty Reduction and Social Strategy (SPRSS)
Annexure 4.2	HPSHIVA Gender Equality and Social Inclusion (GESI) Action Plan
Annexure 4.3	HPSHIVA Climate Risk and Vulnerability Assessment (CRVA) Report
Annexure 4.4	Initial Environmental Examination (IEE)
Annexure 4.5	Stakeholder Communication and Engagement Plan (SCEP)
Annexure 4.6	Poverty and Social Analysis (PSA)
Annexure 4.7	Social Due Diligence Report (SDDR)
Annexure 4.8	Environmental Assessment and Review Framework (EARF)
Volume – 5 Miscellaneous	
Annexure 5.1	Centre & State Government Horticulture Schemes
Annexure 5.2	HPSHIVA Project Readiness Financing (PRF)
Annexure 5.3	HPSHIVA Sector Assessment Report
Annexure 5.4	HPSHIVA Baseline Survey Report
Annexure 5.5	Water User Association (WUA)
Annexure 5.6	Community Horticulture Produce Marketing Association (CHPMA)
Annexure 5.7	Project Component Business Plans
Annexure 5.8	Project Economic & Financial Analysis

Executive Summary

i. About Himachal and its Horticulture and Irrigation Sector

In Himachal Pradesh (hereinafter referred to as the “State”), Agriculture & Allied Sector supports about 60% of the population. It registered a growth of 18.3% in 2019-20 with a Gross Value Add (GVA) of INR 10.58 crore, as compared to INR 8.95 crore during 2018-19. Horticulture sector is proving helpful in strengthening the economic state of the people by generating various sources of income. Out of the total geographical area of the State (55.7 lakh ha.), the area of operational holdings is about 955,000 ha, operated by 961,000 farmers. The average holding size is about 1.00 ha. Distribution of land holdings shows that 87.95 % of the total holding belongs to small and marginal farmers. The State’s agriculture is largely dominated by high value horticultural commodities such as apples, which account for about 49% of the total area under fruit crops and 79% of the total fruit production. The horticulture sector annually contributes approximately INR 3,000 crore to INR 5,000 crore to the State’s economy.

While crop diversification is increasing in Himachal Pradesh, for fruits and vegetables, this is mostly concentrated in districts of the mid-hills and high hills and dry temperate zone, **leaving a substantial income gap between temperate and sub-temperate producers and those producing sub-tropical crops. The sub-tropical region (Bilaspur, Hamirpur, Kangra, Mandi, Sirmour, Solan, and Una districts) in the State face multiple challenges in terms of climate change, rainfall uncertainties, water availability and low productivity of horticulture produce and income disparity.**

In terms of Irrigation, the proportion of current fallow, **long term fallow and culturable waste land to total geographical area is 1.32%, 0.48% and 2.81% respectively, which is very low as compared to that in many other States.** Out of total geographical area of the State, i.e., 55.7 lakh ha, only 1.1 lakh ha is under irrigation. Of the total irrigated areas, **7.14% is irrigated by canals, 7.14% by wells and 85.72% by other sources of irrigation such as kuhls, tube wells, shallow wells, lift irrigation, check dams, and storage tanks.** It is estimated that ultimate **irrigation potential of the State is approximately 335,000 ha., out of which 50,000 ha. can be brought under irrigation through major and medium irrigation projects and the balance 2,85,000 ha area can be provided irrigation through minor irrigation schemes.**

ii. Project Background and Concept

To harness the potential of horticulture in the low hills or valley areas in subtropical climate of the state, **the Himachal Pradesh Subtropical Horticulture, Irrigation & Value Addition (HPSHIVA)** (hereinafter called the **“Project”**) was conceived with the financial assistance from Asian Development Bank. The Department of Horticulture, Himachal Pradesh (DOH) in the month of May 2018 submitted a project proposal to DEA, GOI for development of Subtropical Horticulture viz. “Horticulture Value Chain Infrastructure & Promotion of Climate Resilient Technologies for Development of Subtropical Horticulture in Himachal Pradesh”. This proposal envisaged the inclusion of 10 districts (Solan, Sirmour, Shimla, Una, Bilaspur, Hamirpur, Kangra, Chamba, Mandi and Kullu) covering around 20,000 ha area.

The idea was to bring farmers back to their traditional occupation by providing them with an opportunity of scientific and commercial farming in Clusters followed by post-harvest value addition opportunities. The project has been built on the concept of **“Beej Se Bazaar Tak”**. The project also is a step forward towards **realizing the dream of making Himachal Pradesh the ‘Fruit Bowl of India’**.

The success of first phase of project, which constituted of various pilot activities (constituted and formulated under the name and style of **“Project Readiness Financing’ – PRF**), has been very heart warming and encouraging. The results of two years of working on the PRF have paved way for upscaling the activities to a much larger area which has the potential of making a significant difference to lives and livelihoods of many more rural households, under the larger Ensuing Loan project.

Government of Himachal Pradesh submitted two separate projects to the Department of Economic Affairs (DEA), Ministry of Finance, Government of India in May 2018:

- a) **Horticulture value chain infrastructure & promotion of climate resilient technologies for development of subtropical horticulture in Himachal Pradesh for INR 1,688 crore (US\$ 253 million) by Department of Horticulture (DoH); and**
- b) **Doubling farmer’s income for INR 4,751 crore (US\$ 633 million) by Jal Shakti Vibhag (JSV)**

These projects were approved by DEA in its 84th and 85th Screening Committee meeting and posed to ADB for external funding for US\$ 200 million and US\$ 84 million respectively. The Asian Development Bank also in its various Missions (Consultation Mission, Pre-Fact Finding / Fact Finding Mission, Inception Mission) in the years 2018 and 2019 observed that the project proposals are broad in scope and cover a wide geographic area. Based on ADB's experience with similar projects, this could increase the risk of achieving outcomes and increase capacity of implementation. The ADB mission (March 2019) proposed to integrate the DOH Horticulture Project and JSV Irrigation Project as a single project under the name and style of "Himachal Pradesh Sub Tropical Horticulture, Irrigation and Value Addition (HPSHIVA) Project with DOH as Executing Agency (EA) and both DOH and DIPH as two Implementing Agencies (IA) for the horticulture and irrigation components respectively.

The Mission proposed integration of both projects with a phased approach. After integration, the project was named as Himachal Pradesh Sub Tropical Horticulture, Irrigation & Value Addition (HPSHIVA) Project with a total tentative cost of US\$ 130 million and ADB's resources of US\$ 100 million.

ADB proposed to implement the Project in two parts:

- **HPSHIVA Project Readiness Financing (HPSHIVA- PRF): December 2020 – November 2022:** The PRF time frame was for two years from December 2020 to November 2022 and would cover a pilot area of around 200 ha under High Density Plantations of Citrus, Guava, Litchi and Pomegranate in 17 Clusters in 4 districts (Bilaspur, Hamirpur, Kangra & Mandi) by DOH and establishing / rehabilitating 16 irrigation schemes by DIPH for covering 17 PRF Clusters.
- **Main Ensuing Loan: December 2022 - November 2027:** In 28 development blocks of 7 sub-tropical horticulture districts (Bilaspur, Hamirpur, Kangra, Mandi, Solan, Sirmour and Una with tentative costs of US\$ 90 million as ADB loan.

The Nodal agency of the Project is **Department of Horticulture (DOH)**. A **Project Management Unit (PMU)** at the State level has been established under DOH. Two separate **Project Implementation Units (PIUs)** are established in DIPH & DOH for implementation of respective project

components. Under the PRF of the Project, the Goods and Civil Works packages have been completed well before the project timelines and the consulting packages for (i) Detailed Project Report for the Ensuing Loan, (ii) Horticulture Strategy and Investment Plans, (iii) Package of Practices for the proposed horticulture crops shall all be completed within the PRF project timeline of November 2022. The achievements and learnings of PRF are mentioned at **Annexure 5.2**. The ADB Fact Finding Mission for the main Ensuing Loan project (which was fielded during the period 28th March 2022 to 7th April 2022) approved the Detailed Project Report with an outlay of US\$ 200 Million) ADB resources to cover 6,000 ha area and 162 irrigation schemes will be developed for initial 4,000 ha which will include 33 functional schemes, 19 non-functional schemes and 110 new schemes and these will be implemented from September 2022 to August 2027.

The proposed project aims to **increase the income of rural farm households in the seven districts of Bilaspur, Hamirpur, Kangra, Mandi, Sirmour, Solan and Una in subtropical areas of Himachal Pradesh bringing 6,000 ha of land under horticulture production**. At least 20% of the project's beneficiaries will be poor households. The project proposes to **expand the irrigation facilities to farmers in a coordinated manner with the horticultural needs, to increase the subtropical horticulture production and supply climate resilient plants, to ensure profitability of subtropical horticulture production through value chain development of targeted crops**. The project shall have three key outputs:

Outputs	Description
Output 1	Irrigated area expanded and sustainably operated
Output 2	Climate resilient subtropical horticultural production systems adopted
Output 3	Market access for subtropical horticulture farmers developed

The various activities to be carried out under each of these outputs have been highlighted in Section 2.3.1, Table 7 of this Report. The **outcome** of the Project shall be **'Income and climate resilience of targeted households in subtropical areas of Himachal Pradesh improved'**. The impact of the project shall be "Rural household income increased: (i) by aligning Strategies for Doubling Farmers' Income in Himachal Pradesh, and (ii) Climate resilience strengthened." These impacts are aligned with Himachal Pradesh Sustainable Development Goals (SDGs) 1, 2, 8, 13 and 15.

In order to undertake check the feasibility and sustainability of the Project, the Project Readiness Financing (PRF) was established.

iii. Project Readiness Financing (PRF)

PRF was approved by ADB on 8th December 2020 for an **amount of INR 75 crore (US\$ 10 million)** to be implemented over a period of two years from December 2020 to November 2022. Department of Horticulture, Government of Himachal Pradesh (**DOH**) and Jal Shakti Vibhag (**JSV**) are the implementing agencies for the project where DOH acts as the nodal agency. The funds under the PRF facilities were supported **to undertake advanced solutions which created an environment for subtropical horticulture development in the State.**

The PRF has been successfully implemented. The main activities included demonstrating the Project concept in **17 Clusters in 12 Blocks of 4 Districts covering a total area of approx. 200 ha with assured irrigation and 1081 farmers for pilot testing of four fruits namely Citrus, Guava, Litchi and pomegranate.** The envisaged outputs of the PRF are mentioned below:

Sr. No.	Envisaged Outputs
1	Irrigation infrastructure and farmer management systems established
2	Subtropical horticulture production technology and marketing systems demonstrated
3	Enabling environment, tools, and capacity for promoting irrigated subtropical horticulture provided
4	Ensuing investment project and its implementation readiness prepared

A detailed description of various activities carried out under each of these outputs have been highlighted in Section 3.2 of this Report. The various outcomes of PRF are summarised below:

- **Concept of “One Crop, One Cluster”** successfully implemented.
- **46,000-meter length** of fencing laid.
- **17 Community Horticulture Production and Marketing Associations (CHPMAs) formed and registered** under the Himachal Pradesh Cooperative Act of 1968.
- **Additional income for farmers generated.**
- **Beekeeping florals identified for the Ensuing Loan project.**

- **16 irrigation schemes** (7 functional, 4 non-functional rehabilitated, and 5 new schemes) implemented with CCA of 300 ha
- **17 Water User Association (WUA's) established and capacitated.**
- **Intercropping models** proactively adopted due to the availability of fenced areas that protects the cultivated crops from animal menace.
- **GIS and MIS introduced and initiated** to practice timely monitoring of the ongoing activities within the Clusters.

A Farmer's Satisfaction Survey of the PRF Clusters was conducted between **28th March 2022 to 30th March 2022 in all PRF Clusters based on structured survey questionnaire pertaining to 17 PRF pilot test activities implemented under the project.** A total of 169 respondents from 13 Clusters participated in the beneficiary survey. It was analyzed that the maximum **61 % farmers are very satisfied with the activity Awareness programme and consultations organized followed by 56.21 % farmers were very satisfied with the growth /development of the plants in the Clusters. Only 2.96 % farmer beneficiaries were very satisfied** with the processes of formation and working/ functioning of Water User Association (WUA) in the Cluster (meetings, collection of User charges, information sharing etc.) followed by **4.14 % farmers beneficiaries who were very satisfied with quality of drip irrigation system installed in the Cluster.**

The detailed analysis of the survey is presented in Section 3.5 of this Report.

There were various learnings from the PRF implementation. Some of the key learnings are highlighted below:

Key Learnings from PRF	
Beneficiaries	• Finance plus element in the project needs to include beneficiary farmers contribution in the form of cash, kind, and labor during the Cluster investment period. • Convergence is needed with various schemes such as MNREGA and PM Kusum Yojana
Project Components	• Procurement of 105% of the estimated quantity of plants is needed to account for plant mortality. • The height of the fencing above ground level will be 6.95 feet. Additionally, the depth of the fencing below the ground will be 1.5 feet. • The project land should not be having any other uses except horticulture plantation of the project. • For land preparation, bed height needs to be raised to 0.3 mtrs. • The final plant spacing will be decided based on the field observation, through discussion with YS Parmar University and discussion with experts of CS03 and CS04 packages.

Key Learnings from PRF	
	- During PRF, the prices of the fertilizer went up so a strategic plan needs to be created to address such a situation. - All the quantities of inputs such as fertilizers, pesticides etc. need to be as per the Package of Practices (PoPs) developed via CS-04 package by Y. S. Parmar University. - Double line of Drip Irrigation should be used which has proven to be more efficient. - The Irrigation design task to be done by a single agency to avoid any possible design conflicts and shall be judiciously and appropriately packaged. - An upgradation plan for approximately 30% nurseries has been prepared. A proposal of developing 10 new nurseries to facilitate the nursery requirements has been scheduled in the main project.
Project Components	The production and quality of fruits will finally be ascertained after 3rd / 4th year of plantation.
Project Procurement	- The procurement plan prepared and appropriately packaged into Lots and Lot Sizes so as to achieve a reasonably acceptable level of competition and also to allow local and regional bidders to effectively. - Global Request for Expression of Interest had been issued under the PRF and assessment is currently being made on the projected availability of quality planting material, based on which the procurement and contracting strategy for the Ensuing Loan project will be finalized.
Project and Contract Management	- CHPMAs should be formed for a group of Clusters. - Clusters should be grouped as per irrigation scheme for effective and efficient management. - IEC Specialist should be recruited to propose a communication strategy and take care of all IEC requirements.
Project Cost estimates	The overall Project Costing needs to be increased because of the following reasons: - Initially at the time of preparation of the DPR, a tentative cost was taken which has now been detailed and as per ha costs awarded in PRF which comes to be around INR 7.5 lakhs for construction of new irrigation schemes. - The potential area being created is much more than the potential being utilized for horticulture Clusters and the rest can be utilized for agriculture or horticulture purposed at a later stage

Key Learnings from PRF	
	3. The minimum size of each Cluster being taken is 10 ha which are scattered in 7 districts and in hilly terrain that led to an increase in the number of irrigation schemes. 4. The SCADA component has been added in some new schemes 5. Focus on source strengthening and climate resilient irrigation schemes 6. The number of schemes as mentioned in the PPR is 100. Additional 94 schemes have been now added post undertaking the topography surveys. The revised total no. of schemes is 162. These irrigation schemes shall create more irrigation potential for more than 6,000 ha. 7. Demand based project and required community mobilization and people's participation at the initial stage 8. The latest price index has been taken as the PPR is 3 years old. 9. Drip irrigation design should be modified from single to double line with additional provision for intercropping and accessories to ensure proper supply of water to every plant. 10. The design of the animal proof solar fencing needs to be modified with additional supporting structure.

The learnings from PRF (as highlighted above), the Project Concept, learnings from other Donor Projects (Japan International Cooperation Agency (JICA) HPCDP-1, World Bank funded Himachal Pradesh Horticulture Development Project (HPHDP) and World Bank funded Integrated Project for Source Sustainability and Climate Resilient Rain-fed Agriculture in Himachal), Inputs from DEA comments including various Departments such as NITI Aayog and Ministry of Agriculture) have been taken into account while designing the Ensuing Loan Project.

iv. Detailed Project Design:

- a. **Cluster and Beneficiary Selection:** Based on the learning, the project envisages a Cluster based approach for adoption of high-density plantation technologies developed globally with active involvement of the community. The general parameters for Cluster selection criteria include **10 ha. of private able land with unit size of minimum 5 ha. each, in case of more than one unit and in near vicinity for combined operation and at least ten (10) no. of household farmers involved in the Cluster. The other Technical and Irrigational parameters are explained in detail in section 4.2.1 of this Report**

- b. Willingness of Farmers:** Once the Clusters have been identified and priority has been finalized based on ranking, the next task is to onboard farmers for the project. For this Cluster wise Farmer Groups will be created and termed as Community Horticulture Production and Marketing Association (CHPMA).

A summary of output wise detailed design consideration for the ensuing project is highlighted below:

Output	List of activities
Output 1: Irrigated area expanded and sustainably operated	• Design and build Irrigation Schemes with SCADA • Grouping of Cluster as per Irrigation Schemes – Functional, Non-Functional and New
Output 2: Climate resilient subtropical horticultural production system developed	• Horticulture Production support (planting material, inputs, tools & drip irrigation) • Animal Proof Composite Fencing • GIS based land resources mapping and Digital Agri-Tech Service • Nursery Development • Training on other revenue generating activities such as Intercropping, Beekeeping, and organic fertilizers • CHPMA/WUA formation and Capacity building • Capacity building of DOH & JSV
Output 3: Market access for subtropical horticulture farmers developed	• Post-harvest infrastructure such as collection center, integrated facility center and processing unit (new and upgradation) • Formation of a APEX level Farmers Producer Company (FPC) promoted by CHPMA Cooperative societies (Society) formed at the GoC level • Capacity building of APEX body • Incubation and Training Centre / Centre of Excellence

The detailed description of various activities and sub-activities has been provided in section 4.3, 4.4 and 4.5 of this Report.

v. Environmental and Social Impact Assessments

As the project involves civil works activities for establishing/ expanding/ rehabilitating irrigation schemes and land/ site preparation for horticulture development, solar fencing and installing drip irrigation systems, which could

lead to minor to moderate adverse environmental impacts, a rapid environmental impact assessment (REIA) has been carried out following ADB's REIA screening checklist.

The team has conducted extensive consultations with all relevant stakeholders during field visits in the project preparation process, including the **Department of Forest, Irrigation (now JSV), Public Works, and NABARD**. The objective of these consultations was to **understand the scope of their participation and sectoral interventions under the Project and the potential social and environmental risks and issues involved**. The Project has also developed a **Stakeholder Engagement and Communication Strategy, which adopts a systematic, transparent, and participatory approach to stakeholder engagement and information disclosure, mechanism for stakeholder feedback, and implementation of an accessible and responsive grievance redressal mechanism**.

Global Best Practices for EIA will be adopted which include ADB's Irrigation Sub-Sector Guidance note, World Bank guidance note on Governance in Irrigation and Drainage, World Bank guidance note on Governance in Irrigation and Drainage and ILO Labor Standard.

Field visits were undertaken as part of the preparatory work to understand the current agricultural/ horticulture practices, environmental baseline status, perceptions of key stakeholders about the project and further assess the need for their capacity building and institutional strengthening. The field visits were followed by stakeholder consultations with primary stakeholders, i.e., the farmer beneficiaries. **A detailed survey questionnaire in line with ADB's REIA screening checklist** was prepared to capture the environmental baseline condition, social structures, gender composition and participation in the Cluster formation, climate impacts and anticipated environmental impacts etc.

The risks and impact across phases of the project i.e Construction and Operation phase have also been anticipated, correlation of the impacts of project activities with the environmental attributes has been undertaken and accordingly a risk mitigation plan has been prepared.

An EARF is being prepared as a guideline to the borrower on the scope, approach, and results expected for the project's environmental matters. One IEE Report is being prepared to cover all off-farm macro irrigation-based activities. For on-farm activities (i.e., preparation of horticulture fields, solar fencing, and installation of drip irrigation systems) an Environmental Management and Monitoring Plan is being prepared.

To understand and map the climate risk and thereby design climate-resilient project components, **a detailed Climate Risk Analysis using the IPCC approach defined under Assessment Report 5 (AR5) has been applied.**

The Project will be implemented without private land acquisition hence no physical displacement is anticipated in this Project. However, livelihood of certain marginal farmers may be affected temporarily (mainly the marginal farmers) due to this project and the same would be addressed by providing income supporting opportunities to such families.

vi. Project Cost Estimate and Phasing

The total Project cost (excluding the beneficiary contribution) works out to be INR 1292 crore. The breakup of the cost is detailed out in the table below:

All figures in INR crore

Project Components	Project Cost			Beneficiary Contribution	Overall Cost
	ADB	Government	Total		
Output 1	266	32	298	-	298
Output 2	617	55	673	447	1120
Output 3	70	0	70	5	75
Project Management	39	170	209	-	209
Outputwise cost	992	257	1250	452	1702
Contingencies	38	3	41		
Financial Charges	0	2	2		
Total Cost	1030	262	1292	452	1744
In million USD	130	33	163	57	220

Out of the total project cost, 80% shall be contributed by ADB in the form of loan. The State Government shall have a share of 20%.

Financing Plan			
Source	Project Loan (INR crore)	Project Loan (million US\$)	Share (%)
Asian Development Bank	1030	130	80%
Government of Himachal Pradesh	262	33	20%
	1292	163	100%

Reason for increase in Project cost:

At the initial stage of Project conceptualization in May 2018, DOH and JSV had separately submitted two separate Project proposals of INR 1688 crore and INR 4751 crore respectively for the development of an area of 20,000 ha (i.e., approximately INR 0.32 crore per ha). In Feb 2019, both the projects were

integrated into one and US\$ 130 million (approximately INR 950 crore) was sanctioned, out of which ADB loan was US\$ 100 million. The amount sanctioned was basis lumpsum rates and not upon the detailed estimates. Also, PRF of US\$ 12.5 million was proposed to undertake a pilot project in order to assess the Project feasibility and costing for the Ensuing Loan Project.

From the learnings during the implementation of PRF, ADB agreed for funding to cover 6,000 ha area under plantation. The project components specially the cost was redefined as per the actual and following are the major reasons for increase in cost from US\$ 130 million to US\$ 163 million:

- **Irrigation schemes** – Initially only 100 schemes were proposed. But during designing of the Ensuing Loan Project, a total of 162 schemes have been identified out of which 108 schemes are new.
- **Irrigation Costing** – Initially cost of approximately INR 1–2 lakh/ha cost was envisaged tentatively. However, in the PRF, after undertaking a detailed design and construction, the cost was increased to INR 7.5 Lakhs per ha. Also, the focus on source strengthening and climate resilient techniques have added to the overall cost.
- **SCADA** – This is additional component for the Ensuing Loan Project for undertaking automation of the irrigation system management.
- **Horticulture** – For the drip system, additional drip line and emitters have been added. Further provision for watering the intercropping in drip has been done in design. Also, additional valves, controllers and solar operated pumps have been introduced in the main Project design leading to cost increase.

For the Project feasibility the above have been incorporated in the main Project design and costing. Also, the Economic and Financial analysis has been highlighted in Chapter 5 and the Project is viable with this costing,

vii. Economic and Financial Analysis

The quantitative economic and financial analysis focused on three core sub-projects and envisaged outputs to be undertaken during the seven-year implementation period.

The beneficiaries are marginal and small farmers with limited capacity to invest in necessary irrigation as well as preliminary plantation investment. Hence, government support by way of fiscal assistance and subsidy is required.

Furthermore, assistance by way of support in marketing and other capacity building is also required at the Project level.

Without-Project and With-Project Scenarios

The per ha crop budget has been estimated for the potential horticulture crops including **Citrus, Guava, Litchi, Pomegranate, Persimmon, Plum, Pecan nut, Mango etc.** “With Project” cropping pattern is taken into consideration **total water availability, water requirement of each horticulture crop and the market demand and price of expected output.** With the project, **crops to be produced are by horticulture.** However, without the Project, **paddy and maize will continue to be the dominant crops.** The yield and income per ha with the Project have been compared with the “without Project” income per ha i.e., the net benefit of diversification into more remunerative horticulture produce from paddy and maize is captured.

With regard to “without Project” estimates, the data from the baseline survey has been incorporated to estimate the **net operating income per ha of different commodity combinations i.e., paddy-wheat, paddy-gram, maize-wheat, maize-gram.** The cultivated area for each crop is multiplied by the specific crop’s per ha income to derive the overall income from each crop in the Project area.

A sensitivity analysis considered several alternate scenarios. The analysis considered an increase in investment cost by 10 per cent, decrease in output price by 10 per cent and a 10 per cent decrease in output yield.

Project - FIRR & EIRR

FIRR	16.06%
EIRR	17.45%

Sensitivity Analysis

Scenario	FIRR	EIRR
Base case	16.06%	17.45%
10% increase in investment cost	13.85%	15.13%
10% decrease in price of produce	13.14%	15.02%
10% decrease in yield of produce	13.14%	15.02%

The analysis revealed the Project to be robust to adverse changes with both FIRRs and EIRRs being well above 9 per cent.

viii. Project Implementation

The Nodal agency of the Project is Department of Horticulture (DOH). A Project Management Unit (PMU) at the State level has been established under DOH. Two separate Project Implementation Units (PIUs) are established in Jal Shakti Vibhag (JSV) and DOH for implementation of respective Project components.

The procurement strategy to be adopted for the Project is being currently formulated as part of the Strategic Procurement Plan (SPP) that will form the basic planning document for developing the Detailed Procurement Plan for the Project.

The Project shall be implemented over a period of 5 years, i.e., from 2022-23 to 2024-27.

1. Introduction

1.1. About Himachal Pradesh

Himachal Pradesh is in the northern part of India and came into being on 15 April 1948 as a centrally administered territory by the integration of 30 erstwhile princely states. At that time, there were four districts, viz. Chamba, Mahasu, Mandi and Sirmour. In 1956, despite the recommendations of the State Re-organization Commission for its merger with Punjab, Himachal Pradesh retained its separate identity. Reorganization of the districts occurred in many phases. Formerly a Union Territory, it became a State of India on 25 January 1971.

Figure 1: Map of Himachal Pradesh



On 1 September 1972, two more new districts, namely Una and Hamirpur, were created mainly as a result of trifurcation of the erstwhile Kangra district. Also, from the then existing districts of Mahasu and Shimla, new districts of Shimla and Solan were formed by reorganizing the boundaries of old districts. The city of Shimla was the summer headquarters of pre- independence British viceroys; it is now the State capital. At an elevation of about 7,100 feet (2,200 metres), it is one of the largest and most popular mountain resorts in the country.

The State is bounded by Jammu and Kashmir to the northwest and Ladakh to the northeast, by the Tibet Autonomous Region of China to the East, and by the states of Uttarakhand to the southeast, Haryana to the south, and Punjab to the west.

1.1.1. Demographic Profile

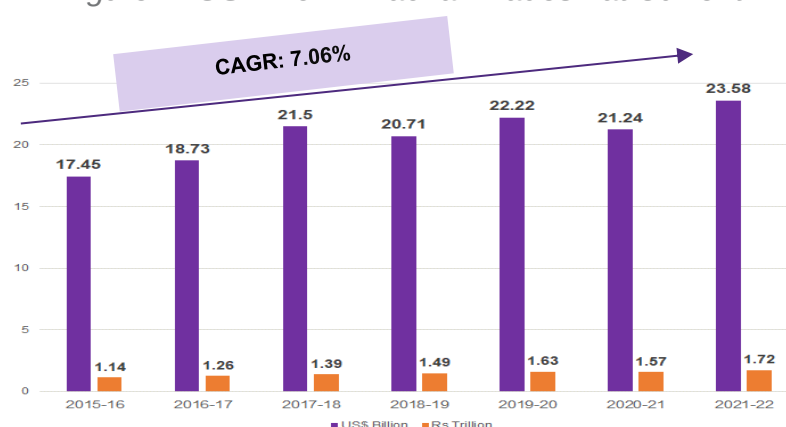
Table 1: Demographic Profile¹

Items	Details
Area (Sq. kms)	55,673
Households	1,483,280
Population (2011 census)	6,864,602
Males	3,481,873
Females	3,382,729
Sex Ratio	972
Rural	6,176,050
Urban	688,552
% of Rural Population	89.97
Decennial Growth Rate %	12.94
Density per Sq. Km	123.30

1.1.2. Economic Profile²

At current prices, the State's Gross State Domestic Product (GSDP) stood at INR 1.72 lakh crore (US\$ 23.58 billion) in 2021-22. The State's GSDP (in INR) increased at a Compounded Annual Growth Rate (CAGR) of 7.06% between 2015-16 and 2021-22. The State's per capita GSDP in 2020-21 was INR 212,262 (US\$ 2,880). The per capita GSDP (in INR) rose at a CAGR of 5.84% between 2015-16 and 2020-21.

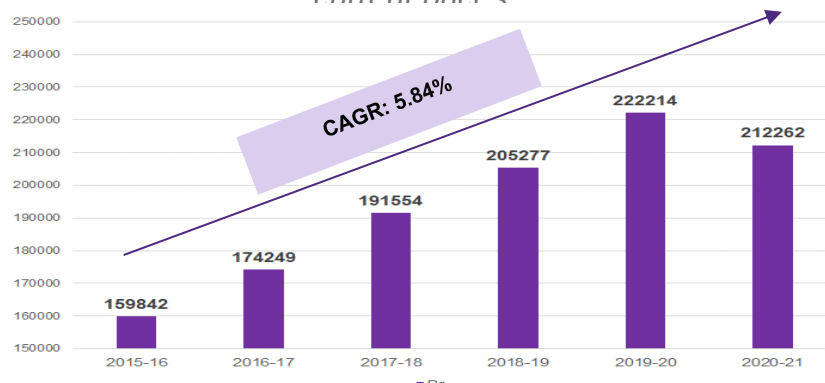
Figure 2: GSDP of Himachal Pradesh at Current



¹ Statistical abstract of HP 2019-20

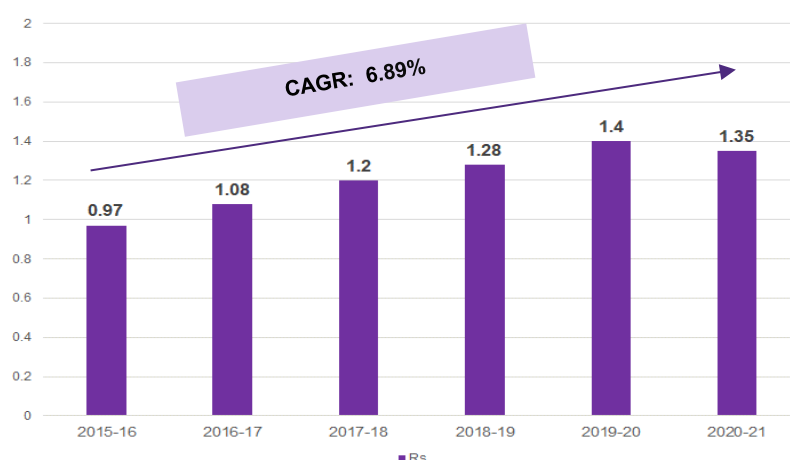
² Directorate of Economics & Statistics of Himachal Pradesh, MOSPI

Figure 3: Per Capita GSDP of Himachal Pradesh at current prices



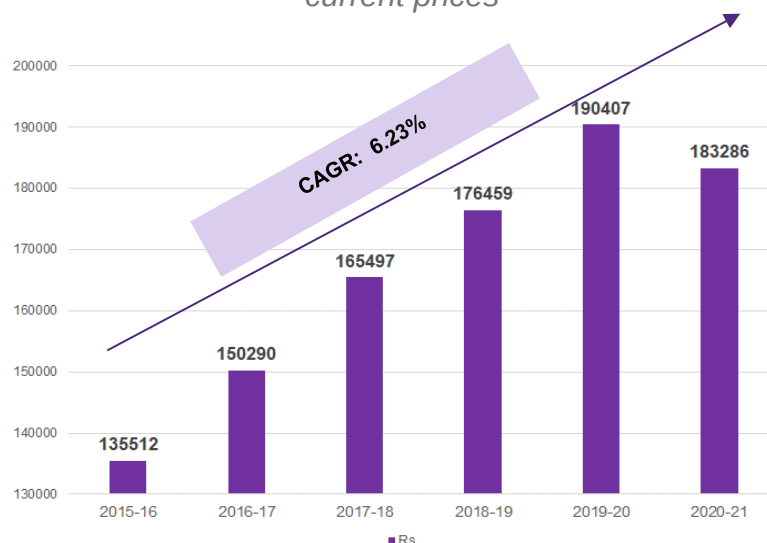
At current prices, the total net state domestic product (NSDP) of the State stood at INR 1.35 lakh crore (US\$ 18.34 billion) in 2020-21. The State's NSDP (in INR) increased at a CAGR of 6.89% between 2015-16 and 2020-21. The State's per capita NSDP in 2019-20 was INR 183,286 (US\$ 2.487). The per capita NSDP (in INR) expanded at a CAGR of 6.23% between 2015-16 and 2020-21.

Figure 4: NSDP of Himachal Pradesh at current prices



In 2020-21, the tertiary sector accounted for 46.47% share of the State's gross service value added (GSVA), followed by secondary and primary sectors at 39.66% and 13.87% respectively. Tertiary sector posted the fastest rise at a CAGR of 10.76% between 2011-12 and 2020-21. Between 2011-12 and 2020-21, the secondary sector expanded at a CAGR of 7.44% and the primary sector expanded at a CAGR of 6.08%.

Figure 5: Per Capita NSDP of Himachal Pradesh at current prices



1.2. Brief Description of Horticulture Sector

1.2.1. Global Scenario

The Food and Agriculture Organization (FAO) declared the year 2021 as the International Year of Fruits and Vegetables. This was done to increase awareness on the nutritional and health benefits of fruits and vegetables and their contribution to a balanced, healthy diet and lifestyle, and to general wellbeing.

Globally, the total production of primary crops had increased by almost 50% between 2000 and 2018. In 2020, the total production reached 9.1 billion tonnes. This constituted about one-third of the cereals (34%), followed by sugar crops (24%), vegetables (12%), fruits (10%), oil crops (11%), and roots and tubers (9%).

The international trade of fresh fruits increased by an average of 20 lakh tonnes per year to about 800 lakh tonnes and by about 400 lakh tonnes for fresh vegetables in the past 10 years. In 2021, the global trade in fresh fruits was valued at US\$ 75 billion, while that in vegetables was valued at US\$ 40 billion.³

³ www.fruitandvegetablefacts.com
<https://www.freshplaza.com/article/2189566/global-trade-in-fresh-fruit-increased-by-2-million-tonnes-per-year-in-the-past10-years/>
<https://www.cbi.eu/market-information/fresh-fruit-vegetables/what-demand#:~:text=Belgium%20accounted%20for%20a%206.5,quarter%20of%20Belgium%E2%80%99s%20fresh%20export>

In terms of the processed fruits and vegetables, market size crossed US\$ 280 billion in 2020 and is estimated to grow at over 7% CAGR from 2020 to 2027. The consumption of ready-to-eat and convenient food products has significantly increased owing to a busy lifestyle, increasing women working population, and reduced time for food preparation. Consumers view processed fruit & vegetable products as a time-saving solution in their fast-paced lifestyles.

1.2.2. Indian Scenario

Indian horticulture sector contributes about 33% to the agriculture Gross Value Added (GVA), making very significant contribution to the Indian economy.

India produced about 33.10 crore tonnes (2020-21) of horticulture produce, which has surpassed the food grain production, that too from a much less area (i.e., 2.71 crore ha. for horticulture against 12.76 crore ha. for food grains). Productivity of horticulture crops is much higher compared to productivity of food grains (12.49 tonnes/ha against 2.23 tonnes/ha.)

The State has made significant progress in horticulture development. The Himalayan ecosystem offers an enabling environment, characterized with favorable microclimatic conditions for cultivation of a wide range of temperate to sub-tropical fruits. This characteristic has resulted in shifting of land use pattern from agriculture to fruit crops over the past few decades.

There has been a 300-times increase in area (from 792 ha. to 233 thousand ha.) and 700-times increase in production (from 1200 tonnes to 845 thousand tonnes) in last 70 years from 1950-51 to 2019-20.

1.2.3. Horticulture Scenario in the State

The Agriculture & Allied Sectors as a key sector has been supporting about 60% of the population. It registered a growth of 18.3% in 2019-20 with a GVA of INR 10.58 crore, as compared to INR 8.95 crore during 2018-19.

Out of the total geographical area of the State (55.7 lakh ha.), the area of operational holdings is about 955,000 ha, operated by 961,000 farmers. The average holding size is about 1.00 ha. Distribution of land holdings shows that 87.95% of the total holding belongs to small and marginal farmers. About 11.71% of the holdings are owned by semi-medium and medium farmers and only 0.34% by large farmers. The State's agriculture is largely dominated by high value horticultural commodities, which account for about 49% of the total area under fruit crops and 85% of the total fruit production. The horticulture sector annually contributes approximately INR 3000 crore to INR 5000 crore to the State's economy.

The State also enjoys a rich diversity of agroclimatic conditions, topographical variations, and altitudinal differences, which favours the cultivation of temperate to sub-tropical fruits and exotic vegetables. The State is almost wholly mountainous, with latitudes ranging from 350 metres to 6,957 metres above the mean sea level. Agro-climatically, the State can be divided into 4 zones:

Table 2: Agro Climatic Zones in the State⁴

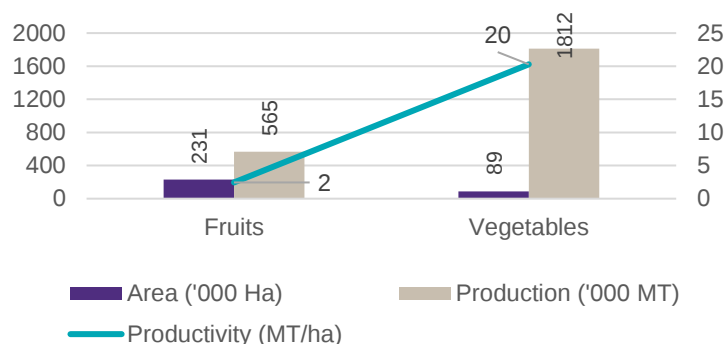
Zone	Elevation (metres)	Horticultural crops	District/area covered
Sub-tropical, Submountain, Low Hill	365 -914	Mango, Litchi, Citrus, Amla, Guava, Pomegranate, low chilling varieties of Peach, Plum and Pear, Strawberry	Una and Hamirpur districts and parts of Bilaspur, Kangra, Sirmour and Solan districts
Sub- tropical, Sub-humid, Mid Hills	915 - 1523	Stone fruits (Peach, Plum, Apricot, Almond), Pear, Pomegranate, Pecan nut, Walnut, Kiwi fruit, Strawberry	Mid hill area of Solan, Sirmour, Shimla, Chamba, Mandi, Kullu and Kangra districts
Wet Temperate - High Hills	1524 - 2472	Apple, Pear, Cherry, Almond, Walnut, Chestnut, Hazelnut, Strawberry.	High reaches of Shimla, Mandi, Kullu, Sirmour, Chamba districts
Dry Temperate High Hills & Cold Desert	Above 2472	Apple, Grapes, Prunes, Drying type Apricot, Almond, Chilgoza, Pistachio nut, Walnut, Hazelnut	Lahaul Spiti, Kinnaur, and Bharmour and Pangi area of Chamba district

Among the temperate fruits, the State produces apples, peaches, plums, pears, citrus, kiwi fruits and apricots along with many other exotic fruits. The State also produces a range of sub-tropical fruits, including citrus, pomegranate, litchi, guava, mango, etc. Among vegetables, it leads in the production of potato, tomato, peas and brinjal, along with off-season vegetables. The State has emerged as a leading producer of apples, offseason vegetables and other ancillary horticultural produce like flowers, mushroom, honey, and hops.

⁴ (Source: Envis Center in Himachal Pradesh at http://www.hpenvis.nic.in/Database/Horticulture_4022.aspx)

Majority of agricultural activities in the State are dependent on rainfall with 80% of the area under rain-fed. Even though there is a large volume of water available in the State, only a part of its cultivated area is irrigated because of physiographic constraints.

Figure 6: Horticulture Crops Category Wise in the State (2017 - 2018)

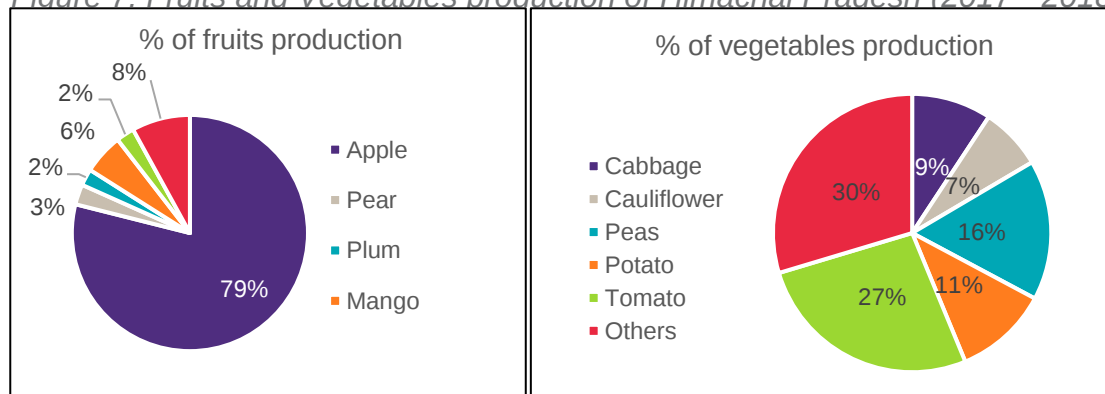


Apples make up the largest volume (79%) of fruit produced in the State, constituting 49% of the total area under fruit cultivation.

Tomatoes, peas, and potatoes makes up 54% of the total vegetable production followed by cabbage, cauliflower with a mixture including capsicum, onion, okra, and chillies making up the remaining 46%.

There is limited scope to increase production through expansion of cultivable land. Like the rest of the country, the State has almost reached its limit in so far as the productivity and income from the staple crops is concerned. Hence, emphasis must be given on increasing productivity levels and diversification towards high value crops. Due to an increasing shift towards commercial crops, the area under food-grains production is gradually declining. In 1997- 98, the area under food grains was 853,880 ha. In 2018-19, this had declined to 732,620 ha.

Figure 7: Fruits and Vegetables production of Himachal Pradesh (2017 - 2018)



While crop diversification is increasing in the State, for fruits and vegetables, this is mostly concentrated in districts of the mid-hills and high hills and valley zone, leaving a substantial income gap between temperate and sub-temperate producers and those producing sub-tropical crops. The sub-tropical region (Bilaspur, Hamirpur, Kangra, Mandi, Sirmour, Solan, and Una districts) in the State face multiple challenges in terms of climate change, rainfall uncertainties, water availability and low productivity of horticulture produce and income disparity, etc. For instance, farmers of the temperate zone earn on average, INR 117,534 per month (US\$1,550 per month) while horticulture farmers in the sub-tropical low hills zone and some mid-hill zones earn, on average only INR 1,706 per month (US\$22.5 per month) or 1.45% of farmers in the temperate zones.

Production Characteristics

The average yield for some fruit varieties grown in the State is very low (1 - 5 tonnes/ha) when compared to other States (18 – 23 tonnes/ha), whereas average yields of vegetables in the State are like those in other States, i.e., about 20 tonnes/ha.

The reasons for low fruit productivity are several inter-related factors such as non-availability of quality planting material, poor irrigation infrastructure, lack of inputs supply, untimely rainfall, unfavorable weather conditions, shortage of staff, animal and cattle menace etc.

Table 3: Fruit Production in the State⁵

#	Crop	Year (unit in `000 tonnes)			
		2018-19	2019-20	2020-21	2021-22 up to Dec. 2021
1	Apple	368.60	715.25	481.06	601.95
2	Other temperate fruits	37.15	49.85	40.65	35.18
3	Nuts and dry fruits	3.65	4.24	4.69	2.00
4	Citrus fruits	29.34	32.11	33.29	10.07
5	Other sub-tropical fruits	56.62	43.97	64.80	48.76
		495.36	845.42	624.49	697.96

⁵ Economic Survey of Himachal Pradesh, 2020-21

1.2.4. Government initiatives and strategies

The National Government's scheme '**Aatmanirbhar Bharat Abhiyan**': In the wake of the Covid-19 global pandemic, to boost the economy and to make India self-sufficient and self-reliant, the Government of India launched a mission named as Aatmanirbhar Bharat Abhiyan (Self-reliant India Movement) in May 2020 with a special economic & comprehensive package of INR 20 lakh crore. In this package, Hon'ble Finance Minister announced INR 1 lakh crore **Agriculture Infrastructure Fund** for farm gate infrastructure for farmers. Similarly, in February 2020, the government announced a new central scheme titled '**Formation and Promotion of Farmer Producer Organizations (FPOs)**' to form and promote 10,000 new FPOs with a total budgetary provision of INR 4,496 crore for five years (2019-20 to 2023-24), with a further committed liability of INR 2,369 crore for period from 2024-25 to 2027-28 towards handholding of each FPO for five years from its aggregation and formation¹. Other key schemes of the National Government include:

- Mission for integrated Development of Horticulture (MIDH)
- Soil health card scheme
- Pradhan Mantri Krishi Sinchayee Yojana
- Pradhan Mantri Fasal Bima Yojana
- Kissan Credit Card (KCC) Scheme
- ATMA: To support state extension programme in agriculture.
- Pradhan Mantri Kissan Samman Yojana
- Rashtriya Krishi Vikas Yojana

The Government of Himachal Pradesh. has been operating several different schemes on horticulture, agriculture, and allied sectors, which include irrigation development, improvement of crop productivity, crop protection, insurance schemes, farm mechanization, etc. Regarding crop diversification, related schemes and programmes are to diversify agricultural activities.

During the financial year 2021-22, the State Government has launched new schemes for bringing all round development of Horticulture sector in the State. The key schemes are:

- Himachal Pushp Kranti Yojana
- Installation of Anti Hail Net Scheme
- Krishi Utpadan Sarankshan Yojana
- Mukhya Mantri Kiwi Protsahan Yojna
- Himachal Khumb Vikas Yojna
- Mukhya Mantri Madhu Vikas Yojana

The focus of the government is on promoting off-season vegetable production by switching from traditional crops to cash crops, as a result of various promotional programmes and schemes.

The State Government has started a scheme named **‘Establishment of Centers of Excellence for Vegetable Nursery Production’**, to raise vegetables seedlings, flowers, and other valuable plants by farmers under controlled environment. Centers of excellence for nursery production are established at Jubbarhatti of Shimla, Solan, and Mandi districts to provide better planting material to the farmers.

For systematic diversification of crops, the Department of Agriculture has taken up **‘Seed Village Programme’**, **‘Sub Mission on Seed and Planting Material’ (SMSP) of National Mission on Agriculture Extension and Technology’ (NMAET)** for introduction of high yielding hybrids of vegetables, grafted vegetable seedlings, exotic vegetables, popularization of micro irrigation system, protected cultivation and to encourage seed production.

To further boost vegetable production and to achieve faster and more inclusive growth in the agriculture sector, the State government has also launched projects on production of vegetables under protected cultivation by supporting the development of polyhouses. The schemes that support polyhouse development include **‘Dr. Y. S. Parmar Kisan Sawrozgar Yojana’**, **‘Mukhya Mantri Nutan Polyhouse Yojana’ (MMNPY)** under ‘RIDF XXV’, and **‘Mukhya Mantri Green House Revolution Scheme’ (MMGHR)**. A detailed description of schemes related to horticulture is attached at [annexure 5.1](#)

1.2.5. Donor Funded Project

The State Government envisions to promote horticultural crop diversification and has constantly been putting in efforts to develop necessary infrastructure and capacity building initiatives for horticultural plants and practices within the State. To support the State’s vision, numerous donor-funded projects and schemes are periodically implemented across the State.

1.2.5.1. Himachal Pradesh Crop Diversification Promotion Project (HPCDP) - JICA Funded

The project aims at promoting crop diversification through development of necessary infrastructure in irrigation, farm access roads, marketing, formation of Water User Association (WUAs) and training/capacity building of farmers to increase income per unit area per unit time of small and marginal farmers

across the target area of 12 districts (Hamirpur, Bilaspur, Kangra, Mandi, Una, Solan, Kullu, Shimla, Kinnaur, Chamba, Sirmour, Lahaul and Spiti). The first phase of the project was implemented in 2011-2016, whereas the second phase is being implemented for the period 2021-2029.

1.2.5.2. Himachal Pradesh Horticulture Development Project (HPHDP) – World Bank funded

HPHDP was initiated in 2016 with an objective to support small farmers and Agri-entrepreneurs to increase the productivity, quality, and market access of selected horticulture commodities in the State. The project beneficiaries include farmers and entrepreneurs in the Micro, Small and Medium Enterprises (MSME) segment, Farmer Producer Organizations (FPOs) and other value chain participants, prioritizing small and marginal producers with specific focus on fruit-bearing tree crops. Even though the project targets the whole State, major proportion of the interventions are to be provided in Shimla, Kullu, Kinnaur, Chamba, and Mandi districts due to the existing production potential. The total project cost is INR 1300.40 crore (US\$ 171.5 million) with an implementation period of seven years.

Table 4: Major Development Partners Projects

Development Partner	Project Name	Duration	Amount (US\$ million)
World Bank	Horticulture Development Project	2021 - 2023	171.5
World Bank	State Roads Transformation Project	2020 - 2024	82
World Bank	Integrated Project for Source Sustainability and Climate Resilient Rain-Fed Agriculture in Himachal Pradesh	2020 - 2025	80
JICA	Himachal Pradesh Crop Diversification Promotion Project I	2011 – 2016	43
JICA	Himachal Pradesh Crop Diversification Promotion Project II	2021 – 2029	80

JICA = Japan International Cooperation Agency.

Sources: www.worldbank.org, www.jica.go.jp

1.3. Brief Description of Irrigation Sector

1.3.1. India Irrigation Scenario

Water is a critical input into agriculture in nearly all its aspects, having a determining effect on the eventual yield. India accounts for about 17% of the world's population, but only 4% of the world freshwater resources. While water for drinking purpose has been accorded top-most priority in water use, irrigation is the major consumer of water. In India, major (84%) water withdrawals are dedicated to agriculture, and 42% of agriculture land is irrigated, meaning water plays a critical role in India's food security and in the welfare of the rural poor.

In India, the annual precipitation is nearly 4 lakh crore cubic mtrs (BCM) and the average flow of rivers is estimated to be 1869 BCM. But nearly 75% of rainfall occurs during monsoon season (June-Sept), which restricts utilizable quantum of surface water to 690 BCM. Total annual replenishable groundwater potential in the country is estimated to be 433 BCM, in which rainfall contributes 74% in groundwater recharge and the rest is contributed by canal, pond and other water conservation practices. With an annual groundwater draft of 253 BCM, irrigation alone consumes nearly 91% of total draft, irrigating 62% of total irrigated area of the country (CGWB, 2017).⁶ But, groundwater development is not uniform across the country. Net irrigated area (%) of India has increased from nearly 1.81 crore ha. in 1950 to 5.26 crore ha. in recent times due to government interventions at various levels.⁷ Although government has given much emphasis on improving canal system in various Five-year Plans, it has declined over years. People have identified groundwater irrigation as much reliable and an independent source of irrigation.

The current average surface irrigation Water Use Efficiency (WUE) of 38% points towards the need for serious performance improvement in this area. The productivity of irrigation water is further hampered by low crop yields and cultivation of low-value crops. Increased groundwater exploitation has caused a decline in the water table in many areas.

With intense urbanization and industrialization, the need for water from the non-agriculture sector is fast increasing and water shortage is becoming an area of major concern for industries. In order to appropriately address the present and future water demand and food grain requirements, the following thrust/priority areas for water resources related issues have been identified by the government:

⁶ Annual Report 2019-20, Central Water Commission, Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of Jal Shakti

⁷ Agriculture statistics at a glance, 2019

- Improving water utilization efficiency,
- Command area development and participatory irrigation management,
- Flood management and erosion control; Protection from coastal erosion,
- Dam safety and rehabilitation; Revival and restoration of existing water bodies, and
- Appropriate regulation and management of ground water and ground water recharge.

1.3.2. State's Irrigation Scenario

In the State, agriculture is the main source of livelihood. Agricultural systems are totally dependent on the availability of fertile land, which is one of the main determinants of sustainable agriculture.

The proportion of current fallow, long term fallow and culturable waste land to total geographical area is 1.32%, 0.48% and 2.81% respectively, which has been very low as compared to many other States. Over the years, the forest and barren land has showed an increase, whereas a reverse trend has been observed in the case of permanent pastures.⁸

Climate change has led to an increasing number of farmers moving to other livelihoods or moving from food grains to horticultural crops. While the area of fallow land is increasing, the remaining areas are intensely cultivated, creating pressure on marginal and steeply sloping areas.

Irrigation Water Availability

Due to lack of irrigation facilities, the agricultural production to a large extent still depends on timely rainfall and weather conditions.

Out of total geographical area of the State, i.e., 55.70 lakh ha, only 1.10 lakh ha is under irrigation. Of the total irrigated areas, 7.14% is irrigated by canals, 7.14% by wells, and 85.72% by other sources of irrigation like kuhls, tube wells, shallow wells, lift irrigation, check dams, and storage tanks.

It is estimated that ultimate irrigation potential of the State is approximately 335,000 ha., out of which 50,000 ha. can be brought under irrigation through major and medium irrigation projects and the balance of 285,000 ha area can be provided irrigation through minor irrigation schemes up to December 2020.⁹

⁸ Water and Agriculture in India, 2017, Dr. Vibha Dhawan, Federal Ministry of Food and Agriculture

⁹ Economic survey 2020-21, Government of Himachal Pradesh

High priority has been accorded to this sector by the State. During 2020-21, the State made a budget provision of INR 3.02 crore in the irrigation sector to provide irrigation facilities to an area of 4,437.98 ha., against which, up to December 2020, an area of 3,256.18 ha. has been covered.

Table 5: Status of Irrigation in the State¹⁰

Total geographical area of the State	556,700 ha.
Total cultivable area of the State	583,000 ha.
Area identified under Major/Medium Irrigation projects	50,000 ha.
Area identified under Minor irrigation schemes	285,000 ha
Total identified area for irrigation	335,000 ha.

1.3.3. Government Initiatives and Strategies

Recently, the State Government has introduced new schemes “Flow Irrigation Scheme” and “Solar Irrigation Scheme” for lifting water in distressed regions. Additionally, to improve the agricultural productivity, the government of India has started a new scheme, the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) to improve water usage efficiency in agriculture systems. The Department of Agriculture has also prepared a plan to harvest rainwater by constructing tanks, ponds, check-dams, and storage structures. Besides this, low lifting water devices and efficient irrigation system through sprinklers are also being popularized.

The State introduced the **Himachal Pradesh Water Regulatory Authority Act, 2011** to regulate the water resources in the State and ensure sustainable management, allocation and optimal utilization of water laid down by **State Water Policy 2005**. The Policy also considers a participatory approach to involve communities and stakeholders, including women, in the management of water resources, in an effective and decisive manner in various aspects of planning, design, development and management of water related schemes. It also ensures that Water User Association (WUAs) and the Local bodies, such as municipalities and gram panchayats are involved in the operation, maintenance and the management of water related infrastructure/facilities at appropriate levels, progressively, with a view to eventually transfer the management of such facilities to the user groups/local bodies.

¹⁰ Source: Jal Shakti Vibhag

State Water Policy 2013

The State Water Policy 2013 comprehensively addresses water usage and distribution for diverse purposes, including domestic, commercial, industrial, irrigation, hydropower generation, and recreation. The policy puts priority on water supply for irrigation following drinking water due to necessity of water resource development, watershed management, and improvement of water use efficiency in agriculture. It also indicates the need for covering 84,000 ha by irrigation schemes to improve productivity of the cultivable land and economic prosperity of agriculture through diversion of land to cultivation of vegetable, horticulture, and cash crops. Shift from flood irrigation and open channel irrigation to micro irrigation and piped supply is instructed in the policy.

1.4. Challenges in the Sector

Table 6: Current challenges in Horticulture Sector in the State

 Production	• Farms are small and fragmented, making it difficult to achieve economies of scale for input supplies, delivery of extension services and marketing¹¹ • Key services, such as soil testing, are lacking, resulting in either overuse or underuse of fertilizers or low yields • Farmers lack the technical skills needed to establish and maintain crops, including planting, nutrition, mulching, watering, and pruning to ensure optimum yields. The current package of practices needs updating to ensure that they are aligned with national standards and local recommendations. • Frequency of extension services are limited by budget constraints as well as lack of staff that are trained in the use and transfer of improved technology. • Planting densities are very low and result in low yields and poor financial returns • The quality of inputs, particularly fertilizers and Agri-chemicals for pest and disease control, is variable and results are often poor.
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¹¹ Himachal Pradesh Value Chain Report of CS03

	• Existing water sources are not adequate to meet the demand. Irrigation infrastructure is either lacking or is not in operation. • Water shortages exist during critical times of the growing cycle and result in a large impact on yield. In addition, there is a lack of water saving technology such as storage tanks and low volume micro irrigation. • Nursery infrastructure and management is poor, making it difficult to consistently produce disease free healthy varieties in sufficient quantities to meet demand. There is a lack of certified planting material. • Inadequate public or private investment in agriculture research is leading to lack of technical solutions for local problems including pest and disease control and varietal performance resource and analysis on varietal performance. • High crop losses occur due to wild animals, especially stray cattle, and monkeys. • Farmers lack access to credit that is aligned to the specific needs of the fruit crops, i.e., matches cost of orchard establishment, maintenance, and harvest cycle.
 Post-Harvest Management	• Currently, the wastage at various levels of supply chain of sub-tropical fruits is about 30-40%. Apart from the loss of revenue to the farmers, it leads to additional costs in the supply chain, which is ultimately passed on to the consumers. Factors that lead to high wastage include: ○ Lack of primary processing i.e., washing, grading, packing, etc. ○ Lack of pre-cooling and cool chain logistics infrastructure ○ Lack of protocols to guide post-harvest management

	As per a report by the Ministry of Agriculture & Farmers Welfare¹², as on 31 August 2020. The State has relatively few cold stores, when the storage capacity is considered as a proportion of the total output of fruit and vegetables.
 Marketing	- Inadequate private enterprise penetration of commodity markets is there in the rural areas due to the small production quantities from small scale farmers. Thus, there is poor price realization compared to the market price. - Due to hilly terrain, the cost of transportation to reach the high value market is high, which makes the produce less price competitive. Also, the quality deteriorates which leads to further issues in marketing and sale of produce. - Only few regions have gained popularity for their produce but there has been no branding or geographical identity provided to these commodities, thus leading to poor price realization and roadblock towards unleashing the market potential.

The challenges mentioned above are spread across all the four agro-climatic zones highlighted in the section 1.2.3 and in the table above. In order to resolve the issues specifically in the low-lying areas of the sub-tropical zone, the Department of Horticulture is currently implementing the Sub-Tropical Horticulture, Irrigation and Value Addition Project (HPSHIVA). The details of the Project are highlighted in the subsequent chapters.

¹² [Cold Storage Facilities](#) in the Country by Ministry of Agriculture & Farmers Welfare

2. HPSHIVA Project Concept

2.1. Project Overview

2.1.1. Need for the Project

More than 90% of the population in the State reside in rural areas and more than 62% of the population is engaged in agriculture, but the contribution of the agriculture sector to the State's gross value added is only 15%. This has been mainly due to the farmers moving away from farming as a result of low financial returns across the sector and in the subtropical region. Poor performance of the sector is due to lack of irrigation, lack of technical skills, lack of market access and damage from wild animals.

Farmers require access to better irrigation facilities, planting material and inputs to protect crops and improve yield and quality. There is also a need to strengthen value chains and support the development and coordination of linkages between all actors. A key part of this is the establishment of post-harvest infrastructure that will assist in reducing losses and in developing quality control systems and focus upon linkages of farmers to modern agribusiness value chain to improve farmer's share in prices through value addition and improved post-harvest best practices and infrastructure.

At least 20% of the Project's beneficiaries will be poor households. The Project proposes to expand the irrigation facilities to farmers in a coordinated manner with the horticultural needs, to increase the subtropical horticulture production and supply climate resilient plants, to ensure profitability of subtropical horticulture production through value chain development of targeted crops.

The proposed Project will thus also benefit small and marginal farmers who have stopped farming or have reduced their areas under cultivation.

Figure 8: Districts covered under the Project



2.1.2. Project Goal

The project goal is aligned with government of Himachal Pradesh Sustainable Development goals as depicted below.

Eliminate poverty and improve the quality of life in target districts by increasing the productivity of the subtropical horticulture sector



2.1.3. Project Objectives

1. Construct and rehabilitate water saving climate smart irrigation systems covering 6,000 ha of land that are sustainably managed by Water User Associations
2. Build the capacity of farmers to establish sub-tropical high density plantation using high quality planting material that provide sustainable and profitable financial returns
3. Establish infrastructure that is managed by producer groups to reduce post-harvest losses, add value and to enhance linkages between farmers and markets

2.2. Project Stakeholders and Beneficiaries

The beneficiaries of the project can be divided into two categories:

Direct beneficiaries	• Small and marginal farmers • Implementing agencies, i.e., the Department of Horticulture and Jal Shakti Vibhag
Indirect beneficiaries	Small and medium size enterprises involved in input supply, processing, logistics and marketing.

The details of the mentioned beneficiaries – both direct and indirect is mentioned below:



2.3. Project Output, Outcomes, and Impact

The Project will invest and develop better skills to boost the Horticulture sector in the Sub-tropical region of the State. It will aim of utilizing new technologies in the future. In order to sustain the Project outcomes after its completion, the necessary amendments would be incorporated along with necessary activities for smooth transition. The following activities contribute to the achievement or sustainability of Project outcomes during or after Project implementation.

2.3.1. Outputs and Activities

Table 7: Expected outputs and activities

Outputs	Description	Activities
Output 1	Irrigated area expanded and sustainably operated	• Build or upgrade irrigation schemes with SCADA • Support WUAs to establish on-field tertiary water distribution infrastructure • Transfer irrigation scheme management to WUAs
Output 2	Climate resilient subtropical horticultural production systems adopted.	• High density plantation including drip irrigation, planting materials, horticulture input and tools provision • Animal Proof Solar Composite Fencing • GIS-based land resource mapping and land management plan establishment • Digital Agri-Tech Services for monitoring of soil, water, weather, erratic climate risks, disease, cropping pattern and providing real-time farming advisories • Training of lead/demonstration farmers and build the network of training for farmers through community horticulture production and marketing associations (CHPMA) • Training on intercropping, beekeeping and organic fertilizer production and sales • Training of extension officers of DOH & JSV • Nursery Development and Training • Research and study on climate resilient crops, climate vulnerability, PoP refinement & leveraging carbon credit

Outputs	Description	Activities
Output 3	Market access for subtropical horticulture farmers developed	• Post-harvest Value addition facilities at the community level to support post-harvest handling, primary processing and storage, and packaging via collection centre and integrated facility Centre • New and upgradation of processing units • Formation of APEX body with CHPMA societies for business management, operation and marketing. • Capacity Building of APEX body • Market Development and Promotion by APEX body • Establishment of Incubation and Training Centre (Centre of Excellence)

2.3.2. Outcomes

Income and climate resilience of targeted households in subtropical areas of Himachal Pradesh improved.

2.3.3. Impact

- Rural household income increased: By aligning Strategies for Doubling Farmers' Income in Himachal Pradesh
- Climate resilience strengthened: Which are aligned with Himachal Pradesh Sustainable Development Goals

SDG 1 - End poverty in all forms everywhere

SDG 2 - End hunger, achieve food security and improved nutrition and promote sustainable agriculture

SDG 8 - Promote inclusive and sustainable economic growth, employment and decent work for all

SDG 13 - Take urgent action to combat climate change and its impacts

SDG 15 - Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss

2.4. Project alignment and convergence with Central and State Government and ADB Strategy

The Project responds to both State and national poverty reduction strategies. At the State level, the proposed Project is aligned with the State government's Strategy for Doubling Farmers Income. This strategy identifies development of subtropical horticulture and irrigation facilities as a priority to address a significant income gap between the temperate zones of hilly areas and the subtropical zones in low and mid-hills areas by targeting small and marginal farmers who have stopped farming or have reduced their areas under cultivation because of a lack of irrigation facilities, and crop damage by wild and stray animals. The Project should also attempt convergence and leveraging the finance of selected components from the various schemes of the State and Central Government.

Capacity Building is vital in maintaining the sustainability of the Project, emphasizing on knowledge development and skills building. Capacity building exercises including orientation, technical, refresher, advance trainings, workshops, and exposure visits. The capacity building exercises along with monitoring and learning process would not only help to ensure the environmental and social safeguard application, but also develop awareness and understanding towards environmental solutions by the communities.

2.4.1. Alignment with Central Government Schemes

In 2017, the Government of India launched a strategy for doubling farmers' income by supporting agribusiness development as a vehicle to increase farming incomes and integrate marginal farmers into an efficient food supply system. The Ministry of Agriculture and Farmers Welfare issued guidelines that laid out the central government's support schemes in agribusiness models, production and post-harvest infrastructure, innovation and agri-enterprise development, income diversification, and promotion of Farmer Producer Organizations (FPOs). Additionally, the government also provided a financial stimulus package to boost infrastructure support and neutralize the impact of Covid-19 pandemic in agriculture and allied sectors, this includes¹³:

1. The INR 1 lakh crore Agro Infrastructure Fund (AIF) will help in strengthening farm gate infrastructure for farmers and benefit both supply and demand.

¹³ <https://www.hindustantimes.com/india-news/nirmala-sitharaman-live-8-point-agricultural-reform-announced-in-3rd-tranche-of-aatma-nirbhar-bharat-pkg/story-cOEHn5XEy4alkL4kmyJGzH.html>

2. The provision of INR 5 lakh crore for animal husbandry and fishery will enhance the scope for alternate income avenues for rural population.
3. The INR 10,000 crore scheme for the formalization of Micro Food Enterprises (MFE) and a Cluster-based approach will help in building capacity at regional levels and better supply chain integration.
4. Extension of Operation Green to all fruits and vegetables will enable farmers to diversify their produce and add much needed quicker cash generation, which comes with shorter sales cycles of fruits and vegetables.
5. Several additional and emergency working capital funding schemes have been announced to improve the liquidity with the farmers.

In February 2020 the government announced a new central scheme titled **“Formation and Promotion of Farmer Producer Organizations (FPOs)”** to form and promote 10,000 new FPOs with a total budgetary provision of INR 4,496 crore for five years (2019-20 to 2023-24) with a further committed liability of INR 2,369 crore for period from 2024-25 to 2027-28 towards handholding of each FPO for five years from its aggregation and formation¹⁴. FPOs will be formed and promoted through Cluster Based Business Organizations (CBBOs) engaged at the State/cluster level by implementing agencies. The CBBOs will have five categories of specialists from the domain of Crop husbandry, Agri marketing / Value addition and processing, social mobilization, Law & Accounts, and IT/MIS. These CBBOs will be platform for end-to-end inputs for all issues in FPO promotion.

2.4.2. Alignment with State Government

The State’s “Drishti Himachal Pradesh 2030: Sustainable Development Goals” is aligned with the United Nations Sustainable Development Goals (SDGs) endorsed by the Government of India in 2015. The key SDGs applicable to agriculture and allied sector included by the State are:

- **SDG 1:** By 2030, eradicate extreme poverty for all people everywhere in the State, currently measured as people living on less than US\$1.25 a day and reduce at least half of the population of men, women, and children of all ages living in poverty in all its dimension according to national definitions.
- **SDG 2:** Increase productivity of agriculture and allied sector in food grains and horticulture by implementing programmes and schemes in close coordination with key stakeholders.

¹⁴ <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1605030>

- In terms of horticulture the government aims to achieve an increase in vegetable productivity from 21 MT tonnes/ha to 27 tonnes/ha and fruits productivity from 5 tonnes/ha to 25 tonnes/ha by 2030.
- Increasing cropping area under organic cultivation from 17,000 ha to 30,000 ha.
- Increase area under protected cultivation from 150,000 ha. to 230,000ha.
- **SDG 5:** Increase water use efficiency across all sectors and ensure sustainable withdrawals and supply of fresh water to address water scarcity
 - Reduce % of water losses in irrigation sector from 35% to 15%
 - Implementation of Command Area Development (CAD) and Water Management (WM) programme to increase the farm efficiency and potential utilization. This aim to increase the area under implementation from 35,971 ha to 165,790 ha.
- **SDG 9:** Providing an enabling environment, supported by robust and resilient infrastructure, a simplification of procedures and investment friendly policies, for the promotion of industrialization and to generate employment opportunities for the local youth.
 - Value chain and marketing to be established in 7 districts for agri and horticulture produce.
 - Establish 6 agriculture value chain Clusters
- **SDG 12:** Increasing resource efficiency for overall improvement in the quality of life.
 - Reduce the total pesticides usage in agriculture/horticulture by 30%
 - Increase covered storage for food grains by 40%
 - Promote and setup horti-agri produce processing and preservation units at small scale level through 78 FPOs.
- **SDG 13:** Increasing resource efficiency for overall improvement in the quality of life. The State shall endeavor to enhance net welfare from those economic activities that use limited resources and cause less degradation and pollution during their entire life cycle.
 - Adoption of climate smart agriculture technologies and farm diversification options for climate resilience livelihoods – 500,000 farmers to be brought under climate smart technologies.

2.4.3. ADB's Strategy

The Project is aligned with ADB's Strategy 2030 operational priorities on promoting rural development and food security; addressing remaining poverty and reducing inequalities; tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability; strengthening governance and institutional capacity development; and accelerating progress

in gender equality.¹⁵ The Project falls under the Country Partnership Strategy for India, 2018-2022 pillar II on inclusive provision of infrastructure network and social services by improving the infrastructure bottlenecks in lagging regions, and supporting investments in rural infrastructure to improve agricultural productivity and reduce the growing rural-urban income gap.¹⁶ The Project is also included in the Country Operations Business Plan for India 2021-2023.¹⁷

The Project will help implement agricultural reform measures announced by the Government of India as part of the coronavirus disease relief package. In particular, the project will support farmers' market access and facilitate contract farming.

The next chapter discusses on the Project Readiness Financing (PRF) that was established to undertake the feasibility and sustainability of the Project.

¹⁵ ADB 2019, Strategy 2030: Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific. Manila

¹⁶ ADB. 2017. Country Partnership Strategy for India 2018–2020. Manila 13

¹⁷ ADB. 2019. Country Operations Business Plan: India, 2021–2023. Manila.

3. Project Readiness Financing (PRF)

Project Readiness Financing (PRF) was established to check the feasibility and sustainability of the Project within the sub-tropical regions of the State as discussed in Section 2.1.1. PRF was approved by ADB on 8th December 2020 for an amount of INR 74.35 crore to be implemented over a period of two years from 2021 to 2022. DOH and Jal Shakti Vibhag (JSV) are the implementing agencies for the Project where DOH acts as the nodal agency. The funds under the PRF facilities were supported to undertake advanced solutions which created an environment for subtropical horticulture development in the State.

The pilot Project is being implemented at 17 locations in 4 districts (Bilaspur, Hamirpur, Kangra and Mandi) and involves the development of drip-irrigated high-density horticulture production in 12 blocks incorporating 200 ha of irrigated land across 16 irrigated areas and involving 1081 male and female beneficiary landowning households. Also, the demonstration pilot would encourage the farmers to join the Project so that they could start the new horticultural practices of cultivating subtropical crops and leave behind conventional farm practices.

3.1. PRF Objectives

1. Establish financially and economically viable technology and beneficiary participation systems for project implementation and facilitate a smooth transition from preparation to implementation.
2. Roll-out of small holder managed high and ultra-high-density subtropical horticulture production and associated irrigations systems operation
3. Demonstrate the income potential of subtropical horticulture production and generate interests of agricultural landowners in subtropical horticulture production for generation of self-employment
4. Test innovative technologies for water extraction, harvesting, distribution and storage.
5. Pilot the production of four commodities (guava, litchi, pomegranate and citrus), selected on the basis of estimated profitability, farmer demand and agro-ecological suitability in selected areas within the
6. Finance plus element for upgradation and strengthening of the irrigational practices, systems for sustainable transformation of traditional farming systems into modern hi-tech productive farming.

In order to achieve the above-mentioned objectives, various activities have been carried out under PRF. The envisaged outputs of the PRF and various activities carried out to achieve these outputs are specified as below.

Table 8: PRF Outputs and Activities

#	Envisaged Outputs	List of Activities
1	Irrigation infrastructure and farmer management systems established	• Establish 4 new and rehabilitate 12 existing irrigation schemes for water extraction, distribution, and storage. • Establish Water User Association (WUA's) on the completed irrigation schemes and enhance women participation and gender equitable leadership. • Finalize the draft WUA ACT to be submitted for the State Legislative assembly's enactment.
2	Subtropical horticulture production technology and marketing systems demonstrated	• Develop 17 sub-tropical horticulture plots covering 200 ha, engaging about 1081 farmers for high and ultra-high-density production of citrus guava, litchi, and pomegranate. • Fence the horticulture plots to protect from animal predation. • Form Community Horticulture Production and Marketing Associations (CHPMAs) in PRF areas and built their capacities for business. • Assist CHPMA meetings with private sector, marketing representatives and help CHPMAs develop investment plans for sub-tropical horticulture value addition and market development.
3	Enabling environment, tools, and capacity for promoting irrigated subtropical horticulture provided	• Support to Department of Horticulture (DOH) to prepare HP Horticulture Sector Development Strategy and Investment Plan 2023-2030. • Provide technical training and study tours on Project design and management such as climate smart design, safeguards, procurement, gender, financial management and institutional strengthening for DOH and JSV staff. • Prepare the 'Packages of Practices (PoPs)' which are crop specific best practices for orchid husbandry and post-harvest procedure. • Provide on-site training for CHPMA members on orchard management and the Package of Practices.

#	Envisaged Outputs	List of Activities
		Establish scientific and Project monitoring and evaluation systems in the Project Management Unit.
4	Ensuing investment project and its implementation readiness prepared	- Baseline Survey. - Feasibility Studies. - Detailed Engineering Drawings and Cost Estimates. - Due Diligence Assessment. - Safeguard preparation work. - Bid Documents for the Ensuing Loan Project. - Requirements for the Ensuing Loan.

3.2.1. Output 1: Irrigation infrastructure and farmer management systems established

3.2.1.1. Establish 4 new and rehabilitate 12 existing irrigation schemes of water extraction, distribution, and storage

In consultation with the Jal Shakti Vibhag, water sources were mapped for the identified areas with adequate water availability to the Clusters. A total of 16 irrigation schemes were developed for 17 PRF Clusters by introducing innovative technologies for water extraction distribution and storage. A slight variation was done in the implementation wherein establishing 4 new and rehabilitating 12 existing scheme was done. The total investment incurred for the development of the irrigation schemes was INR 15.70 crore.

Figure 9: Identification of water source for irrigation



3.2.1.2. Establish Water User Association (WUA) on the completed irrigation schemes and enhance women participation and gender equitable leadership

17 WUAs were established and capacitated on the constructed irrigation schemes with women's participation and gender-equitable leadership. Further Water User Association Act and Water User Association Manual has been prepared.

3.2.1.3. Finalise the draft WUA ACT to be submitted for the State legislative assembly's enactment

Participatory Irrigation Management (PIM) has been advocated in the national Water Policy GOI 2012 and the State Water Policy GoHP, 2013. In line with this, the GoHP is enacting an Act titled Himachal Pradesh Irrigation Water User Association Act 2021 which is currently in the draft stage. In the proposed Act, it is proposed that irrigation water management shall be done by WUA at the local level.

3.2.2. Output – 2: Subtropical horticulture production technology and marketing systems demonstrated

3.2.2.1. Develop 17 sub-tropical horticulture plots covering 200 ha, engaging about 1081 farmers for high density production of citrus, guava, litchi, and pomegranate

Clusters having at least 10 households where farmers were engaged in agriculture activities, were selected for the Project. Out of the total number of farmers in every Cluster, 80% were small and marginal growers. The extension team of DOH sensitized the farmers for diversification of the crops from traditional agriculture to horticulture, explaining the benefits of the Project through meetings, workshops and one to one discussion. Farmers' willingness to participate in the Clusters was undertaken and Field Level Demonstrations

Figure 10: Identification of Cluster Areas



(FLDs) were undertaken at 9 places in four districts of the State. With initial investment provided from the government schemes, the Department motivated farmers to adopt the proposed Project intervention on their land parcel and leverage the benefit.

Table 9: Area of PRF Clusters

District	Development Block	Cluster name	Cluster Area (ha)
Mandi	Dharampur	Binga	10.00
	Dharampur	Sandhole-Neri	9.50
	Dharampur	Dabrot	8.50
	Dharampur	Kalswani	10.90
	Gopalpur	Tanda-Matour	14.46
	Sundernagar	Kalahod	12.62
Hamirpur	Bamsan	Kehdroo	10.00
	Sujanpur	Bhaleu	10.00
Bilaspur	Sadar-Bilaspur	Majher	17.00
	Ghumarwin	Talwara	10.81
	Shri Naina Devi	Dulhet	18.23
	Ghumarwin	Lanjhta	13.25
Kangra	Sullah	Lahat	14.50
	Lambagaon	Rit-Trehla	10.00
	Bhowarna	Sehal	7.20
	Baijnath	Ghraoon-Dehan	11.20
	Baijnath	Gartholi-Dhanag	11.50
		TOTAL	200.00

- Crop Selection for Clusters:** A team of Project's Management experts and the Y.S Parmar University scientists were constituted to collect the ecological parameters in the proposed Clusters. The experts, along with the technical field officers of the Department, collected the soil samples randomly from the identified Clusters, which were analyzed for water holding capacity of the soil and nutrient status in the laboratory.

A consultative approach was adopted by the Department to bring a consensus amongst the beneficiary farmers and scientists to finalize the particular crop and variety for the respective Clusters on the basis of ecological parameters, soil analysis report and farmer's choice. Four major horticulture crops, namely Sweet Orange, Guava, Pomegranate and Litchi were finalized for plantation in the PRF Cluster. On the basis of findings of the analysis, 7 varieties of Sweet Orange (Valencia, Red Blood, Hamlin, Jaffa, Pera, Westin and Natal), 3 varieties of Guava (Lalit, Sweta and VNR Bihi), 2 varieties of Litchi (Calcutta and Dehradun) and 1 variety of Pomegranate (Bhagwa) were identified and finalized for plantation.

Figure 11: Procurement of plant material from nurseries



Table 10: Details of Crops for PRF

District	Cluster name	Type of Crop
Mandi	Binga	Citrus
	Sandhole-Neri	Litchi
	Dabrot	Guava
	Kalswani	Guava
	Tanda-Matour	Guava, Pomegranate
	Kalahod	Guava
Hamirpur	Kehdroo	Citrus
	Bhaleu	Guava
Bilaspur	Majher	Citrus
	Talwara	Citrus
	Dulhet	Citrus, Guava
	Lanjhta	Litchi
Kangra	Lahat	Guava
	Rit-Trehla	Citrus
	Sehal	Guava
	Ghraoon-Dehan	Litchi
	Gartholi-Dhanag	Litchi

- **Site Clearance:** The land in the Clusters was cleared and prepared with the help of the community for plantation of saplings of horticulture crop. The land clearance involved levelling of land and removal of unnecessary hindrance.

Figure 12: Site Clearance for plantation



- **Field Preparation:** The field preparation activities were undertaken for the identified 17 Clusters. A crop wise standardized layout design and specifications were prepared for each of the Clusters. The major field preparation activities included layout plan, land levelling and terracing, dressing cum bed making and pit digging.

Figure 13: Field Preparation activity



- **Plantation:** Plantation is considered to be one of the most important activities under horticulture. Every Cluster was supplied with the required quantity of planting material in time, with no compromise on the quality basis the crop selection carried out earlier. To support the future need of planting material for the Project, Nursery Development is also planned to be strengthened within the State.

Figure 14: Plantation in Clusters



- **Drip Irrigation:** Drip irrigation is a smart and innovative solution for the horticulture plantation. It is significantly proven to be effective in case of hilly areas and for small farmers. It can increase the production by 50% and limits topsoil erosion, pest infestation and evaporation from the soil surface. The advantages of the drip irrigation system are as follows:

- Improves quality and ensure early maturity of the crops.
- Water Saving up to 40% – 70%.
- Controls weed growth, saving of fertilizer (30%) and labour cost (10%).
- High Water Use Efficiency
- Reduces greenhouse emission

Figure 15: Main water tank & Drip Irrigation System



- **Mulching:** The use of mulching is recognized as an important part of crop management to reduce the application of chemicals for weed and pest control, while conserving the soil moisture from evaporation. The activity also helps to decrease the requirement of water and is considered to be environment friendly. The use of mulch has been provisioned under the PRF Clusters considering the following advantages:

- Helps in conserving the moisture by reducing the amount of soil water loss through evaporation which is beneficial for plant productivity in sub-tropical areas.
- Reduces the soil erosion and compaction from heavy rains and aid in water penetration rate.
- Support root growth of the plants by regulating soil temperature, aeration, and micro-organism activities.

Figure 16: Mulch laying in Clusters



- **Intercropping:** Since the production is expected to start after three years of plantation, the major concern of the beneficiaries in the Clusters is the loss of farm income and livelihood during initial years of the Project. Hence, to mitigate the problem and to create alternatives for farm income and livelihood of the Project beneficiaries, concept of intercropping has been introduced in the PRF Clusters. Crops such as onion, ginger, turmeric, Wild marigold, pea, cowpea, cabbage, urd, etc. have been planted by the farmers on recommendations of the experts and has shown good results. The inter crops were also used for fodder. The experiments were found encouraging for the farmer beneficiaries and will be replicated in the Ensuing Loan phase of the Project with modifications as per recommendations of the expert.

Figure 17: Intercropping in PRF clusters



3.2.2.2. Fence the horticulture plots to protect from animal predation

To help the farmers in resolving the issue of animal predation, an innovative solution of Solar Powered Electric Fencing has been proposed. In this modern, non-conventional fencing, wires carry solar energy produced current, delivering a fierce but non-fatal shock to an animal coming in its contact, causing a suitable deterrent effect on the animal. The current does not cause any harm to the animal, but it acts as a psychological barrier for the animal from intruding into the field and helps in preventing losses.

The Solar Fencing consists of Energizer, solar panel, battery, insulation material, poles, High Tensile conducting wire, and Interlink Galvanized Steel chain mesh. The electric impulse is generated by the energizer, which produces high voltage impulses of approximately 8 kV once every 0.9 to 1.2 seconds. The impulse lasts for about 300 millionths of a second to 0.1 second with a current of up to 10 mA.

Figure 18: Animal Proof Composite fencing



3.2.2.3. Form Community Horticulture Production and Marketing Associations (CHPMAs) in PRF areas and built their capacities for business

The community was made aware of the Project design, Project objectives, implementation process, Project outputs, role of various stakeholders and role of community as a group in the Project. To generate awareness, individual meetings, focussed group discussions and meetings at Cluster level were organized. A provisional management committee were constituted by electing representatives from among the Project beneficiaries and the Community Horticulture Produce Marketing (CHPMA) Cooperative Societies were formed in the PRF Clusters. These CHPMA Cooperatives were registered as a legal entity under HP Cooperative Societies Act 1968. Separate accounts of each CHPMA were opened and four (04) shares of INR 500 each were collected by

the members as share capital of the CHPMA Cooperative Society. The major role of CHPMAs is to undertake collective production and marketing from the Cluster. Besides this the CHPMAs will also undertake various other business activities to increase the income members. In addition, the CHPMAs will also operate and maintain various facilities/infrastructure being created at the Cluster level. As an initial support for institutional development, CHPMAs were facilitated by CHPMA Group Facilitation and Training Facilitators, an agribusiness professional having expertise in farmer group formation and development.

Capacity Building of CHPMAs

The Project beneficiaries were exposed to various trainings during PRF implementation. The trainings included fertigation, micro-irrigation, training and pruning of fruits, insect & pest management, maintenance of drip irrigation systems, harvesting of fruits, packaging of fruits, management of weeds, mulching, CHPMA functioning and role of office bearers, CHPMA Record keeping, Business Development Strategies for FPOs, etc. The Scientist, extension officer and CHPMA Facilitator organised regular training programmes at the Cluster level. Exposure visits were also organized for the farmers by enabling them to participate in State level events such as exhibitions and workshops at different locations across the State.

Figure 19: Meeting & Training for Capacity Building of CHPMA



Assist CHPMA meetings with private sector market representatives and help CHPMAs develop investment plans for sub-tropical value addition and market development

Farmers of the FLDs established under the project experienced the first harvest of fruits. Since the quantities were very small and the lot size was not enough to supply the organized markets, beneficiary farmers decided to sell their produce on their own. This has not only built the sense of ownership but has also increased their confidence of undertaking the marketing process.

Initiatives were taken at the Project level by holding interaction of the farmers with the local buyers at farm gate level, which has resulted in sale of guava crop at a good price. In addition to the above, dialogues with various renowned companies such as Reliance Fresh, Dabur, Mother Dairy, Patanjali, etc. have been initiated with positive response from all. Being new in the commercial production, the farmers are yet to learn the processes of sale and purchase of agricultural produce and hence, based on the learnings of the PRF, a marketing strategy is being formulated for marketing of the produce.

Figure 20: Sorting, Packing and Marketing of produce



3.2.3. Output – 3: Enabling environment, tools, and capacity for promoting irrigated subtropical horticulture provided

3.2.3.1. Support to Department of Horticulture (DOH) to prepare HP Horticulture Sector Development Strategy and Investment Plan 2023-2030

The DOH has prepared the HP Horticulture Sector Development Strategy and Investment Plan (HSDSIP) 2023-2030 to guide the overall future development of the State's horticulture sector and Ensuing Loan Project design in particular. This plan included Value Chain Assessment, Nursery Development Plan particularly focusing to the Ensuing Loan Project under the CS03 package.

3.2.3.2. Provide technical training and study tours on Project design and management such as climate smart design, safeguards, procurement, gender, financial management and institutional strengthening for DOH and JSV staff

The DOH and JSV staff were provided technical training and study tours on Project design and management such as climate smart design, safeguards, procurement, gender, financial management and institutional strengthening.

3.2.3.3. Prepare the Packages of Practices (POPs) which are crop specific best practices for orchard husbandry and post-harvest procedure

Package of Practices (PoPs) of sub-tropical fruits was developed by Y. S. Parmar University to support and provide technical know-how, scientific knowledge on modern food production practices for the use of field level extension workers and sub-tropical fruit growing farmers under CS-04 package.

3.2.3.4. Onsite training for CHPMA members on orchard management and Package of Practices

The CHPMA members were exposed to various trainings on Orchard Management and POPs.

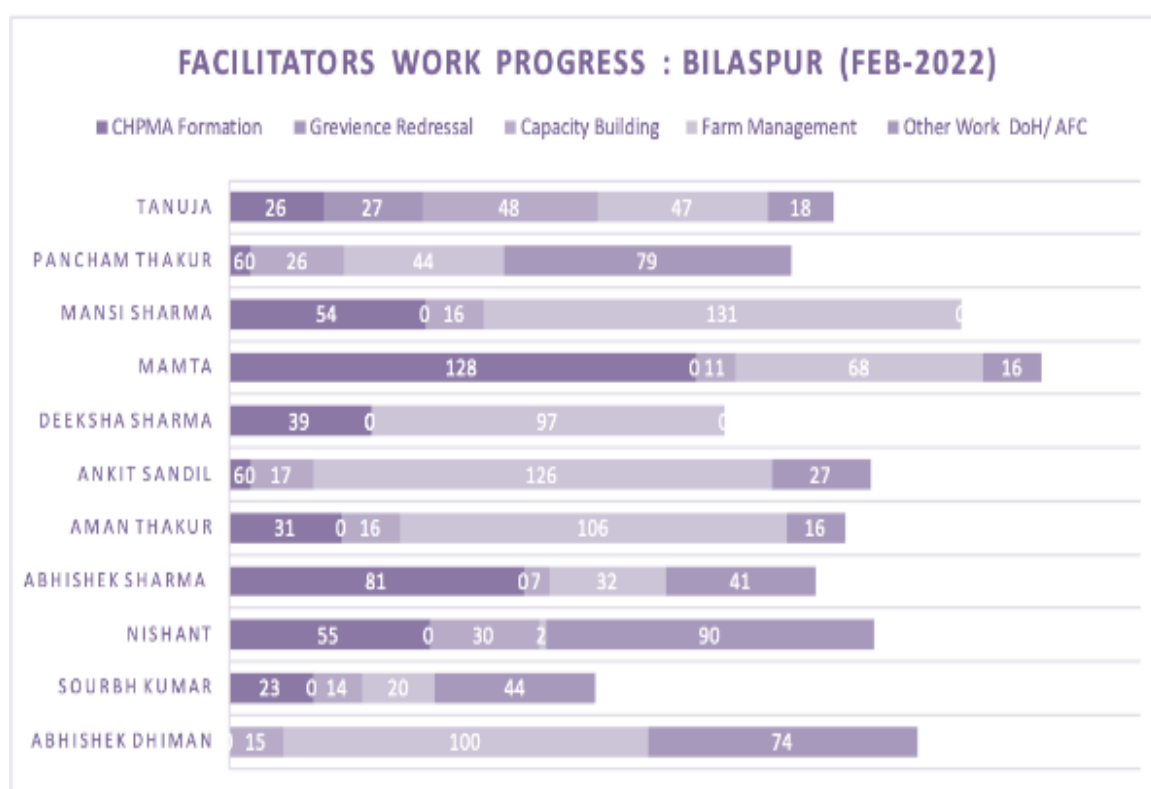
3.2.3.5. Establish scientific and Project monitoring and evaluation systems in the Project Management Unit (PMU)

- i. **Development of a Management Information System (MIS) including an online monitoring framework:** The Management Information System (MIS) and monitoring framework assists the farmers in performing various tasks, ranging from operational planning and implementation to documentation for assessment of performed field work. It is aimed to support management tasks and real-time decision making, as well as compliance management by automating data acquisition and market information etc. A SQL database was created for the MIS and monitoring of the PRF activities. The SQL database included the following parameters:

- **Beneficiaries:** Name, Gender, Caste Category, Annual income, Total Land Ownership, Parcel of land given in the project.
- **Cluster:** Name of the Cluster, Block & District.
- **Plant:** Name of the plant and its varieties.
- **Plantation:** Farmer wise plantation details, along with varieties and date of plantation
- **Input, Tools and Equipment:** Inventory of input issued to the beneficiaries and similarly, the tools and equipment.
- **Infrastructure Details:** Water Tanks, Drip Irrigation, Mulching, Solar Fencing, etc.
- **Water User Association (WUA):** WUA data on working members, registration, training
- **Community Horticulture Produce Marketing Association (CHPMA) Cooperatives:** CHPMA Provisional committee, CHPMA registration, activities being undertaken, manpower (Facilitators and District In-charges), work monitoring database, meetings, etc.
- **Farm Management:** Farm activities database for fortnightly monitoring of Package of Practices, Training and Marketing activities.

- ii. **The concept of online monitoring** has been framed with the aim of representing the knowledge that can be used for understanding the concepts and relations regarding various aspects of horticultural development and to support the farmers in decision-making regarding the land and crop management. It is aimed that the monitoring framework platform will integrate the external services including value chain development, i.e., business process modelling between farmer, suppliers, and potential clients as well.

Figure 21: Monitoring of Facilitator's work progress



- iii. **Development of a web-based GIS Application:** A Web GIS is developed for PRF Clusters, where users can get the information on individual Clusters, farmers, plants, crops etc. Several layers such as Clusters points, polygons, Water tanks, blocks and districts are integrated in the application. Satellite images can also be overlaid for further analysis. PRF Web GIS can be accessed through this link:

<https://doh-hpshiva.maps.arcgis.com/apps/mapviewer/index.html?webmap=33298f16c3b54e2ca13e6fb934aeabc7#>

A GIS based dashboard has also been developed, where different data are linked and displayed on a single screen with Maps, Charts, Graphs, Lists etc.

Figure 22: Snapshot of the Web GIS page

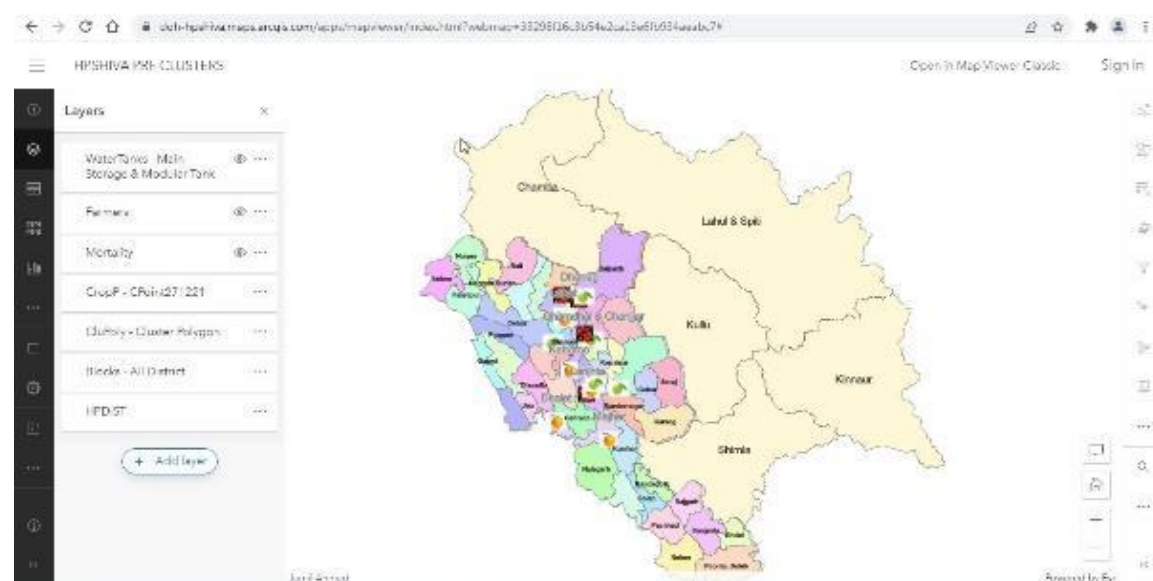
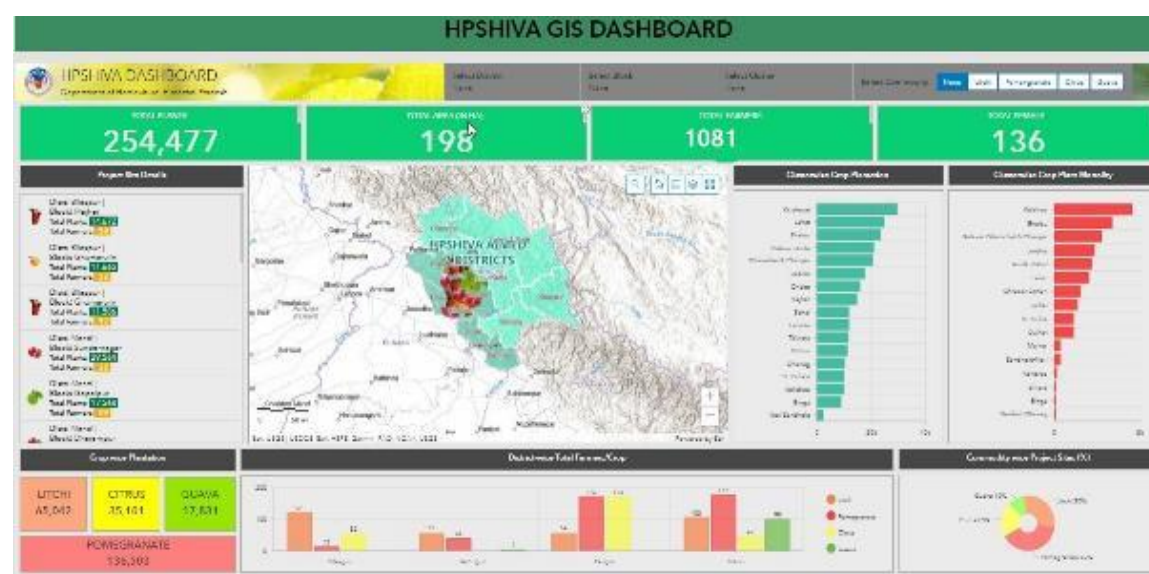


Figure 23: GIS Dashboard for PRF Clusters



- i. **Plant Tagging:** Every plant in the Cluster shall be given a unique code for better monitoring of the plant. The unique code shall be associated with / refers to owner detail, plant variety, date of plantation, Cluster, etc. A complete history of the plant will be maintained in the larger database for farm practices (which includes Irrigation, Fertigation, Pesticide plant protection, Pruning, Shaping, etc.) with an alert trigger for the upcoming activities to be performed with for the individual plant. This database will also help in future projection of production and early warning system for disease outbreak-based onset of symptoms and control measures. This database will be linked with Block Chain Technology in future for Traceability and other transactions. This activity has been initiated as pilot activity in Talwara Cluster.

3.2.4. Output – 4: Enabling environment, tools, and capacity for promoting irrigated subtropical horticulture provided

3.2.4.1. Baseline Survey

The baseline survey was conducted by carrying out primary surveys of targeted Project beneficiaries across 28 blocks in the 7 Project districts, covering a total of 1016 households, covering 10% of the total households. The detailed district wise **baseline survey outputs are at [Annexure 5.4](#)**.

A topographic survey of more than 4000 ha identified under phase 1 of the Project was completed. The topographic survey of the Clusters spread over seven districts was carried out for designing the irrigation system from source to Cluster and within the Cluster. The survey also included existing status of crops, accessibility to farms, and terrain of the Clusters. The detailed district wise topography outputs are annexed with the report.

3.2.4.2. Horticulture Sector Strategy and Investment Plan

For studying the existing and potential value chain analysis of sub-tropical horticulture Ernst & Young was engaged under CS03 package. Also, nursery development plan and detailed Horticulture Sector Strategy and Investment Plan 2023-2030 under this package.

3.2.4.3. WUA Facilitators

For creation of Water User Association (WUA) act and manual, AMC was engaged under CS07 package. The agency also assisted in formation and capacity building of WUA. Detail about WUA is in chapter 4.3.

3.2.4.4. CHPMA Facilitators

Under the PRF, Community Horticulture Production and Marketing Association (CHPMA) was formed and registered under cooperative act. AFC was engaged under CS08 package as facilitators for CHPMAs and provided the necessary assistance related to society formation, handholding and guidance to farmers in cultivation, creation of manual, etc. Detail about CHPMA is in chapter 4.4.

3.2.4.5. Feasibility Study, Detailed Engineering Drawings and Cost Estimates

Joint venture of Grant Thornton Bharat LLP and Tata Consulting Engineers was engaged to conduct necessary consultations, surveys, studies for preparation of the Project, due diligence documents and assessing Project feasibility for various components of the Ensuing Loan Project, as required by the Government and ADB towards preparation and finalization of a Project

Investment Plan, covering 6,000 ha of sub-tropical horticulture area and a target beneficiary of 15,000 rural households.

- Horticulture Design
- Irrigation Design
- Economic financial Analysis

3.2.4.6. Due Diligence Assessment

As a part of due diligence, the team of engineers visited to the existing LIS schemes, Clusters and collected data of the existing infrastructure in consultation with the officials of Jal Shakti Vibhag (JSV). A check list was prepared for collection of the data related to the existing scheme. Format for data collected related to few schemes are attached at [Annexure 3.2](#) in Irrigation Design Feasibility Analysis.

3.2.4.7. Safeguard preparation work

In terms of the safeguard compliances within the Project, various environment and social safeguard compliances have been documented. As per ADB's environmental Safeguards Policy Statement (SPS) 2009 requirements, there is a need to ensure the environmental soundness and sustainability of PRF and to support the integration of environmental considerations into the Project decision-making process. The SPS requires borrowers to identify Project impacts and assess their significance; examine alternatives; and prepare, implement, and monitor environmental management plans. Also, the SPS requires borrowers to consult people likely to be affected by the Project and disclose relevant information in a timely manner and in a form and in languages understandable to those being consulted. Therefore, following the requirements of the ADB's SPS, the Project has adopted environmental and social considerations during Project designing and implementation.

i. Environmental Safeguards

During the initial environmental screening, the Project has been assessed with minor environmental impacts and classified as Category C for environment risks associated in accordance with ADB's SPS. Although environmental risks are minor, the mitigation measures are added to contractor's requirements in the bidding documents to ensure that the PRF's piloting activities are done within the scope as a Category C Project. For overall management of the Project, in the Department of Horticulture, a PMU has been established in DOH, assisted by the Environmental Safeguards Specialist to oversee monitoring and documentation of the implementation of environment mitigation measures and reporting as part of the environmental monitoring progress reports to be submitted to ADB.

The risk and impacts related to Biodiversity and Natural Resources will be addressed through implementation of mitigation measures, including applying offsetting measures such as compensatory afforestation activity along the periphery of pilot-test areas by the JSV and DOH, if required, to mitigate residual impact.

In addition, the Project will not harm the existing wildlife, and conserve the natural resources of the pilot-test areas. In compliance to the government's policy, the implementation of the PRF will follow standards for safe disposal of construction wastes, used oil and discarded paints. JSV and DOH will follow standards for controlling the pollution on ambient air, water quality and noise levels, following the applicable national rules and amendments. Similarly, all applicable rules and guidelines for Hazardous Waste Management, Construction and Demolition Waste Management, Noise Pollution will be strictly followed as per the requirement of the environmental safeguards. Similarly, workers will be provided with a safe and healthy working environment, considering risks inherent to the type of construction and specific classes of hazards in the pilot-test areas. PMU will take steps to prevent workers' accidents, injury, and disease (i.e., COVID-19) arising from, associated with, or occurring during implementation of pilot test irrigation schemes. PMU will continue to ensure that no damage is done to physical cultural resources. Access of people for entering temples, cremation ground across, and other religious and culturally important places will not be blocked at any the pilot-test sites. The passages will be maintained open as is the case even during the PRF implementation.

The DOH has also constituted a Grievances Redressal Mechanism (GRM) under the PRF to support the environmental and social safeguards of the Project. The same has been discussed in subsequent section 3.7.

ii. Social Safeguard

During the PRF, a social baseline survey was conducted to understand the socio-economic status of the region. The survey interviewed 304 farmers out of which 12.6% were women farmers. Majority of the farmers across the targeted districts were marginal landowners with only 6% semi-medium in Bilaspur district, 14% and 6% small farmers in Hamirpur and Kangra district respectively. In majority of cases, barren land that was lying fallow has been utilized for the Project. Thus, the farmers did not have to forgo any produce in the Project land. A lower level of academic achievements was noted amongst the women farmers. In terms of the social category status, 81.5% farmers belong to

General Caste with 6.5% belonging to Scheduled Tribes (6.5%) such as Gujjars and Gaddis in Bilaspur & Kangra.

In terms of crop production, generally wheat is grown during Rabi and maize during Kharif seasons which is mainly grown for subsistence. Only a small number of farmers were involved in multi-cropping of chilies, ginger, pulses, fodder, soya bean, cucumber, turmeric, etc. which is also grown for self-consumption. 71% of the farmers use their own labour for on farm activities whereas 25% use both own labour and hired help. It is pertinent to note that while women farmers comprised of 15% of the respondents for this survey, overall labour provided at the Cluster level is more than 50% by women. The land ownership rests mainly with farmers above the age of 50 years, the family members participating in the Cluster activities are much younger. More qualified women family members provide labour for the Cluster.

3.3. PRF Key Outcomes

The activities carried out in the PRF as explained in the earlier sections have resulted in various outputs described above. The salient outputs are briefly

- **Concept of “One Crop, One Cluster”** successfully implemented. The same will be further upscaled in 1000 clusters across the seven districts on similar lines in Ensuing Loan project.
- **17 subtropical horticulture clusters** in total area of ~ **200 ha** established. This will benefit **1081 farmer families** by introducing high-density production of citrus, guava, litchi and pomegranate.
- **46,000-meter length** of fencing laid.
- **17 CHPMAs formed and registered** under the Himachal Pradesh Cooperative Act of 1968.
- **Additional income for farmers.**
- **Beekeeping florals identified for the Ensuing Loan Project.** This would also act as an additional source of income for the sub-tropical farmers.
- **16 irrigation schemes** (7 functional, 4 non-functional rehabilitated, and 5 new schemes) developed for **17 PRF clusters** covering an area of **approximately 200 ha** by introducing innovative technologies for water extraction distribution and storage. however, these schemes are designed to cater an overall area of 300 ha, thus provides a potential to expand the cluster area by 100 ha subsequently.
- **Intercropping models** proactively adopted due to the availability of fenced areas that protected the cultivated crops from animal menace. Some of the inter-crops cultivated by farmers included turmeric, flax seeds, black grams, wheat and cucumber etc. This initiative also supported by adding additional income for the farmers.
- **17 WUA’s established and capacitated** water user associations (17 WUAs formed) on the constructed irrigation schemes with women’s participation and gender-equitable leadership. Further Water User Association Act and Water User Association Manual has been prepared.
- **GIS and MIS introduced and initiated** to practice timely monitoring of the ongoing activities within the clusters.

These have contributed to achieving the PRF Outcome – ‘Income and climate resilience of targeted households in the subtropical areas of Himachal Pradesh is improved’.

3.4. Procurement packages

The table below represents the various procurement packages under the Project

Table 11: Procurement packages under the Project

Package no.	Package Name	Contract value (INR)	Expenditure done (INR)	% Work completed	Status	Cost / ha (INR)
G1	Plant supplies	2,54,42,521	2,55,05,712	100%	Completed	
G2	Computer Software	26,50,792	26,50,792	100%	Completed	
G3	Agriculture Input	1,60,23,305	1,53,71,773	96%	Completed	80,117
G4	Farm Equipment's	69,88,299	69,86,417	100%	Completed	34,941
G5	Office Equipment's	85,41,392	56,41,112	66%	Ongoing till June 22	
G6	Vehicles	74,75,384	48,41,645	65%	Ongoing	
G7	IEC Materials	22,74,780	-	-	Under progress	
CW 1-4	Irrigation Scheme	15,51,33,501	13,56,70,309	87%	Under completion	7,75,667
CW 6	Drip irrigation and water storage	4,16,67,841	3,92,10,324	94%	Completed	2,08,339
CW-7	Field preparation and land levelling	5,29,09,086	5,28,42,912	100%	Completed	2,64,545
CW-8	Animal proof facing and installation	5,27,71,200	5,14,53,807	98%	Completed	2,63,856

Note: All the values in the above table are in INR

3.5. Farmer Satisfaction Survey

A farmer's survey of the PRF Clusters was conducted between 28th March 2022 to 30th March 2022 in all PRF Clusters based on structured survey questionnaire pertaining to 17 PRF pilot test activities implemented under the Project. Out of the total 17 PRF Clusters, beneficiaries from 13 PRF Clusters responded to the survey questionnaire. A total of 169 respondents from 13 Clusters participated in the beneficiary survey. The response from each respondent were further categorized from 1 - 5 based on level of satisfaction from very unsatisfied (1) to very satisfied (5), the analysis of which is presented below.

From the analysis of the survey findings, it was analyzed that the maximum 61 % farmers are very satisfied with the activity Awareness programme and consultations organized followed by 56.21% farmers were very satisfied with the growth /development of the plants in the Clusters. Only 2.96 % farmer beneficiaries were very satisfied with the processes of formation and working/ functioning of water user association in the Cluster (meetings, collection of User charges, information sharing etc.) followed by 4.14 % farmers beneficiaries who were very satisfied with quality of drip irrigation system installed in the Cluster.

About 17.16 % of beneficiaries were very unsatisfied with the processes of formation and working/ functioning of water user association in the Cluster (meetings, collection of User charges, information sharing etc.) followed by 15.38 % were very unsatisfied with quality of drip irrigation system installed in the Cluster.

About 37.87 % of beneficiaries were neutral on awareness grievance redressal committee formed in the Cluster followed by 27.81 % beneficiaries were neutral on awareness /training/support for disease and pest management by the DOH.

About 24.26 % of beneficiaries were unsatisfied with quality of drip irrigation system installed in the Cluster followed 20.71 % beneficiaries were unsatisfied with quality of fencing work in the field/Cluster.

About 58.58% of beneficiaries were satisfied with overall implementation of the Project followed by 29.59 % beneficiaries were very satisfied.

Figure 24: Analysis of farmer's satisfaction survey

PRF Producer's Satisfaction Level in HPSHIVA Project Implementation						
Producer Response Results in Percentage						
Nos	Questions	Very Unsatisfied	Unsatisfied	Neutral	Satisfied	Very Satisfied
Q1	Awareness Programs and Consultations organized by the Project	0.00	0.00	4.73	34.32	60.95
Q2	Regularity/Frequency of Meetings and Consultations with farmers conducted by Department of Horticulture	0.00	8.28	13.02	35.50	43.20
Q3	Quality of Field Preparation Work (leveling, Bed Preparation, Pit Digging etc.)	0.00	3.55	10.65	42.01	43.79
Q4	Quality of Fencing Work in Field/Cluster	1.78	20.71	14.20	28.99	34.32
Q5	Availability and Quality of Water for irrigation	13.02	7.10	18.93	37.28	23.67
Q6	Quality of Drip Irrigation System established in the cluster	15.38	24.26	24.26	31.95	4.14
Q7	Quality of Training/Facilitation for Training and Pruning of plants by DoH/Scientists	7.69	1.78	8.28	44.97	37.28
Q8	Quantity and Quality of Inputs (Fertilizers) provided by DoH under the project	0.59	2.37	7.69	48.52	40.83
Q9	Awareness/trainings/support for Disease & Pest management by DoH	1.78	1.78	27.81	39.64	28.99
Q10	Growth/Development of plants in the cluster	0.00	0.00	4.73	39.05	56.21
Q11	The processes of Formation and Working/functioning of CHPMA Group/Cooperative Society in the cluster (meetings, share collection, monthly savings, information sharing, etc.)	0.00	0.00	13.02	51.48	35.50
Q12	The processes of Formation and Working/functioning of Water User Association (WUA) in the cluster (meetings, collection of user charges, information sharing, etc.)	17.16	0.59	27.22	52.07	2.96
Q13	Information and knowledge shared by facilitators and other officials on Marketing of fruit Produce through CHPMA	0.00	0.00	14.20	46.15	39.64
Q14	Information and knowledge shared by facilitators and other officials on Post Harvest Management of the produce	0.00	1.18	31.36	41.42	26.04
Q15	Exposure Visits/ Training/Workshop/ Fair/ Buyer Seller Meet organized by DoH/CHPMA	7.69	1.78	26.63	34.91	28.99
Q16	Awareness of Grievance Redressal Committees formed in your Cluster	0.00	0.59	37.87	31.95	29.59
Q17	Over All implementation of HPSHIVA Project	0.00	0.00	11.83	58.58	29.59

3.6. Learnings from PRF

Table 12: Learnings from PRF

	What was adopted in the PRF	Observations on the functioning / performance	What is proposed to be changed in the Ensuing Loan
Beneficiaries	Development of horticulture Clusters and standardizing specifications for various subcomponents within such as land development, fencing, planting materials, micro irrigation systems etc.	Training and capacity building needs of farmers, CHPMAs, WUAs and line Departments.	- Finance plus element in the Project needs to include beneficiary farmers contribution in the form of cash, kind, and labor during the Cluster investment period. It has been observed that beneficiary farmers contribute more than 20% of the total investment cost for Cluster. - Convergence with various schemes such as MNREGA and PM Kusum Yojana.
Project Components	Planting: 2% extra plants were delivered by the suppliers than the ordered quantity without any	Mortality rate (please refer table 25 below) of about 5-7% which is similar to national average of mortality rate in horticulture.	Procure 105% of estimated quantity.

	What was adopted in the PRF	Observations on the functioning / performance	What is proposed to be changed in the Ensuing Loan
	additional cost.		
	Fencing: Fencing height of 7.15 feet.	Less cost effective • Fencing has been encircled and constructed on the personal property and Project area. • The enclosed Project area also served as a grassland and hence, conflicted with the exclusive Project use of land.	• The height of the fencing above ground level will be 6.95 feet. Additionally, the depth of the fencing below the ground will be 1.5 feet. The interlink chain will be till a height of 4 feet, and the wire at an additional height of 2.95 feet. 3 wires are to be fixed, with current flowing in each of them. A height of 0.5 feet will be left both above the interlink chain and from top, and the 3 wires will be fixed within the width of 1.95 feet. The specifications of the poles are such that the corner pole will be of 40 mm diameter, intermediate pole

	What was adopted in the PRF	Observations on the functioning performance /	What is proposed to be changed in the Ensuing Loan
			32 mm diameter, and supporting pole of 25 mm diameter. The pole to pole spacing will be 3 m and after a distance of every 15 m, there will be a corner pole. • The length of the fence should encircle the Project area only. • The Project land should not be having any other uses except horticulture plantation of the Project.
	Land Preparation Bed height of 0.25 mtrs.	Felling of trees for clearing and preparation of land for horticulture plantation.	• Bed height raised to 0.3 mtrs in consultation with the DOG and other Horticultural experts. • Due process of government regulations shall be followed.
	Plant Spacing as needed for high density plantation	Lack of adequate Spacing in case of High-Density Plantation.	• The final spacing will be decided based on the field observation and in consultation and discussion

	What was adopted in the PRF	Observations on the functioning / performance	What is proposed to be changed in the Ensuing Loan
	for different crops		with YS Parmar University and with various experts of CS03 and CS04 packages.
	Fertilizer: Provision of fertilizer was planned propositional to the Project area plantation.	Due to fluctuation, rise in the cost of fertilizer the application of fertilizer quantity was not in keeping with the design.	During PRF the prices of the fertilizer went up so a strategic plan to be created to address the situation.
	Package of Practices (PoPs): High Density plantation was done.	Quantities of various inputs such as fertilizers, pesticides etc., were not found adequate to meet the actual requirement.	(i) All the quantities are as per the PoPs developed by the Y. S. Parmar University
	Drip Irrigation – Single line was provided.	Single Drip line was less effective.	(ii) Double line of irrigation will be used which has proven to be more efficient. (iii) In FLD water was not getting distributed to all parts of the field and the farmers install solar pumping system to counter this issue. (iv) FLD is not part of PRF design and hence, ensuring adequate water

	What was adopted in the PRF	Observations on the functioning / performance	What is proposed to be changed in the Ensuing Loan
			distribution arrangement be acted upon the Project.
	Irrigation Design Task of irrigation design was done by two agencies one for drip irrigation and second for modular tank. Supply of water was only for the purpose of horticulture.	Design conflicts While laying the drip irrigation system water a can be used for intercropping only in the first 2 years before the commencement of horticulture produce. In the laying of pipes, it disturbed water being used for other agricultural use.	- The task will be done by a single agency to avoid any possible design conflict. The location of the modular tank shall also be optimized for efficient use of the resources. - The Irrigation designs for the Clusters have been put together in such a way that the source parameters, component of irrigation pipelines, layout and the drip irrigation within the entire Cluster area are drafted altogether.

	What was adopted in the PRF	Observations on the functioning / performance	What is proposed to be changed in the Ensuing Loan
			The laying of drip irrigation system should not disturb any water supply arrangement for horticulture/agriculture outside the Project area.
	Nursery Development Nurseries within the State were targeted but some of the planting material had to be procured from out of the State nurseries.	Current strength of nurseries in the State is not adequate to provide sufficient planting material for the Ensuing Loan Project.	6. An upgradation plan for approximately thirty (30) present nurseries has been prepared. A proposal of developing ten (10) new nurseries to facilitate the nursery requirements has been scheduled in the main Project.
Product ion and Marketi ng	Accessing the production and quality after 2 years of plantation.	7. Fruiting starts from the second year itself. The reason for this change could be High Density Plantation and proper management of field activities, such as drip irrigation,	9. It can be estimated that the production target of 30 MT per ha is achievable. Also, the fruits being produced are of high quality in the initial

	What was adopted in the PRF	Observations on the functioning / performance	What is proposed to be changed in the Ensuing Loan
		timely fertigation from the PoPs, pruning activities and various others. 8. During the second year, fruit production has been observed around 5 - 6 MT on an average per ha.	observations. The production and quality will finally be ascertained after 3rd / 4th year of plantation.
Project Procurement	• Packaging the procurements into appropriate lots and sizes was not done. • Limiting the procurement	• Most of the suppliers/vendors/contractors that expressed interest and participated in the PRF procurement tenders (mainly from the State and a few from other adjoining states) are normally part of the MSME sector with relatively small or modest financial turnovers. Maximum participation can be expected from this category of bidders. • Lack of suppliers for high quantity of Quality Planting Material.	• The procurement plan to be conducted shall be to be judiciously and appropriately packaged into Lots and Lot Sizes so as to achieve a reasonably acceptable level of competition and also to allow local and regional bidders to effectively participate in the business opportunities that would be thrown up through the procurement process.

	What was adopted in the PRF	Observations on the functioning performance /	What is proposed to be changed in the Ensuing Loan
	ent process for Quality Planting Material to only National suppliers.		Global Request for Expression of Interest had been issued under the PRF and assessment is currently being made on the projected availability of quality planting material, based on which the procurement and contracting strategy for the Ensuing Loan Project will be finalized.
Project Management and Contract Management	- CHPMAs were formed in each Cluster basis. 16 Irrigation schemes were developed for 17 Clusters.	- The arrangement was not found suitable or viable for effective management of activities and statutory compliances. - Lack of management.	- CHPMAs will be formed for a group of Clusters. - Clusters have been grouped as per irrigation scheme for effective and

	What was adopted in the PRF	Observations on the functioning / performance	What is proposed to be changed in the Ensuing Loan
	No IEC Expert for communication and extension services.	Communication and extension services were found inadequate	efficient management IEC Specialist has been recruited to propose a communication strategy and take care of all IEC requirements. The activities of IEC Component will be further scaled up in Ensuing Loan Project. A communication firm is also proposed to be engaged to producing various creatives as per communication strategy / plan, brochures / flyers/ leaflets, print campaign, radio spots, informational films, farmers' training videos, etc.
Project Cost	For output 1 which	During the irrigation feasibility analysis of the schemes, it	Increase in the overall Project Costing.

	What was adopted in the PRF	Observations on the functioning / performance	What is proposed to be changed in the Ensuing Loan
Estimates	consist of Irrigation design, it was envisaged to have 100 schemes. • Older Drip Irrigation Design. • No use of structural steel in the animal proof solar fencing.	was observed that more than 200 schemes need to be developed out of which approximately 100 new schemes are to be build. • Lack of proper water supply to each plant. • Not that efficient.	• Drip irrigation design has been modified with additional accessories to ensure proper supply of water to every plant. Further double drip line for plant and drip line for inter-cropping increased the overall cost. • The design of the animal proof solar fencing has been modified with additional support structure. Due to which the quantity has increased and additionally the cost of structural

	What was adopted in the PRF	Observations on the functioning performance /	What is proposed to be changed in the Ensuing Loan
			steel has increased in recent past which has increased the overall cost of fencing.

Table 13: Plant Mortality in the PRF Clusters

Plant Mortality in the PRF Clusters				
Plant	Variety	Planted Quantity	Mortality	% Mortality
Citrus	Jaffa	5828	323	5.54
Citrus	Valencia	16479	658	3.99
Citrus	Blood Red	21550	1418	6.58
Citrus	Hamlin	2597	119	4.58
Citrus	Westin	6817	115	1.69
Citrus	Natal	2719	0	0.00
Citrus	Pera	8705	293	3.37
Citrus	Mosambi	347	10	2.88
Guava	Sweta	45334	3112	6.86
Guava	Lalit	54328	9070	16.69*
Guava	VNR Bihi	36911	2699	7.31
Litchi	Dehradun	25169	4282	17.01*
Litchi	Calcuttia	9932	16	0.16
Pomegranate	Bhagwa	17831	1320	7.40
	Total	254547	23435	9.21

3.7. Refined design for Ensuing Main Project

The outcome and impact of the Project will be strengthened by refining the design parameters as described in Section 3.7 above. The proposed assignment has three closely linked outputs where the following innovative steps and measures have been adopted.

Table 14: Outputs for Ensuing Main Project

Outputs	Innovative steps and measures
Output 1: Irrigated area expanded and sustainably operated	• Unlike the existing scheme wherein the land was identified by the farmer themselves, in this Project DOH and JSV together identified the land which is suitable for growing sub-tropical horticulture fruit plants along with ensuring water availability in the area. • Ranking system methodology was designed and adopted by DOH for selection of Clusters which will ensure future sustainability of farmers and the Project. • In order to promote the women participation, various provisions have been made in the Project. • For the Project Cluster minimum 10 ha of contiguous land has been selected so as to achieve economies of scale in pre-production, production and post-harvest management.
Output 2: Climate resilient subtropical horticultural production systems adopted	• Provision for intercropping, beekeeping, etc. have been incorporated to meet the farmer's requirement in initial years of plantation. • To ensure crop water availability, the water storage tanks are being designed for each Cluster by Jal Shakti Vibhag (JSV) and DOH. Jal Shakti Vibhag (JSV) is responsible for providing the water from the water source to the storage tank near the Cluster; on the other hand, DOH is responsible for providing water from Jal Shakti Vibhag (JSV) storage tanks to the Clusters, creating water storage facility within Cluster, as per requirement and then distributing to the individual plants via drip irrigation. • To maintain the uniformity in plantation, pre-designed plantation layout which include plant spacing, drip laying, mulching, etc. have been adopted in Clusters based on its topography. • In order to protect the land and the produce from various stray and wild animals, animal proof composite solar fencing is being installed around Cluster perimeter.

Outputs	Innovative steps and measures
	• Using Civil 3D Software for land Surveys for the complete Project. GIS application in identification and mapping of Clusters for designing Ensuing Loan areas in the State. • Details irrigation feasibility scheme for each Cluster and mapping group of Clusters with an irrigation scheme. Further classification of scheme to functional, non-functional and new scheme to detail out the requirement of each scheme with costing. • Using of Software i.e., Startpro Water Gems and epanet for designing of irrigation structure and water supply designs. Use of drone in field survey. • To create the sense of ownership, a nominal contribution will be required from the farmer's end.
Output 3: Market access for subtropical horticulture farmers developed	• For collective management of Cluster, a cooperative society Community Horticulture Production and Marketing Associations (CHPMA) is being formed with Cluster farmers which will make sure collective agri-input procurements, farm day-to-day operations and management. • A provision of revolving fund has been created that will be disbursed to the Clusters to cater the post-harvest expenditure, to avoid distress sales. • An apex body will be created under the Company's Act 2013 with CPMA as its member for overall post-harvest management, processing, marketing, branding and sales of produce. • A Water User Association (WUA) is being formed to keep check on proper availability of water to the Clusters from the designated irrigation scheme. It will be responsibility of WUA for collection of water usage charges for operation and maintenance of the irrigation schemes. • To meet the planting material requirement in future, various nurseries will be developed.

3.8. Grievance Redressal Mechanism (GRM)

The GRM is accessible to aggrieved farmers at any time, prior or post involvement with the Project GRM, which will receive, evaluate and facilitate the resolution of impacted people's feedback, including concerns, complaints and grievances about the social and environmental performance at the level of the Project. The GRM will aim to provide a time-bound and transparent mechanism to voice suggestions and appreciations and to resolve social and environmental concerns linked to the Project. The Project specific GRM is not intended to bypass the government's own redress process, rather it is intended to address stakeholders' concerns and complaints promptly, making it readily accessible to all segments of the community, and is scaled to the risks and impacts of the project. Complainant may access the formal legal system at any time.

The project stakeholders have the

- Right to information.
- Right to seek redressal against inappropriate intervention.
- Right to ensure that the project is free of fraud, corruption and coercion.

In case of any deviation, the stakeholders have the right to register complaints and DOH is bound to redress them and resolve these at the earliest.

The Government has issued gazette notification for formation of Grievance Redressal Committees for all the levels. The GRM will continue to function throughout the project life. A Govt. portal titled E-Samadhan is also available to lodge complaints.

All out measures will be taken to resolve concerns / issues / complaints / grievances on the spot or within two days at the local level where it is raised. The first level of feedback will be at the WUA/CHPMA level which should be sorted out within a maximum of 2 days. Beyond this it will be handled at the district level within a maximum of 15 days and if not resolved then will be handled at PMU level and resolved within a maximum of 60 days.

3.9. Significant Milestones

The Hon'ble Prime Minister of India, Shri Narendra Modi visited the Horticulture Exhibition in Mandi, Himachal on 27th December 2021. HPSHIVA Horticulture Cluster Development Model was showcased and appreciated by the Hon'ble PM. It was suggested to focus upon the Value Chain Development and Marketing component for Horticulture crops.

Figure 25: Honorable PM Shri Narendra Modi ji visiting HPSHIVA exhibition at



Foundation Stone for the Crop Plantation was laid by the Hon'ble Chief Minister on 25 July 21.

Figure 26: Laying of Foundation stone by Honorable CM Shri Jai Ram Thakur ji



Plantation drives have been promoted by various Center and State Ministers, Members of Legislative Assembly and other Public Representatives.

Figure 27: Plantation activities by Ministers, MLAs & Public Representatives



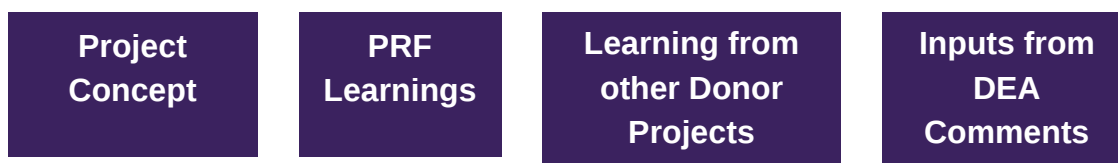
3.10. Glimpse of Project Activities during PRF



4. Detailed Project Design

4.1. Introduction

The detailed project design and the basis is presented this chapter. Inputs from the following has been taken to conduct the detailed designing.



The project concept and the PRF learnings are discussed in chapters 2 and 3 respectively.

Learnings from other donor projects

Project 1: Japan International Cooperation Agency (JICA) HPCDP-1: The project had few major takeaways, that are as follows:

Water resources were evaluated in the preliminary assessment from verification of observation discharged data and sufficiency of observation discharge data for sub-project demand. The validity was verified after measuring the catchment area over the intake point with GIS and calculating the specific discharge based on observed discharge data and catchment area. Regarding sufficiency of the observed data, water demand in the observation month was projected through assumption of a typical cropping plan based on DPR, and water adequacy is assessed using estimated demand and observation discharge data. The result of the assessment indicates that a fresh measurement is required before the final selection of the project for the subprojects, where there is a possibility of over- or under-measured in the observation data.

Samples survey was conducted through the interview survey to farmers and site inspection in each subproject in 30 areas covering whole 12 districts. The survey has confirmed eligibility of the proposed infrastructure improvement including 1) minor irrigation, 2) micro irrigation, 3) catchment area treatment, 4) solar pump, 5) farm access road, and 6) solar fencing.

Project 2: World Bank funded Himachal Pradesh Horticulture Development Project (HPHDP): Although HPHDP does not handle vegetables directly in its activities, some activities which are closely related to HPCDP II. Since improvement of market related information and intelligence mechanism, which is one of the important factors in the HPCDP II, is fundamentally covered in HPHDP, the mechanism established in HPHDP shall be adopted in HPCDP II. Promotion of agri-enterprises and development of market are common objectives in both HPHDP and HPCDP II even though targeting produces might be different. Therefore, strategies and lessons learnt

through the experiences of HPHDP on the activities including market development and FPO formation shall be applied in HPCDP II. Moreover, collaboration and referral to the HPHDP shall be necessary where horticulture production is operated within the target CCA of HPCDP II.

Project 3: World Bank funded Integrated Project for Source Sustainability and Climate Resilient Rain-fed Agriculture in Himachal: The project addresses several elements of outstanding agendas in the realm of NRM, forestry, and agriculture. The broad area of interventions includes (i) promotion of participatory and sustainable land and water management (SLWM) through financing the planning and implementation of upstream investments in selected micro-catchments, (ii) improved agricultural productivity and value addition, (iii) institutional capacity building for integrated watershed management, and (iv) project management. The project incorporates lessons learnt from other watershed development projects in India by incorporating improved monitoring to inform the location and types of watershed development investments, increased financing, and increased community engagement in the planning and implementation of watershed development interventions.

Inputs from DEA comments

The comments from DEA have also been taken into account during the project design. Following are the action taken on DEA comments.

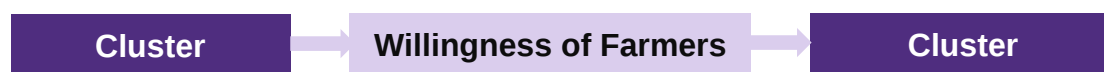
Table 15: Action taken on comments of DEA

#	Department	Comments	Action Taken
1	NITI Aayog (Agriculture Vertical)	- The project is deficient in assessing the intercropping potential of the new orchards to ensure additional earning of farmers. - Development of quality planting materials a nursery may be established.	- The activity of intercropping has been started in the PRF Clusters. The farmers have been encouraged to practice intercropping post consultations and crop finalization held with DOH and university. Trainings for the same have also being imparted. - Nursery Development Plan has been developed to ensure quality planting materials within the State. Upgradation of existing 30 public sector nurseries have been planned along with development of 10 new crop specific nurseries. Detailed report at Annexure 2.3.
2	Ministry of Agriculture & Farmers Welfare, (Horticulture Division)	To ensure that project should be complimentary to the activities of approved annual action plan of MIDH with proper strategy without any duplication of activities from ongoing programmes.	- Front line demonstration (FLD) under MIDH scheme has been established in an area of 1 ha each with 200 FLDs. This will be further scaled up in convergence with HPSHIVA project covering an area of 2,000 ha or more. - Convergence from MIDH scheme has been done for the Value Chain Infrastructure components. - The components have been designed in convergence with the existing Central and State schemes and considered in project cost estimates.

#	Department	Comments	Action Taken
3	NITI Aayog	To promote Beekeeping in the Sub Tropical areas of the State along with Cluster Development.	- Beekeeping has been considered within the Cluster based on the suitable bee flora and necessary steps have been taken in PRF for identification of bee floras and adopt bee keeping for crop pollination requirement and additional income. - Provision for training and infrastructure setup has been initiated in convergence with the existing center KVIC and NBHM and State govt. schemes. Detailed report at Annexure 2.5.
4	Ministry of Agriculture & Farmers Welfare, (Horticulture Division)	To promote Pecan – Nut along with the other sub-tropical plants considering its advantageous adaptability.	Pecannut has been considered in ensuing project and the crop modelling has shown it as a potential crop. Hence, focus on its planation is being done by identification of exclusive Clusters.
5	NITI Aayog (WR & LR Division)	10. Create irrigation facility at community level. 11. Construct irrigation schemes through innovative technologies. 12. Improving water efficiency.	13. For every individual Cluster i.e., at community level, specific requirements of water for the crops have been calculated and considered within the design of irrigation facilities. 14. Feasibility analysis has been carried out followed by irrigation designs for each Cluster by the use of sustainable and innovative technologies. Drip Irrigation technology has been adopted to improve the water efficiency.

4.2. Cluster and Beneficiary Selection

The below diagram depicts the step-by-step process of Cluster and beneficiary selection:



4.2.1. Cluster Selection Criteria

Based on the learning, the project envisages a Cluster approach for adoption of high-density plantation technologies developed globally with active involvement of the community. The approach will facilitate peer learning and skills acquisition in raising of high-density orchards with collective responsibility. Hence the design of Cluster was done considering the technical parameters and financial viability. The detailed selection criteria for Clusters adopted for the project is summarized below:

Cluster Selection Criteria - General

- **Minimum 10 ha of private land with unit size of minimum 5 ha.** each, in case of more than one unit and in near vicinity for combined operation.
- **At least ten (10) no.** of household farmers involved in the Cluster. Out of the total number of farmers in every Cluster, 80% are small and marginal growers.
- **Presence of a perennial water source** for development of new irrigation schemes/ renovation of existing functional / defunct schemes of Jal Shakti Vibhag or any other Department. Land should not be in flood line.
- **Willingness of growers to participate.**
- **Future scope of expansion of plantation (preferred).**
- **Easy accessibility.**
- **Proper water drainage & no stagnation of water.**
- **Free of unwanted trees, bushes, weeds,** etc. before the start of project activities.
- Beneficiaries should be voluntarily **ready to organize themselves in CHPMAs and WUAs.**
- **Soil status, soil testing, aspect, altitude etc.** should be considered.
- **Preference to Small and Marginal Farmers with gender equality.**
- Caretaking of own plants/ plantation/ other infrastructure etc. should be mandatory for owners.
- Preference be given to small and marginal farmers with gender equality.
- Selection of fruit crops should be on basis of recommendations of technical advisory committee based on feasibility report in consultation with beneficiary farmers.

Cluster Selection Criteria – Technical Factors

- Selection of site having predominated fruit growing area, with natural slope and drainage.
- **Climate:** - Night & Day temperature, average rainfall, wind, light, atmosphere, hail, frost etc. favoring the identified fruit crops.
- **Soil:** - best is well drained, sandy loam, soil type, depth, with good water table and fertility status.
- Clearing and levelling of land/ terrace to be made along contours in hills.
- **Irrigation source:** - Permanent water source, installation of tanks and possibility of surface water harvesting must be explored.
- **Fencing:** - As per status of menace of wild animals/ stray cattle/ monkeys etc.
- **Wind breaks:** - Availability of natural wind breaks.
- Connectivity with roads, paths, and availability of irrigation and drainage channels.
- Suitability/willingness for adoption of one Cluster one fruit.

Cluster Selection Criteria – Irrigational Factors

- By the end of Project meeting the requirements for:
 - **60 % of schemes to be existing/rehabilitation works.**
 - An existing high-head pump scheme that can demonstrate the above components.
 - An existing weir or riverbed infiltration water source and gravity supply and distribution system.
 - A small dam and gravity supply piped scheme.
 - A system with catchment management interventions, tank storage and gravity supply.
 - Free intake on larger river and low head, solar powered pumping.
 - **Approximately 45 % of irrigation schemes** should be gravity fed, **30 % low lift and only 25 % other schemes including high-lift schemes.**
- Opportunities for innovation in system design and possibility for additional water storage.
- Satisfactory analysis of the hydrology of the selected schemes, ensuring adequate and reliable supply for the scheme taking account of climate change impacts and downstream water commitments.
- Satisfactory result from watershed risks and vulnerabilities assessment. As well as looking upstream, each scheme should ascertain the potential for the proposed scheme to negatively impact downstream communities, dry season low flows and freshwater flora and fauna.

Based on the above criteria, DOH and JSV had jointly identified more than 450 clusters with approximate area of 6,000 ha of land during the implementation of PRF. A Cluster ranking system was also developed to prioritize the clusters for further detailed designing from the PRF financing.

4.2.2. Willingness of farmers

Once the Clusters have been identified and priority has been finalized based on ranking, the next task is to onboard farmers for the project. For this Cluster wise farmer groups will be created and termed as Community Horticulture Production and Marketing Association (CHPMA). Further the group of Clusters in near vicinity has been registered under Cooperative Act and termed as CHPMA Cooperative Group. This is being done to enable collective procurement, maintenance, harvesting and to ensure quality is maintained.

To encourage farmers to participate and be part of the project, DOH has held meetings to publicize the benefits of the project. Also, in the PRF, a consultancy agency AFC Ltd. was engaged under CS08 package for assistance in formation of CHPMA in which the agency deputed their team to guide farmers in the registration with CHPMA. The detailed process followed by PMU, Project Implementation Unit (PIU) and District Implementation Units (DIU) / Block Implementation unit (BIU) is attached at [Annexure 2.7.](#)

The following were done for finally capturing the willingness of farmers:

- Undertaken stakeholder consultation at panchayat, block and district level.
- Motivate farmers by establishment of Front-Line Demonstration at more than 200 Clusters.
- Before the commencement of topography and baseline survey, all Cluster representatives were contacted and list of farmers in each Cluster was prepared and validated with CHPMA and DOH/JSV representatives.
- During the topography survey farmers were asked to mark out the area of their land that would be in the Cluster.
- Finally, MOUs with farmers are being signed with details of activities of CHPMA, farmer detail and land area contributes for Cluster and their role in the CHPMA.

4.2.3. Cluster finalization

Under the CS09 package of PRF, Topography survey (with DGPS and drone) of each identified Cluster was conducted for detailed designing. During the survey farmers by themselves demarked their land area voluntarily and also initiated the process of signing the MOU.

A total of **320 Clusters** with **4,722 ha** of area were mapped with detailed coordinates, area, contour map and permanent benchmarks.

The block wise detail of Cluster surveyed is mentioned below:

Table 16: Clusters surveyed during topography survey

District	Block	Clusters	Cluster Area (ha)
Bilaspur	Bilaspur	49	754.59
	Ghumarwin	24	267.66
	Jhandutta	10	186.99
	Sadar-Bilaspur	10	174.39
	Swarghat	5	125.56
Hamirpur	Hamirpur	51	711.55
	Bamsan	2	26.16
	Bhoranj	7	161.17
	Bijhar	8	84.55
	Hamirpur	10	150.68
	Nadaun	17	214.32
	Sujanpur	7	74.67
Kangra	Kangra	50	1089.92
	Bajinath	8	84.60
	Bhawarna	8	199.54
	Dehra	7	487.92
	Lambagaon	6	48.91
	Panchrukhi	13	125.61
	Pragpur	2	23.48
	Sullah	6	119.87
Mandi	Mandi	103	1116.90
	Chauntara	6	114.77
	Dharampur	63	604.16
	Drang	4	30.76
	Gohar/Balh	10	139.73
	Gopalpur	14	147.86
	Sadar	2	25.06
	Sundernagar	4	54.56
Sirmour	Sirmour	24	319.07
	Nahan	10	113.91
	Paonta Sahib	14	205.16
Solan	Solan	24	361.51
	Kunihar	13	168.69
	Nalagarh	11	192.82
Una	Una	19	368.37
	Bangana	19	368.37
	Grand Total	320	4721.92

For these surveyed area, further detailed output wise designing has been done to finalize the 4,000-ha area which has been under the PRF financing.

Further for the balance 2,000 ha area clusters have been identified block wise and the detailed designing will be done by the ensuing loan financing. These Clusters will be in vicinity to the already build irrigation scheme for 4,000 ha area so as to efficiently utilize the existing irrigation infrastructure and to lower the overall project cost. The detail of 2,000 ha area is mentioned below:

Sr. No.	Name of District	Name of Block	Area (ha)
1.	Bilaspur	Swarghat	75
		Jhanduta	60
		Ghumarwin	80
		Sadar	75
Sub Total		300	
2.	Hamirpur	Hamirpur	45
		Bhoranj	50
		Sunjanpur	45
		Bamsan	40
		Bijhar	55
		Nadaun	65
Sub Total		300	
3.	Kangra	Bhawarna	55
		Bajjnath	60
		Panchrukhi	65
		Sulah	65
		Dehra	80
		Pragpur	75
		Lambagaon	50
Sub Total		450	
4.	Mandi	Chauntra	70
		Gopalpur	95
		Dharampur	200
		Sundernagar	100
		Balh/ Gohar	70
		Sadar/Drang	65
Sub Total		600	
5.	Solan	Kunihar	75
		Nalagarh	75
Sub Total		150	
6.	Sirmour	Nahan	75
		Ponta Sahib	75
Sub Total		150	
7.	Una	Bangana/Una	50
Sub Total		50	
Grand Total		2000	

The subsequent section will provide output wise detailed design consideration for the project.

4.3. Output 1

4.3.1. Design of Irrigation Schemes

The detailed design has been done for the area of land for which topography survey was conducted. In this irrigation scheme feasibility analysis, grouping of Clusters based on schemes and detailed designing of each Cluster has been done.

4.3.1.1. Irrigation Feasibility Analysis

The basic details of the Clusters such as name, latitude, longitude, area, source of water, name of LIS scheme etc. was gathered for the surveyed land. Stakeholder consultations with the farmers and the officials of JSV was done as part of the due diligence. The team of engineers from the CS09 package of the PRF from the CS09 package of the PRF visited the LRF schemes, Clusters and collected existing data of for the existing infrastructure in consultation with the JSV officials. A checklist was prepared for the collection of data related to the existing schemes. The sample data collected for few schemes are attached at [Annexure 3.1](#) in Irrigation design feasibility analysis Various meetings were held with the officials of DOH and JSV in all the seven districts for mapping of Clusters. In the meeting source of water/LIS scheme for each of the Cluster was identified by the JSV in assistance. The infrastructure components which need replacement /repair were validated during the site visit and necessary photographs of the same were taken.

4.3.1.2. Hydrological study of source of water for scheme

Data required for estimation of sustainable or 75% dependable yield included different data components such as:

- I. Hydro-meteorological data extending to recent 30 years
 - a. Observed rainfall stations near and within the Cluster area.
 - b. Observed discharges at the gauging stations on different khads.
 - c. Evaporation data that is representative of the Cluster area.
- II. Existing and future water demand along with the proposed cropping pattern / plant pattern to be grown in each Cluster.
- III. Map showing catchment area of the khad in case water is being drawn from surface water in the respective khad.
- IV. Results of pumping test carried out to determine the yield from open well or bore well or tube well.
- V. Area covered under each Cluster.

The above list was reviewed, and the following data has been collected / supplied for use in the present work:

- Location of each Cluster – both latitude and longitude.
- Daily rainfall data at more than 50 stations located in 7 districts of the State. Out of these details of data availability (with gaps) for four districts viz Bilaspur, Hamirpur, Kangra and Mandi Districts.
- The drainage system with stream order and contours were generated from the Cartosat-1 Digital Elevation Model (DEM) information available on the Bhuvan portal of NRSC.
- Checklist for LIS schemes containing information like pumping capacity and number of hours of pumping, details of lift irrigation scheme like size and number of tanks, pumping head with number of stages, etc.
- Source of water at each Cluster like surface water from khad, ground water through open well / tubewell / bore well.

The catchment area at source was worked out based on stream flow data of the area extracted from Cartostrat. The 75% dependable yield at source was worked out based on catchment area and rainfall data. Water demand upstream and downstream of the source was collected and excess/deficit was worked out. Based on the results, suitable storage is proposed.

Sample hydrological study of Bakarti Cluster in Dharampur block Mandi district is presented in [Annexure 3.1](#).

Annual yield from 75% dependable rainfall is estimated as 13.51 mm³. Adequacy of the yield estimated on monthly time steps and assumed data on demands indicate adequacy of source to meet these demands is carried out on monthly steps. The results indicate shortage of 0.018 mm³ in month of April, thus necessity to create the storage structure with a capacity of 0.03 mm³ to account for losses due to evaporation, seepage, sedimentation, etc. At present, water is extracted from percolation well by extracting subsurface water which needs to be ascertained especially during lean period for its adequacy. The work can be carried out in a period of about one month after receipt of data on extraction over a sufficiently long time period.

Similar hydrological study will be carried out for all the Clusters and based on the result of the study suitable arrangement for deficit in water demand if any will be proposed.

4.3.1.3. Grouping of Clusters

The identified Clusters have been planned to be irrigated with the existing irrigation scheme or by construction of new schemes. As these schemes have been build or will be built to cater a larger area, the overall strategy adopted was to group the Clusters which could be irrigated with a single irrigation

scheme. For this joint visit of consultants, expert, Department representatives of DOH and JSV and farmers was conducted to map the Clusters with the nearest irrigation scheme. Also, optimal pipeline route and storage tanks were identified during this exercise.

Once the group of Clusters were identified the existing irrigation infrastructure was analyzed and the scheme was divided into three categories i.e., Functional, Non-functional and new schemes. For these schemes augmentation in the existing system was worked out and the detail of each scheme is as follows:

4.3.1.4. Cluster Classification as per Irrigation Schemes

Typical components of functional, non-functional and new schemes are as follows:

Functional Schemes	Functional schemes are those which are in working condition and in which water has reached up to delivery tank and some minor repair/ replacement of infrastructure components are envisaged • Main delivery tank (MDT) near cluster – The capacity of the tank was decided based on daily water requirement for each plant within the cluster during peak period. MDT are in RCC M30 grade concrete with inlet, outlet, overflow pipe. • Pipeline from Main delivery tank to cluster – The pipelines from MDT to cluster are of GI or HDPE material. • Valves on the rising main/gravity main feeding water to MDT – For controlling the flow into the tank
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The detailed standard design for a functional scheme of Upper Beri Cluster has been attached at [Annexure 3.2](#).

The **existing LIS Beri** scheme consist of a 1 W + 1 S, 20 HP submersible pump for pumping water from Beas River to collection tank. From collection tank water is transferred to circular sump for where it is pumped with the help of 1 W +1 S, 75 HP, HSC pumps to distribution chamber through 150mm dia GI rising main. From distribution chamber water is transferred to fields by gravity or to existing circular tank.

Proposed scheme

There is an existing water supply scheme located besides upper beri scheme. It is understood that this scheme is not in use and hence It is proposed to use the components such as collection tank, sedimentation tank of this water supply scheme in the proposed LIS Beri scheme. Flow diagram of the proposed upper beri scheme is presented below:

Figure 28: Schematic flow diagram of Upper Beri scheme

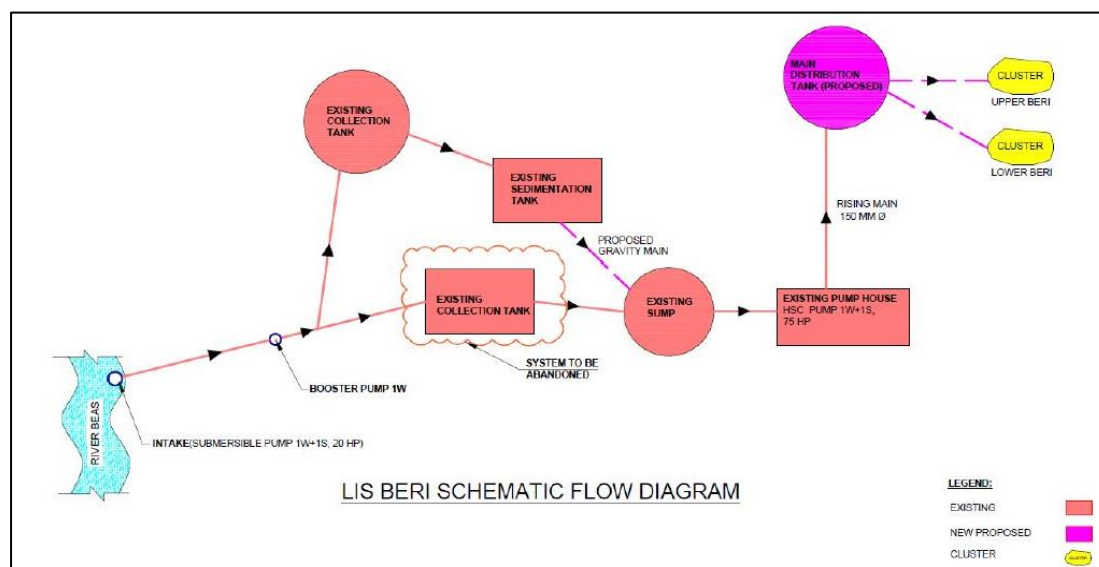
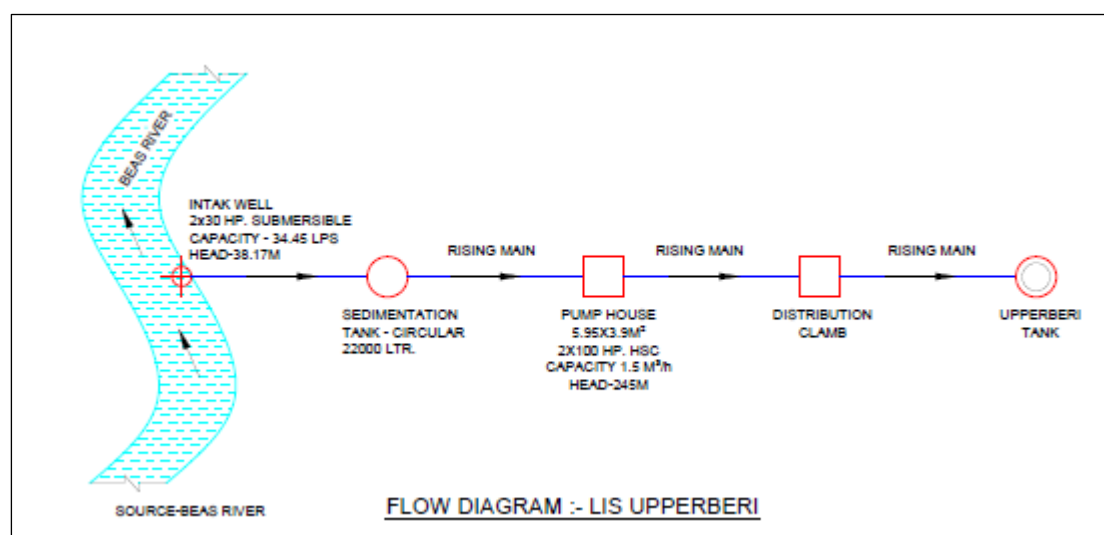


Figure 29 Flow Diagram of existing LIS scheme



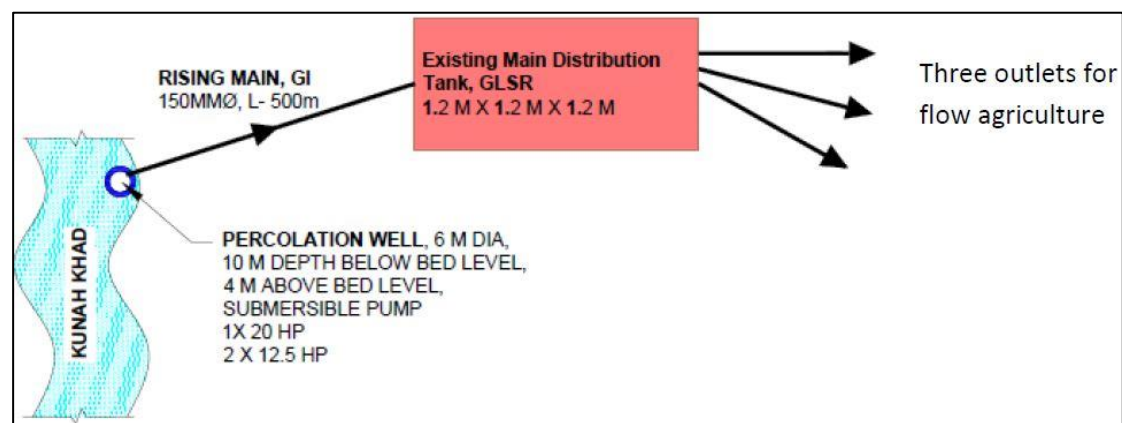
Non-Functional Scheme	Non-functional schemes are not in working condition and some of the components such as pumps, repair/rehabilitation/augmentation of source, rising main replacement is required • Repair /replacement of pumping machinery - The pumping machinery details such as duty point of pump (discharge, head) required for making the scheme functional/working have been worked out and cost for the same is calculated. • Repair/replacement of pipeline – The details of existing rising main/gravity main such as material, diameter etc. to be replaced are finalized and cost for the same have been worked out. • Replacement of valves, flow meters etc. – The details of valves/flow meter on the delivery side of pumping main are collected and cost of the same has worked out. • Augmentation of source of water such as providing check dam, construction of dyke, etc. – For existing scheme based on the hydrological study if storage is required, a check dam is proposed on the khad/stream. Similarly for the proposed scheme at source location, if storage is required a check dam is proposed and cost of the same has been worked. Check dam is normally constructed in plum concrete and suitable energy dissipation arrangement on downstream side is proposed.
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The detailed standard design for a non-functional scheme of Bakarti Cluster has been attached at [Annexure 3.3](#).

The existing LIS Bakarti scheme consist of a percolation well in Kunah khad. From this percolation well water is pumped through 150mm dia GI rising main to existing distribution tank with the help of 1 no of 20 HP pump and 2 nos of 12.5 HP pump. From existing distribution tank water is transferred through three nos of outlets to agricultural fields.

Flow diagram of existing LIS Bakarti scheme is as below:

Figure 30: Flow diagram of LIS Bakarti scheme

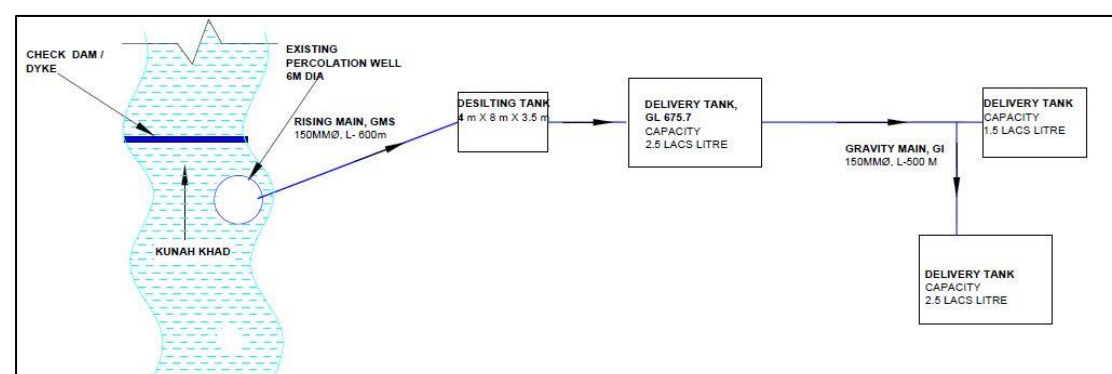


Proposed scheme:

Based on the hydrological study, there is a deficit in water requirement in the month of April. In order to satisfy the water requirement of plants, a cheque dam cum/dyke is proposed to be constructed across Kunah khad downstream of existing percolation well. One new submersible pump is proposed in the percolation well. Existing rising main is used which will discharge water into proposed desilting tank. From Desilting tank, water will be transferred by gravity to the Cluster tank located at highest elevation and from there it will be transferred to the remaining two Cluster tanks.

Flow diagram of the proposed scheme is as below:

Figure 31: Flow diagram of proposed scheme for Bakarti Cluster



New Schemes

Entire irrigation system needs to be planned and designed from source to cluster tank near the cluster. Due to addition of cluster/'s area on the existing scheme, there will be additional water requirement on the proposed scheme. The sustainability of source for this additional water requirement was also checked. In order to validate sustainability of the source hydrological study of the source of water was carried out

Check dam - As per the hydrological study if the storage is required on the khad/stream, a check dam of suitable height for storage of required quantity of water has been proposed. Check dam is in plum concrete with energy dissipation arrangement.

Percolation well, Infiltration well – For tapping subsurface water especially during lean period percolation well, infiltration wells have been proposed.

Raw water Pump house, rising main – For lifting of water from river/ khad/stream submersible pumps have been proposed. Based on discharge, head, length etc. economical diameter of the rising main has been worked out. For rising main Galvanised Mild Steel pipes have been proposed.

Sedimentation tank – For horticulture DRIP irrigation system has been proposed. In order that Drippers shall not clog due to silt/sediment particles in the water, same needs to be removed. In order to achieve this, sedimentation tank of suitable size has been proposed. Sedimentation tank is in proposed to be constructed in concrete.

Sump and clear water pump house -The clear water from sedimentation tank is stored into sump. From sump water is pumped with the help of centrifugal/HSC pump to the main delivery tank.

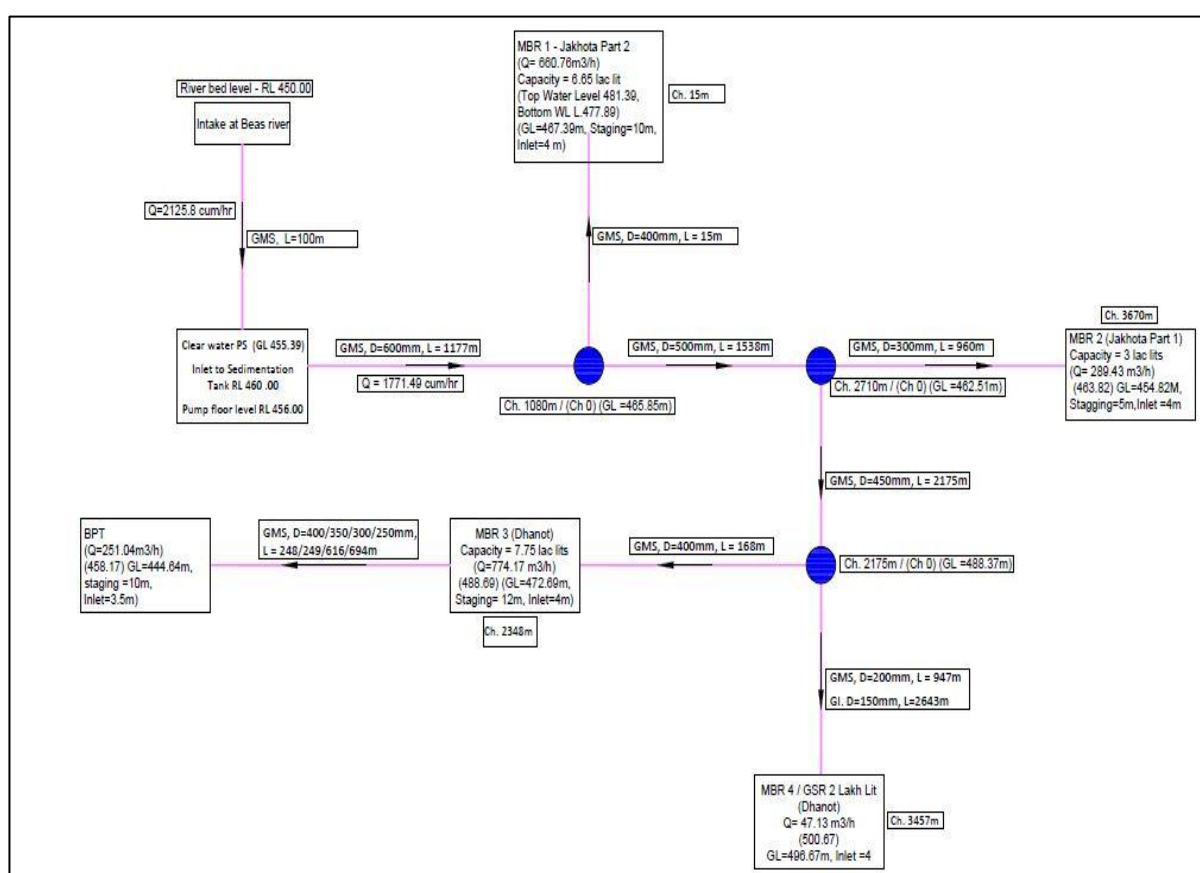
Gravity main – For Gravity main upto 150 mm dia are in GI have been proposed and above 150 mm dia GMS pipes are proposed.

The detailed standard design for a new scheme of Jakhota & Dhanot Cluster has been attached at [Annexure 3.4](#).

Total area of Cluster is 408 ha. It is proposed to lift water from Beas river which is flowing adjacent to the Cluster. Raw water is lifted from beas river to the sedimentation tank. After sedimentation tank water is transferred to the sump from where it is pumped to Master balancing reservoirs. From MBR, it is conveyed to the individual Cluster tanks.

Flow diagram of the scheme is as follows:

Figure 32: Flow diagram of scheme of Jakhota & Dhanot Cluster



The Clusters were classified based on the mapped irrigation scheme for the initial 4,000 ha area under the PRF financing. Further the Cluster wise detailed engineering from water source to the drip irrigation was done under a single contract to ensure design consistency. The detailed irrigation scheme was classification of Clusters is mentioned below:

Table 17: Classification of Cluster as per Irrigation Scheme

#	District	Block	No. of Clusters	District wise CCA (ha)	Block wise CCA (ha)	Irrigation Schemes	Functiona I	Non- Functional	New
							Nos.	Nos.	Nos.
1	Solan	Kunihar	8	276.73	122.46	13	0	0	13
		Nalagarh	5		154.27				
2	Sirmour	Nahan	10	208.25	113.96	14	0	0	14
		Ponta Sahib	6		94.29				
3	Hamirpur	Bamsan	2	593.52	26.19	34	1	13	20
		Bhoranj	6		128.92				
		Bijhar	5		64.53				
		Hamirpur	5		82.41				
		Nadaun	18		234.97				
		Sujanpur	6		56.50				
4	Bilaspur	Ghumarwin	19	645.50	248.27	25	4	5	16
		Jhandutta	8		191.98				
		Sadar-Bilaspur	7		134.93				
		Swarghat	3		70.32				
5	Mandi	Chauntara	6	1085.65	101.29	37	24	1	12
		Dharampur	63		611.19				
		Drang	3		39.38				
		Gohar/Balh	7		137.76				
		Gopalpur	14		141.47				
		Sundarnagar	4		54.56				
6	Kangra	Bajjnath	5	938.60	66.15	32	4	0	28
		Bhawarna	7		106.80				
		Dehra	5		489.50				
		Lambagoan	6		48.94				
		Panchrukhi	9		85.00				
		Pragpur	2		22.30				
		Sullah	6		119.90				
7	Una	Bangana	12	251.75	251.75	7	2	1	4
Total		28	257	4000	4000	162	35	20	107

4.3.1.5. Design parameters for irrigation system components

The major standard design parameters for the irrigation system components have been listed below:

Intake



Location Consideration

Intake shall be located where sufficient quantity of water remains available in all seasons.

During floods in rivers, flood waters should not be concentrated towards the intake.

It shall not be located on the curve of the river. If there is no alternative, then intake should be located on the outer bank and not on the inner bank.

Heavy water currents shall not strike the intake directly, which can be achieved by suitably locating the proposed intake.

Site shall be well connected by good type of roads.

Site should be such that intake should be in a position to provide future water requirements.

Intake shall be located on upstream side of the town/city. Water shall not be contaminated on this side due to sewage disposal of the town/city.

Design Considerations:

- Sufficiently heavy so that it may not start floating due to upthrust of water, Also, so that it may not be washed away by high water currents.
- All the forces that are expected to work on it shall be carefully analysed and the design should be such that it withstands all such forces.
- The foundation should be sufficiently deep below scour depth of the stream. This will avoid overturning of the structure.
- No construction in a navigation channel as far as possible.
- Stainer's in the form of wire mesh shall be provided in all intake inlets. This will avoid large floating objects and fishes into the intake.
- It should be of such size and so located that sufficient quantity of water can be obtained from it in all circumstances.

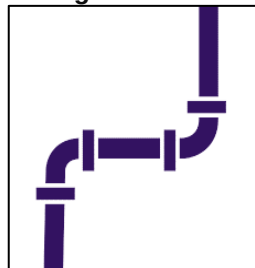
Main Delivery Tank



Design Considerations:

- The tank will be either GSR or ESR as per the topography of the cluster.
- It will be circular RCC tank in M30 grade concrete. Capacity of the tank is decided based on water requirement of plant per day.

Rising Main



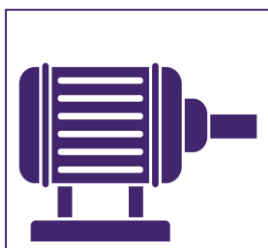
Design Consideration

Selection of cost-effective pipe size is primarily dictated by economics keeping at the same time, the technical feasibility, system reliability and safety aspects. In pumping systems, the minimum cost is determined as a trade-off between capital pipe cost and capitalized energy costs. The minimum cost is worked out by selecting the pipe diameter that results in least life-cycle cost. The parameters used for working out economical diameter are as follows:

- Economical evaluation period
- Energy charges
- Discount rate / Discount rate.
- Present worth factor

For rising main Galvanised Mild Steel (GMS) pipes are used whereas for gravity main upto 150mm dia GI pipes are used. For gravity pipes above 150mm dia pipe GMS pipes are used.

Pump



Design Considerations:

- To give prolonged running at the specified output under site conditions without cavitation.
- To have stable “H-Q” (Head – Discharge) characteristics
- To have identical “H-Q” characteristic curves in view of parallel pump operation
- Waterway through the pumps shall be smooth finish and free from recesses and obstructions
- The driving motors shall be capable of providing more than the maximum power absorbed
- The pump shall be designed to start against a closed discharge valve, to operate satisfactorily over the expected range of total head.

4.3.2. Water User Association (WUA)

Participatory Irrigation Management (PIM) has been advocated in the national Water Policy GOI 2012 and the State Water Policy GoHP, 2013. In line with this GoHP is under Way to enact an act titled Himachal Pradesh Irrigation Water User Association Act 2021. This act is in draft stage.

In the proposed WUA act it is proposed that at local level irrigation water management be done by the WUA. For this they have to be self-sustained role based Financially and technically strong and have legal rights. It is expected this would ensure, management of irrigation water in more reliable, equitable, efficient and optimal manner. This in turn will ensure the sustainable agricultural Production. the act will be applicable in the entire State for all type of irrigation projects. A three-layered system namely at command level, distributary level and Project level has been proposed in the WUA. It will be a corporate body with name, flag and seal, may carry out task as outlined in the Act. It will be a registered body all the irrigation water users will be its members it will have a general body a managing committee. Managing committee members will be elected from the General body and the committee will have an elected president.

Functions Right, Power and activities of WUA

The WUA will allocate water for crop reason, regulate water distribution have a maintenance plan, contribute and be involved in planning design construction and upgradation of irrigation projects, monitor flow of water, adopt an annual budget assist revenue collection resolve dispute, keep accounts and other works.

WUA will have right to information about quality and quantity of water functioning of irrigation projects, Joint measurement of water, receive water, select cropping pattern participate in planning design and operation of schemes, conjunctive use of water, right to recycle water.

It will have powers to collect membership fee, irrigation services, recall members, enter into land, decision making however certain prohibitions are also detailed, such as, pollution of water encroachment, selling water, waste full use of water.

The GoHP will also have powers related to Transfer of irrigation water, information sharing related to water availability, capacity building, making WUA financially and technically sustainable and dissolution of WUA.

Financial Management will be undertaken by the WUA. They have a variety of funding sources such as service fee, membership fee, grants from government,

laves CADA, MANREGA. Many more sources may emerge in near future. The WUA will resolve its administrative disputes. The criminal offences will be governed by criminal Acts and laws This act will surpass the exiting Acts and rules.

The few activities of WUA includes establishment of WUA unit, training of trainers and facilitators, constitution of WUA and working committee, registration of WUA, capacity building etc.

The details of WUA are attached at [Annexure 5.5](#).

4.4. Output 2

The Output 2 majorly focuses on supporting horticulture crop production activities in selected Clusters by providing aid towards plantation activities (such as land development, fencing, planting material, micro irrigation infrastructure, horticulture inputs, etc.), digital agri-tech services, digitization of land records, nursery development, rural financing, capacity building of DOH and beneficiary farmers, and support for intercropping, beekeeping, organic fertilizer production and carbon credit exploration.

4.4.1. Horticulture Production

Under the Project, it has been proposed to establish semi-high density to high density orchards depending upon the fruit crop and available rootstocks and varieties. High yielding and early bearing varieties have been identified after a preliminary survey of both government and private fruit plant nurseries and the required plant material will be procured as per the standard norms for each Cluster. Use of modern technology including soil testing, plantation orientation, nutrient management, pest management, canopy management, irrigation (drip with mulch), pruning and training will be adapted as per the local conditions and the crop requirements. Awareness and training of master trainers and growers will be ensured on the mass scale in the identified Clusters so that the growers don't face any technical difficulty in the cultivation of identified crop. This will include land preparation, layout, pit digging, pit filling, use of pre-planting nutrients, planting, staking, irrigation, fertilization, ensuring maximum survival of planted material, crop and varietal behaviour, pest and disease management, water management, pruning and training, harvesting and harvesting standards, pre-cooling, grading (colour and size), on-farm storage, washing, packing, market survey and analysis, cold/CA storage, creating market linkages and marketing of the produce. Besides, value addition, canning and processing of culled fruits will be a point of focus to involve and educate growers so that they are able to generate more revenue. By ensuring and adapting these measures on scientific lines under the technical guidance of all concerned stakeholders it will be possible to ensure the reduction of gestation

period from 6-7 years to 2-3 years, good quality fruit production with higher productivity. This will also ensure maximum returns to the farmer in the shortest possible time. In addition, intercropping with a suitable crop for each Cluster will be promoted for initial 2-3 years of plantation so that the beneficiary farmers get some revenue to meet the required expenses while establishing the orchard.

4.4.1.1. Current cropping pattern

In the areas identified for the Project, there is currently a negligible cultivation of fruits as people are mostly involved in other agriculture activities. As per the data collected in the baseline survey for present cultivation of crops in the land given by the farmers for the Project, more than 99% of the total crop cultivation is that of Wheat, Paddy and Maize, with individual proportion being 47.5%, 26.1% and 25.8%, respectively. Other crops such as Mustard and Gram have minor contribution to the overall cultivation. With regards to the cultivated land for each crop, Wheat and Maize account for 48.7% and 34.7% of total cultivated land, followed by Paddy (15.2%). Farmers also have a few cows or buffaloes to meet their daily requirements and to provide some income; however, it is not sufficient to meet their day-to-day needs. As a result of these factors the growers in these areas have very meagre income as compared to fruit growing belts of the State. These areas have a very good potential for cultivation of various kinds and varieties of sub-tropical fruits as the climatic conditions are sub-tropical. Exploitation of such climatic conditions and with the availability of land in the identified areas/Clusters will not only go a long way in raising the economic status of the growers living in these areas but will contribute to the overall economy of the State. These majors will also help to create direct and indirect livelihood avenues besides poverty alleviation, which are the main aims of the project.

4.4.1.2. Proposed Horticulture Crops

Selection and identification of the fruit crops for the selected Clusters is very much essential and important for achieving the desired goals of the Project. Hence, a baseline survey on scientific basis was conducted to find out the feasibility of different sub-tropical fruit crops in relation to the climatic conditions involving main stakeholders i.e., DOH, SAU's and the growers of the identified Clusters crops. Selection of different fruit crops was done on the basis of the Cluster ecological parameters, learning from PRF, recommendations of CS04, CS09 experts and discussion with PMU.

These studies included availability of the land, interest of farmers, various soil parameters like physical and chemical characteristics of soil, nutrient status, water requirement, availability of irrigation facilities, environment and climate risk assessment, orchard management practices, production and marketing

facilities, etc. Climatic conditions of an area play a major role in deciding any agriculture activity both at macro and micro-level. Hence, all parameters on scientific lines involving all stake holders were taken into consideration while selecting a Cluster and the fruit crop. Most of the selected area is rain-fed and has sub-tropical climatic conditions. The selected fruit crops have been decided on the basis of the agro-climatic suitability of an area. The parameters taken into consideration are summarized below:

Table 18: Agro climatic conditions for the proposed crops

Crop	Preferred traits for growth					Plantation Plants/ha	Avg. Yield (MT/ha)
	Altitude (m amsl)	Avg. annual rainfall (mm)	Soil Type	Soil pH	Spacing (m x m)		
Citrus (Sweet Orange)	Up to 900	500 - 775	Deep sandy loam or alluvial	5.5 to 7.5	3 x 3	1111	40-50
Guava	410 - 1200	500 - 1000	Loamy	5 to 7	3 x 3	1111	35-40
Litchi	300 to 900	1000	Deep Loamy	5 to 7	4 x 4	625	60-70
Pomegranate	Up to 1800	1000	Deep Alluvial or Sandy to Sandy Loam	6.5 to 7	3 x 3	1111	40-45
Persimmon	900 - 2000	1500- 2500	Sandy loam or Loamy	6.5 to 7.5	4 x 4	625	70-80
Mango	Up to 1000	750 - 3750	Loamy or Deep Alluvial	5.5 to 7.5	3 x 3	833	50
Pecan Nut	1000- 2000	800 - 1500	Deep sandy loam	6.2 to 6.5	6 x 6	278	25
Plum	1000- 4000	1000- 1250	Sandy loam	6.5	4 x 4	625	75

Source: Report from packages awarded during PRF

4.4.1.2.1. Planting Material

Major aim of this project to produce good quality sub-tropical fruits to raise the economic status of the growers involved, utilize the available land for maximum returns and get higher yields in shortest possible time as per crop/variety behaviour by adopting scientific crop management. Among all the factors identified in the Project, planting material has the highest significance. If planting material used turns out to be of poor quality, all other inputs will lose their significance.

Therefore, selection of the rootstock, fruit crop and the variety deserve special attention of all the stakeholders including the authorities involved in the procurement of planting material. Various factors to be taken into consideration while identifying fruit plant nurseries and selecting the required plant material are enumerated below:

- Fruit plant nursery should be registered with any concerned government agency.
- Certification of plant material with truthful labelling from the concerned certifying authority is a must.
- Selection of size of the nursery plant (broomed or un-broomed depending upon rootstock, variety) has to be made with utmost care.
- Registered nursery should be a reputed one with dependable past history of supplying plant material.
- Timely supply of identified fruit plant in a very good condition (in polybags for rainy season) in each Cluster has to be ensured for success of the Project.

Kind-wise and variety-wise fruit plants identified for different Cluster areas of Project depending upon climatic suitability are given below. Selection of any suggested variety for any Cluster will be taken on its suitability. Preference needs to be given to only one or two varieties for a Cluster, so the crop management is easy to handle. More varieties in the same Cluster create management problems at every level till harvest. We should prefer long stretches of same plantation with one or two varieties as it makes handling easy and even ease out storage and marketing.

Table 19: Proposed crops and varieties

#	Crop Name	Varieties
1	Citrus	Valencia, Hamlin, Natal, Pera, Westin, Jaffa, Blood Red, Mosambi
2	Guava	Shweta, VNR Bihi, Lalit, Hisar Safeda, Thai Pink
3	Litchi	Dehradun, Calcuttia,
4	Pomegranate	Bhagwa
5	Persimmon	Fuyu, Jiro, Hachiya
6	Plum	Black-Amber
7	Mango	Mallika, Pusa Arunima, Chausa, Ambika
8	Pecan Nut	Mahan, Nellis

4.4.1.2.2. Water Requirement

Availability of required level of soil moisture to a plant at the right time is imperative for its proper growth, development and survival. A healthy plant is a guarantee for a better crop with high productivity. Moisture available in the soil helps in uptake of different macro and micro-nutrients which admittedly have positive desired results. Different crops require different moisture requirements and even varieties affect the moisture requirement. Plants with more healthy and profuse leaf area demand high moisture levels as the rate of transpiration losses from the leaves is directly correlated with leaf area. More leaf area means more transpiration losses. Further, requirement of moisture is highly influenced by temperature as well as wind velocity. Higher the temperature and wind velocity more is the moisture demand. Therefore, while working out the moisture requirement of different crops, all these factors have been considered. The table given below indicates average moisture requirements for each crop in relation to climatic conditions in consultation with the concerned experts of Dr.Y.S.Parmar, UHF, Nauni, under the PRF package CS-04 of Development of Package of Practices (PoP). Moisture conservation is a matter of very high concern in view of increasing temperatures, climate change and melting glaciers. To conserve the soil moisture without adverse effect on plant growth and development and productivity, besides checking weed growth, under this Project it has been proposed to use drip irrigation system as well as mulch film. Venturies will be used in layout of drip irrigation system to make use of water-soluble fertilizers as per the need of each crop. This will also help in maintaining soil and plant health and minimize the requirement of water as well as fertilizers. In the identified Clusters some water sources are available but are not in a good condition to provided required quantity of water for irrigation. Revival, up-gradation, augmentation and repairs of such water sources have been prioritized in this Project in consultation with Department of Irrigation, HP. In some other Clusters water sources will be created by constructing rainwater

harvesting and storage tanks to meet the requirement for drip irrigation system to irrigate the plants. This aspect has also been taken into account in this Project in consultation with irrigation Department. Accordingly, all these inputs have been incorporated in the financial outlay of the Project.

The table given below highlights the water requirements under Drip irrigation system (litres/plant/day) year-wise for each of the proposed crop:

Table 20: Water requirements under drip irrigation system

S. No	Crop	1 st Year	2 nd Year	3 rd Year	4th Year	5th Year	6th Year	7th Year and Above
1.	Citrus**	3.5	8	18	30	34	38	45
2.	Guava	4-6	8-12	15-20	25-30			
3.	Litchi**	3.5	8	18	30	34	38	45
4.	Pomegranate***	4	13	30	40	45		
5.	Persimmon	4-6	8-10	12-18	24-28			
6.	Plum	4-6	8-10	16-18	28-35			
7.	Mango	4-6	8-10	16-18	28-35			
8.	Pecan Nut	4-6	8-10	12-18	24-28	30-32	35-38	40-42

*Approx. Amount of irrigation water may depend on soil, climate and weather conditions.

**Peak Water requirement (i.e., in the month of June)

***litres per tree biweekly (Peak Water Requirement i.e., in the month of May)

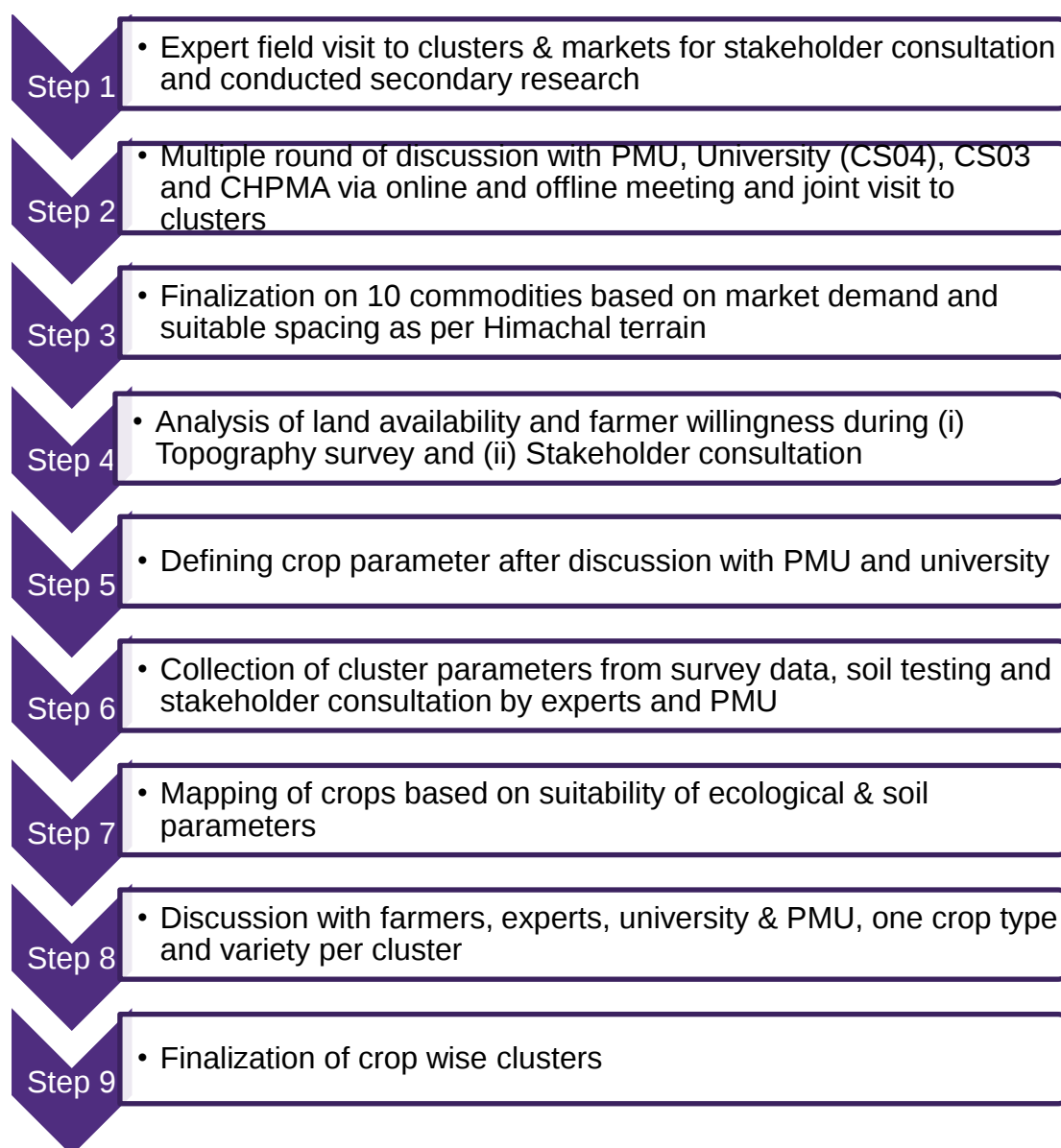
4.4.1.3. Cluster-Crop Mapping

Crop mapping for every identified Cluster is a pre-requisite to identify the suitable crop. For the said purpose Cluster matrix for each crop was developed on the basis of ecological parameters needed for optimal yield and good production. The parameters included altitude and slope of the land, soil and climatic factors. Similarly, for each Cluster soil testing was conducted to gather information regarding the Cluster parameters. Based on the parameters, the best fit crops (1-3 nos.) were mapped for the Cluster. Further, a detailed discussion with all stakeholders such as PMU, SAU's, CHPMA representatives and concerned was held before finalizing of a fruit crop. Growth data obtained from about 200 FLD's (1 ha each) for 4 crops namely Guava, Litchi, Pomegranate and Citrus (sweet orange) was utilized in identification of fruit crops for different Cluster areas. Even the visit to the concerned Clusters and meetings with growers were made by consulting committees as secondary research so as to reach at mutual decision for identifying the fruit crop for each Cluster. Stepwise details of such visits and consultations at various levels of stakeholders are briefly mentioned below:

- **Field visit of experts:** Experts visited various Clusters to assess on ground situation and obtain information related to horticulture practices, marketing and value addition from the growers and stake holders. Detailed discussions were held regarding existing horticultural/agricultural practices in vogue in the area.
- **Discussions with PMU, University (CS04), CS03 and CMPHA via off and online meetings and visit to Clusters:** Multiple rounds of scientific discussions were held from time to time to finalise the strategies to be adopted in selection of crops, varieties, water requirement, climatic suitability, irrigation infrastructure, plant material, crop distance, intercropping, storage, marketing etc.
- **Finalization of 10 sub-tropical fruit crops:** After a detailed discussions with all stakeholders and based on the ever-increasing market demand and observations of about 200 FLD's (Four Crops) in different areas, 8 sub-tropical crops namely Citrus, Mango, Guava, Pomegranate, Litchi, Persimmon, Pecan Nut, and plum and Avocado were suggested for this Project. However, after further discussions with experts and growers, Kiwi and Avocado were removed from the crop list.
- **Land Availability in identified Clusters:** Availability of land in identified Clusters for fruit cultivation was an issue as the farmers are mostly involved in cultivation of agricultural crops like maize, wheat and some vegetables. Therefore, it was felt necessary to contact the growers and seek their willingness for shifting from agriculture to fruit cultivation. Benefits of fruit cultivation were explained to the growers in order to motivate them for a

shift from traditional agriculture to modern scientific horticulture. Consultations were held with concerned stakeholders regarding topography of the area and its suitability before incorporating in the Project.

- **Crop parameters:** Various crop cultivation parameters on scientific basis were discussed and defined in a systematic manner with PMU and SAU's.
- **Metrological information and data collection of Cluster areas:** Data related with annual and seasonal precipitation in the form of rains and snowfall, wind velocity, humidity, temperature, drought incidences etc. were obtained from the meteorological Department to have a fair idea about crop suitability, planning irrigation infrastructure and other requirement for successful crop cultivation. This data was used to decide upon crop as well as the Cluster.
- **Mapping of crops:** Mapping of crops in identified Clusters was conducted in consultation with concerned stakeholders involving various ecological factors as well as soil parameters including soil pH, EC etc.
- **Mono-crop cultivation:** In order to ease out various horticultural operation as per PoP and provide uniform facility to a Cluster area, discussion on the basis of various required parameters were held with all stakeholders like experts, HP DoH, SAU's and PMU to decide only one crop per Cluster. This is a suggestion for consideration.
- **Finalization of crop wise Clusters:** Proposal has been put forward for identifying one crop for one Cluster to keep uniform horticultural facilities available to the grower. This step can lead to expertise of the grower in one crop cultivation which will be to everybody's benefit. Grower will be the master of one crop rather the jack of all trades. Such practice is common in horticultural advanced countries.

Figure 33: Approach for Cluster mapping

4.4.1.4. Crop Management

Crop management is a complex issue which needs involvement of well-established scientific methods as per approved package of practices and sometimes involving indigenous techniques as well depending upon experience of growers in the identified Cluster. Crop management starts from the day one of plantation and is a continuous process till the end of plant/orcharding. It includes pre-harvest, harvest and post-harvest management.

Table 21: Stages of Crop Management

Pre-Harvest Management	Harvest Management	Post-Harvest Management
• Proper labelling of the plants with varietal details and orchard map. • Staking of new plantation (wherever required). • Watering to ensure survival of plant. • Weed management. • Training as per requirements of crop/variety to form the desired scaffold/shape. • Fertilizer/nutrient application as per PoP and for each crop at appropriate time for healthy growth and development in relation to soil testing status. • Pest and disease management as and when required as per PoP. Even in some cases pheromone traps can be used to minimize use of pesticides and save environment. • Flower thinning/pinching in the crops, if required. • Summer and dormant pruning wherever required. • Orchard sanitation. • Use of shade nets in hail prone Cluster, if any.	• Determining the maturity index for each crop which will vary from place to place and will depend on climatic conditions of the area as well as altitude. • Harvesting of fruits at right time better taste, direct marketing and storage.	• Pre-cooling, if needed • On-farm storage. • Sorting and Grading (Size and Colour as per crop). • Packing. • CA/Cold Storage. • Creating Market Linkages. • Direct to the Market. • Transportation. • Value addition and Processing of culled fruit. • Branding.

4.4.1.5. Package of Practices (PoPs)

For all the crops, standard package of practices established by DoH and other research Institutes will be followed. PoP is a broad guideline which highlights many operational aspects for each crop like suitability of area, layout, required soil parameters, climatic requirement, altitude, water requirement, pest and

disease management, nutrient management training and pruning methods, harvest and post-harvest etc. which are very helpful for the Project implementers as well as the growers. Such crop-wise PoP is proposed to be distributed to the identified growers in each Cluster so that it makes them aware about dos and don'ts. Summarized table below shows the nutrient requirement of identified crops as per PoP

Table 22: Nutrient requirements of identified crops

Crop	Nutrient (g/tree)	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th Year				10 th Year and Onwards		
Pecan	Nitrogen	75				150		225	300	375	450	525	600	675	750	
	Phosphorous	35				70		105	140	175	210	245	280	300	300	
	Potassium	75				150		225	300	375	450	525	600	675	750	
Litchi	Nitrogen	45				90		135	170	215	260					
	Phosphorous	20				40		60	80	100	120					
	Potassium	45				90		135	170	215	260					
Mango	Nitrogen	50	100	150	200											
	Phosphorous	25	50	75	100											
	Potassium	50	100	150	200											
Citrus	Nitrogen	60	120	200	300											
	Phosphorous	-	60	80	100											
	Potassium	-	50	100	150											
Guava	Nitrogen	120	240	360	480											
	Phosphorous	60	120	180	240											
	Potassium	60	120	180	240											
Plum	Nitrogen	50				100		150	200							
	Phosphorous	25				50		75	100							
	Potassium	40				80		140	190							
Persimmon	Nitrogen	120				240		360	480							
	Phosphorous	60				120		180	240							
	Potassium	60				120		180	240							

Pomegranate	Nutrient (g/tree)	1-18 Months	19-24 Months	25-36 Months
	Nitrogen	375	63	625
	Phosphorous	187	62	250
	Potassium	166	146	250

In addition to these macro-nutrients, minor nutrients like Calcium, Boron, Zinc, Manganese, etc will be required as per the need of the plant which varies from time and to overcome any nutrient deficiency if observed during growth and fruit formation stages.

4.4.1.6. Land Preparation

In view of the sloppy terrain in most of the Cluster area, land preparation shall have to be taken up by the growers before starting other relevant horticultural activities depending upon the gradient of the site. Terrace farming will be preferred as it will ensure proper layout, reduction of soil erosion losses, moisture run off and loss of nutrients. Cultivation practices and other horticultural operations will become easier than on sloppy lands. Separate provision has been earmarked in the financial outlay of this activity in the Project.

4.4.1.7. Horticulture Inputs and Tools

Various types of horticulture inputs will be required by the grower for successful horticultural operations to be carried out from time to time. These inputs can broadly be divided into following categories:

- Manures and Fertilizers –inorganic as well as organic.
- Different kinds of macro and micro-nutrients as per crop need.
- Staking and tying material.
- Vermicomposting units.
- Tools and implements like spades, khrupa etc.
- Machinery and Equipments like Motor Power Sprayer, Tiller/Weeder, Pit Digger, Mist Blower etc.
- On-farm stores.
- Financial outlay for such inputs has been earmarked in the Project.

4.4.1.8. Drip Irrigation

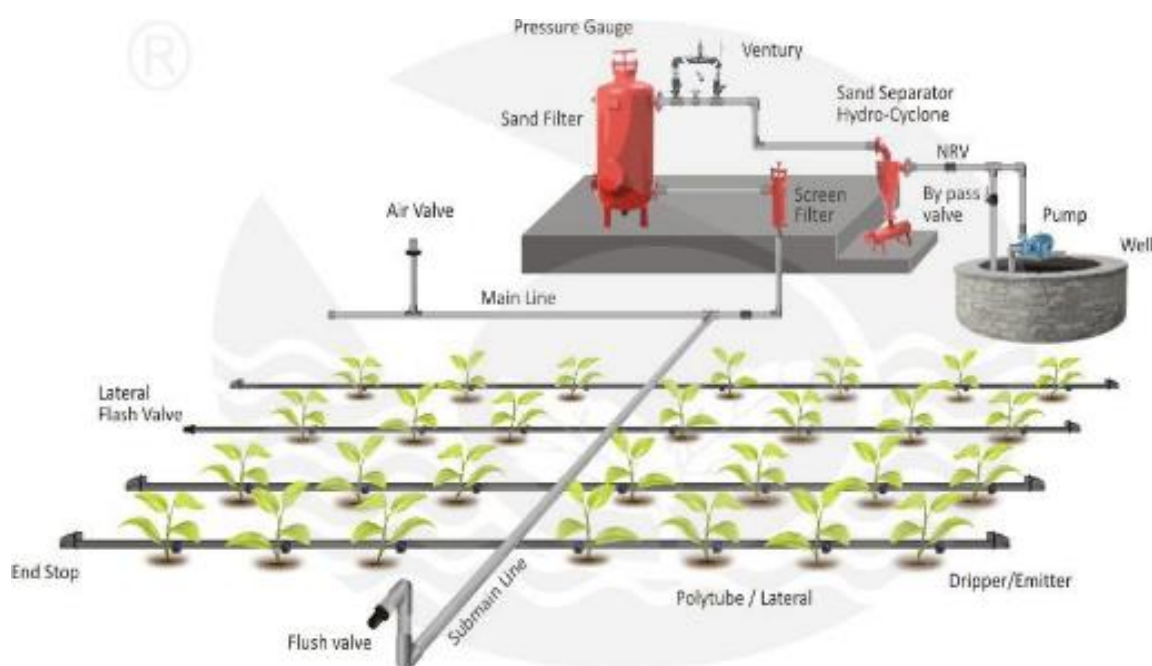
Drip irrigation, sometimes called trickle irrigation, involves dripping water onto the soil at very low rates (2-20 liters/hour) depending on water percolation rate into the soil and crop requirements, through drip lines fitted with emitters/drippers at appropriate length as per plant spacing. Water is supplied close to plants through drippers fixed on drip line near root zone. Such a system helps in moisture conservation and efficiently facilitates uptake of nutrients by plant root system. Frequency of application of water is adjusted as per crop requirement and the season of the year. During summer and fruit development water requirement of plant always remains high and as such frequency is more. Whereas, in other season water requirement of plant remains low as such drippers are regulated accordingly.

Drip irrigation is most suitable for the crops and vegetables planted in rows at proper distance. Generally, only high value crops are considered for drip system because of the high capital costs.

Table 23: Major components of Drip Irrigation system

Major Components of Drip Irrigation System			
1.	Water Storage Tank	11.	By-pass Assembly
2.	Pump Station	12.	De-silting Tank
3.	Control Valves	13.	Pressure Regulator
4.	Fertilizer tank /Venturi	14.	Laterals
5.	Mains / Sub-mains	15.	Emitters/Micro-tubes

Figure 34: Drip Irrigation system



Advantages of drip irrigation

- i. More crop per drop, thus saving about 30–50% of water
- ii. Moisture conservation.
- iii. No loss of soil due to soil erosion which happens in other types of irrigation system particularly on sloppy lands.
- iv. Adaptable to highly variable soil and topographical conditions.
- v. High efficiency and uniformity if designed properly as per actual need.
- vi. Low energy requirements.
- vii. Amount, rate and location of application are easily controlled.
- viii. Light and frequent applications of water as per crop need are possible.
- ix. Only root zone receives water as per need, allowing simultaneous cultural operations, reduced evaporation losses and weed growth.
- x. Fertilizers can be applied with the water through venturi when done with appropriate safety equipment and injection systems.
- xi. No percolation loss of nutrients below root zone.
- xii. Facilitates uptake of available nutrients.
- xiii. Plants and fruits show better growth and development.
- xiv. Fruit and foliage are not wetted with drip/trickle, avoiding many disease and injury problems and
- xv. Irrigation labour costs are low.

4.4.1.9. Animal Proof Composite Fencing

Loss of agriculture produce to the animal damage in different cultivated lands is a very big issue for the farmer. All efforts and labour involved in getting the produce are wasted when animals cause huge damage to the crop. As a result of this factor many farmers have lost interest in agricultural activities in such animal infested areas. If such menace is not managed scientifically without harming these animals, it is expected the cultivated area may shrink and production of different crops will show declining trend.

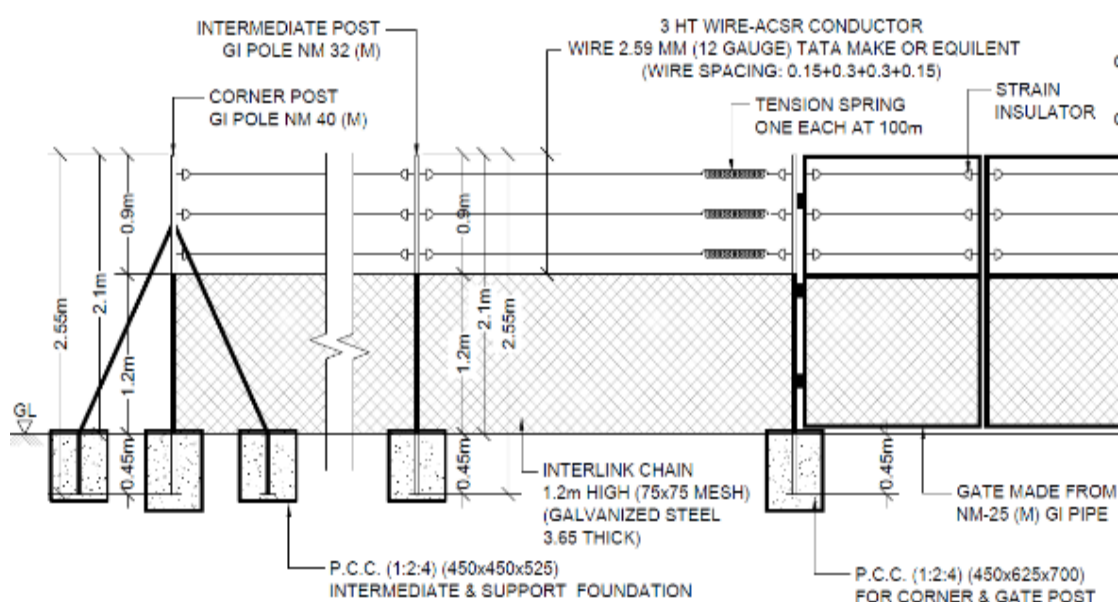
In the State, as per the estimated figures of DoH 1.56 Lakh ha. cultivated area is badly affected by menace of monkeys and wild animals per year, causing estimated annual loss of INR 229 crore to the farmers.

In order to help the farmers in resolving this issue, an innovative solution of Solar Powered Electric Fencing has been proposed. In this modern non-conventional fencing, wires are used to fence the area which carry low voltage current generated by solar equipment which is non-fatal to any animal coming in its contact. Current flowing through these wires act as deterrent for any animal and hence the fenced area gets protected from animal damage. The

current does not cause any harm to the animal but acts as a psychological barrier for the animal from intruding into the field and helps in preventing losses.

The Solar Fencing consists of Energizer, solar panel, battery, insulation material, poles, high tensile conducting wire and Interlink Galvanized Steel chain mesh. The electric impulse is generated by the energizer, which produces high voltage impulses of approximately 8 KV once every 0.9 to 1.2 seconds. The impulse lasts for about 300 millionths of a second to 0.1 second with a current of up to 10 mA. The detailed section drawing of fencing is mentioned below. The major benefit of solar fencing is to protect the crop loss and re-activate the growers in such affected Cluster areas for various agricultural activities. Besides this, the final produce of farmer will increase thus resulting in higher income. Another supplementary benefit is that the provision of fencing will reduce the farmer's mental and physical stress due to constant need of guarding the field, which will lead to improved health and financial well-being.

Figure 35: Solar Fencing

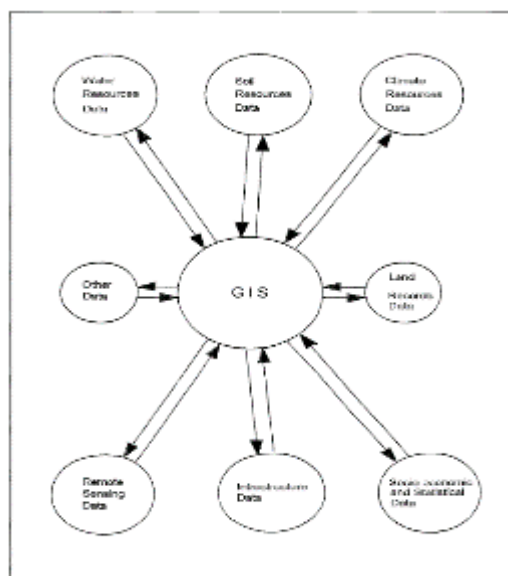


4.4.2. GIS based land resources mapping and management

Project's as well as individual land users need to make the best choices among options for the use of land in order to support development without hazard of land degradation, which would endanger sustainable production of food and other horticulture products. These options of optimal land resources allocation result from complex decision-making processes involving the optimal combination of various kinds of information like soil, climate, vegetation, present and potential land uses, location of irrigation and water sources, towns and villages, highways, railroads and markets, prices, population, social and environment factors. Based on parameters, Geographic Information Systems (GIS) have emerged as powerful tools in the management and analysis of the large amount of basic data and information, statistical, spatial and temporal, needed to generate in a flexible, versatile, and integrated manner, information products in the form of maps as well as tabular and textual reports for land use decisions.

Developing GIS systems in linkage with its agro-ecological zoning and similar models, applying these to tackle issues of land, food and people at local levels are of utmost need. Rational land use planning and integrated land resources management are essential parts of the solution to sustainable land use and related problems. Knowledge of land resource endowment and its potential under different levels of technology is an essential prerequisite to planning of optimum land use and subsequent sound, long term agricultural and socio-economic development.

Figure 36: Cluster of GIS tagging



Making decisions for rational, sustainable land use is becoming increasingly complex as land pressure and the competition for land, and the risk and extent of land degradation problems increase. The information and knowledge required for these decisions should be based on comprehensive and quantified assessments of potentials and development possibilities of the land resources, taking into account the biophysical, environmental, socio-economic factors, as well as the space and time dimensions of sustained land use. The outputs from such assessments are required by a growing variety of needs: land use planning, ecology, environment, economy, agriculture, horticulture extension, corresponding to various areas of applications such as:

- Land suitability and land productivity assessment
- Land use planning
- Land degradation assessment
- Quantification of land resources constraints
- Land management
- Horticulture/Agricultural technology transfer
- Horticulture/Agricultural inputs recommendations
- Farming systems analysis and development
- Environmental impact assessment
- Monitoring land resources development
- Agro-ecological characterization for research planning
- Agro-economic zoning for land development and nature conservation
- Ecosystem research and management

Development of these and related applications involves the analysis and interpretation of large quantities of biophysical and socio-economic data, statistical, spatial and temporal, in order to produce the diverse kinds of information products required in the Form of images, maps and both tabular and textual reports for decision-making at various application scales.

In the course of data collection/surveys, design and drawing, a detailed methodology has been developed for the determination of land resources and land use potentials of individual Clusters.

The main components of the data required to compile the land resource inventory include:

- Soil map (soil type, texture, aspect, slope etc.).
- Climate map, consisting of temperature regimes.
- Rainfall pattern.
- Administrative area map.
- Irrigation schemes and location.
- Other land uses, including forest areas, national parks and reserves and urban areas.
- Population distribution.

The various layers were digitized, and the digitized data were converted to maps and reports. The surveys and data produced numerous map outputs, including physical resources maps (landform, soil, climate, land resources), potential crop suitability maps, as well as maps of potential population supporting capacities and maps of optimal land resources allocations by Clusters. Some of the various outputs are given below:

4.4.3. Digital Agri-Tech Service

Horticulture marketing as a business activity involves the flow of goods and services from the point of production to the final consumption. During this entire process the commodity moves from one hand to another and also from one place to another. But all these actions and events take place in some sequence, which is known as 'marketing processes'. The Horticulture marketing process/system starts with the farmer and his production, while at the other end of the system is the consumer. The process starts with movement of farm products to the market and its contact with business firms or traders. The factors affecting this contact are transportation, communication, system of law and order and monetary systems, which are also, associated with business management activities.

The actual buying and selling activities are done under certain norms and also under some organizational system and ultimately the product first purchased by traders—'wholesalers or retailers through middlemen/agents—and reach the consumers.

Digitalization of processes aims is automating the process being carried out at various stages as mentioned above. The latest technology such as Big Database for data warehousing and mining, IoT for automate the channels, Artificial Intelligence and machine learning for assaying the quality of produce, Drone for better surveillance, cloud and web-based solution for minimize the human beings in the processes, digital devices for timely dissemination of market information, Block Chain for traceability and security of the data are proposed. Following will be included in the digital technology.

- Smart Marketing Processes.
- Digitalization of Orchards.
- Assaying of Produce.
- Auction and Weighing of Produce.
- Payment Settlement.
- Information Dissemination.
- Early Warning System.
- Surveillance System.
- Human Resource Development.

A detailed note is attached at [Annexure 2.6](#)

4.4.4. Nursery Development Plan

Nursery development in cluster and surrounding areas is most important activity of this Project. For initial 2-3 years of the Project, fruits may have to be procured from various reliable sources by a transparent method as per need of the Project but thereafter, the plant requirement is proposed to be met from within the State due to large quantity requirement annually. For the said purpose, new nurseries in government as well as private sector and up-gradation of existing Departmental nurseries shall be required under the Project. Year-wise financial outlay has been estimated and included in the Project. Establishment /up-gradation of nurseries will not only create employment but will also cater to the needs of the Project. The plan for the said purpose has been framed after detailed discussion with concerned experts of CS03 package.

Under the proposed plan it is expected to produce disease/insect free plants, true to type and truthfully labeled. Such a facility in the concerned areas of activity will ensure very high survival rate of plants as they will be transplanted under similar climatic condition in which they are produced. Besides, transportation costs on carriage of plant material from long distance sources will come down thus saving the procurement cost of plants. It has been planned to procure 100% of planting material required from Year 1 to Year 3 covering 30 % of the proposed area through procurement from the reliable certified government and private sources. To accomplish the requirement of plant material within the State, it is proposed to establish eight (8) model nurseries on scientific lines under guidance of experts so that from the 4th.year of Project implementation plants of different crops are available right around Cluster areas to cover the annual targets of plantation. Depending upon the volume of requirement of different fruit plants it has been proposed to establish these 8 nurseries with the following breakup.

Table 24: Crop Wise planned nurseries

Sr. No	Fruits Crop	No. of Nursery	Cost (Lakh INR)	Productuin (Lakh Nos)	Altitude (M) asml
1	Citrus	2	630	2	600-800
2	Pomegranate (Tissue culture)	1	552	1	600-800
3	Guava	2	226	2	600-800
4	Litchi	1	101	1.4	600-800
5	Persimmon	1	115	0.80	800- 1200
6	Plum	1	112	1	800-1200
7	Mango	1	128	1	600-800
8	Pecan nut	1	122	0.66	800- 1200
	TOTAL	10	1986	9.86	-

The locations of nurseries for different fruit crops have been proposed based upon the elevation of the area, nearness to the road, availability of water source and manpower as well as the interest of the nursery grower to handle these nurseries.

Mother orchard blocks to serve as germplasm banks are proposed to be established in each such nursery with all the required facilities like mist-chamber, fan and pad green house, drip and mulch system, naturally ventilated poly house, shade net, electricity and water facilities depending on the crop. These pedigree orchards will also serve as demonstration plots and will be quite helpful in motivating more and more growers for fruit cultivation.

Facilities for hardening of planting material, storage and general administrative requirements will also be maintained. The pomegranate planting material is to be raised through tissue culture whereas virus indexing is the major requirement for Citrus which is further propagated through micro-grafting. Depending upon the crop, different standards and established propagation techniques as per PoP, have been proposed for different crops.

Table 25: Propagation techniques for various crops

S.No.	Crop	Propagation technique
1.	Citrus	Micro Building
2.	Pomegranate	Tissue Culture
3.	Guava	Patch Budding/Grafting
4.	Litchi	Air Layering
5.	Persimmon	Chip Budding/Grafting
6.	Plum	T-Budding/Grafting
7.	Mango	Veneer grafting
8.	Pecan nut	Whip Grafting

The nursery development plan is to serve the supply quality planting materials to the Project and act as a commercial venture for the young entrepreneurs of the State, thus boosting further economic growth in the State.

Detailed nursery development plan is attached at [Annexure 2.3](#)

4.4.5. Other revenue generating activities

4.4.5.1. Intercropping

During the initial 2-3 years of planting, grower may not be able to generate any revenue till fruit plants come into bearing. Therefore, in order to safeguard his financial interests, it has been proposed to introduce inter-cropping as per the suitability of the area and market requirement. During growth of inter-crops water will be required for irrigation which can be provided without any financial involvement as the irrigation infrastructure will already be in place for the main fruit crop. This will also help in clean cultivation of the orchard. Such intercrops will provide initial income to the grower from the same piece of the land to sustain his livelihood and other orchard activities.

Selection of Intercrops for different crops and Clusters

Requirement of intercrops will vary from Cluster to Cluster depending upon its suitability for an area. Depending upon line-to-line plant spacing, elevation, climatic suitability, etc., different intercrops with market acceptability and profitability have been identified after detailed discussions with all the stakeholders. Such identified intercrops will be quite helpful in improving soil aeration as well as soil nutrient status which will directly benefit the fruit crop growth.

Keeping in view the topography of targeted location, about 25% to 30 % planted (800 to 1000 sq m of 4000 sq. m.) area will be available for intercropping. It is proposed to grow intercrop on beds between the main crop of 1.0-meter width and convenient length on well drained and fertile soil. These beds should be atleast 50 cm distanced from main crop beds on both sides. There is also a need to keep atleast 30 cm distance between two beds of intercrop when main crop planted at 3.0 or 4.0-meter distance. Sowing of seed or seedling should be sown atleast 10 to 15 cm distance from the corner of bed. Seedling or seed should be sown on recommended spacing of above crops. One lateral of drip irrigation with drips of 4 liters per hour capacity needs to be fixed in the middle of beds for assured irrigation. Maintenance of crop must is of prime importance for proper growth and development of plants and also to achieve the targeted yield. On an average, cost of cultivation is expected in between Rs 6.0 to 10.0 per square meter considering in house labour and input cost particularly planting material.

The hired consultancy firm along with the Agriculture University conducted a detailed study and proposed various intercrops (as highlighted in the table below) in the Project Clusters. The brief description for pulses, spices,

vegetables, flowers and medicinal and aromatic plants along with respective cultivars are given in the table below which can be picked depending on the fruit crop, spacing, location etc. Irrigation infrastructure being installed for main fruit crop will serve as source of irrigation not only to main crop but to inter-crop as well.

Advantages of intercropping

- Improves soil aeration.
- Leguminous crops (Moong Dal, Pea, Urd and Cowpea) enrich the soil with more nitrogen thus help in maintaining soil fertility.
- Medicinal herbs and crops like Ashwagandha, Turmeric, Ginger and Mint as well as Wild Marigold help in keeping the soil free from diseases and insects as they act as repellents.
- Better weed control
- Minimizes the formation of soil crust formation.
- Prevention of soil erosion at sloppy land
- Ensured income to the farmers till the main crop comes into bearing
- It ensures income to the farmer till main fruit crop comes into bearing

The infrastructure supported by the Project considers climate resilience and incorporates adaptation measures and supports more reliable fruit crop production and sustainability on scientific lines. The Project will ensure that the investments are as technologically efficient and cost effective as possible. Drip lines already proposed for the main crop will be utilized for irrigating the intercrop without any additional financial involvement.

Training for intercropping

The Project would specifically focus on training the CHPMA farmers on intercropping practices. The training will be conducted at Group of Cluster levels or block level. It will comprise of training on general information about intercropping, cropping practices, IPM, IPH, GAP and others. The training will be funded by the existing State and center schemes.

Table 26: Suggested Intercrops

Seasons			Zaid			Kharif Season				Rabi Season				
Fruit Crops		Year/ Month	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
1.	Citrus (Sweet Orange)	Year 1	Mung bean / Wild Marigold			Ashwagandha								
		Year 2	Urd			Turmeric								
		Year 3	Turmeric							Peas				
2.	Guava	Year 1	Mung bean wild Marigold			Ashwagandha								
		Year 2	Urd			Turmeric								
3.	Litchi	Year 1	Mung bean			Ashwagandha								
		Year 2	Urd			Turmeric								
		Year 3	Turmeric							Peas				
4.	Pomegranate	Year 1	Mung bean			Ashwagandha								
		Year 2	Urd			Turmeric								
		Year 3	Turmeric											
5.	Mango	Year 1	Mung bean			Ashwagandha								
		Year 2	Urd			Turmeric								
		Year 3	Turmeric							Peas				
6.	Pecan nut	Year 1	Mung bean			Ashwagandha								
		Year 2	Urd			Shatawari								
		Year 3	Shatawari							Wild Marigold		Mint		
		Year 4	Mint							Peas				
		Year 5	Cowpea			Basil				Carrot				
7.	Persimmon	Year 1	Mung bean			Ashwagandha								
		Year 2	Urd			Turmeric								
		Year 3	Turmeric							Peas				
		Year 4	Cowpea			Wild Marigold				Cabbage				
8.	Plum	Year 1	Mung bean			Ashwagandha								
		Year 2	Urd			Ginger								
		Year 3	Ginger							Peas				

A detailed note on intercropping is attached at [Annexure 2.4](#).

4.4.5.2. Beekeeping

Beekeeping, also known as apiculture, has attained great significance in present day orchard system as the bee's act as pollinators. Good pollination ensures better pollination and results in good fruit set thus a key to higher productivity. Besides, honey harvested from the bee colonies generates additional income for the growers. The process is quite profitable in areas with good floral pasturage. The possibility for the development of beekeeping in the State has tremendous potential due to its rich diverse available all over in all the seasons. This potential can be utilized to its full capacity by developing fruit cultivation. The honeybees convert the nectar of flowers into honey and store that honey in the hive. Honey and honey wax are two significant products of beekeeping, while other products include royal jelly, propolis or bee glue, bee pollen and bee venom.

The current value of the honey market in India is INR 2110 crore and is expected to reach INR 3830 crore by 2027, exhibiting a CAGR of 10.31%.

The benefits of beekeeping are multifold - the farmers earn income through the sale of products and the fruit/crop productivity increases due to pollination. Additionally, honeybees have helped mankind in maintaining biological diversity through hybrid vigour by cross pollination and have prevented several numbers of botanical sources from extinction by providing free ecosystem services in the form of cross pollination and propagation of many cultivated and wild plants. In our country, over 80 crops, mainly oil seeds, pulse, fodder seed, vegetables, fruits and commercial crops are benefitted by the honeybees.

Key aspects of Beekeeping

- Beekeeping can be started in any season, but generally, honeybees like warm weather and thus, spring season is considered to be the right season to begin since the flowering of plants also starts in this period.
- The place selected for beekeeping should be dry, since high levels of moisture affect bee flying and honey ripening. A natural or artificial source of water at the site is necessary. Also, the beehive can be set under the shade of trees, or artificial arrangements can be constructed to provide shade.
- It is advisable to establish a bee colony in areas with at least a 10% flower area.
- The farmer needs to gain requisite technical knowledge and experience for beekeeping.
- The two techniques of beekeeping are Traditional Bee Farming and Modern Honeybee Farming.

Government Schemes

To promote beekeeping, the Government has launched various schemes, both at national and State level. The Government schemes for beekeeping are as follows:

- KVIC Schemes¹⁸.
- National Beekeeping and Honey Mission (NBHM)¹⁹.
- Department of Horticulture, Himachal Pradesh Schemes²⁰.

Training on Beekeeping

The Cluster farmers and CHPMA members will be trained on beekeeping, which will be done by undertaking a training program for 5 to 7 days.

- The training program will serve the purpose of imparting training to prospective beginners and giving skill upgradation, extension services to beekeepers / farmers in honeybee breeding, queen rearing, encouraging migration of bee colonies, recognizing bee diseases, disseminating technologies for pollen, propolis royal jelly collection.
- The training will provide management of bee colonies, pest and disease management of bees and cultivation of nectar plants for the year-round production of honey.
- The training will also strive to establish entrepreneurial development models to meet the increasing demand of honeybees for pollination purposes.

A detailed note on beekeeping is attached at [Annexure 2.5](#).

¹⁸ <https://msme.gov.in/sites/default/files/Beekeeping.pdf>

¹⁹ <http://midh.gov.in/PDF/Guidelines%20NBHM.pdf>

²⁰ http://www.hpensis.nic.in/Database/musroom_beekeeping_4681.aspx

4.4.6. Promotion and training on organic fertilizers

Organic fertilizers provide natural carbon essential for improving and sustaining the physical, chemical and biological properties of the soil under continuous and intensive cultivation. Increasing the use of organic fertilizer presents opportunities to manage public waste and greenhouse gas emissions through controlled decomposition.²¹

Organic fertilizer can be produced from organic materials that include farmyard manure (FYM), animal waste, organic waste, crop residue, decomposed plants or vegetables, and other. The most common raw material used for the production is animal manure. Manure and compost supply many macro and micronutrients thereby improving the soil structure. Organic manure is prepared from organic matter through the microbial conversion process. Prepared organic fertilizer is free from foul smell, weeds, and free from inorganic substances such as glass, plastic.²²

The global organic fertilizer market is projected to reach around **US\$ 12.5 billion by the end of 2027, in terms of revenue, growing at CAGR of 7.2% during the forecast period (2019-2027).**²³

Enriched composting can be prepared in RCC pits, kachha pits by adding crop residues, loppings or prunings, dry leaves and weeds at farm. Addition of Azotobacter and PSB inoculation further enrich the rock phosphate and its biodegradable structure. A layer of cow dung slurry is added after 6 to 8-inch layer of materials. By adopting this technology waste can be converted into valuable product.

Figure 37: Advantages of organic fertilizers



²¹ [Organic fertilizer use by smallholder farmers: typology of management approaches in northern Ghana | Renewable Agriculture and Food Systems | Cambridge Core](#)

²² [Organic Fertilizer Production Project Report, Cost, Profits | Agri Farming](#)

²³ [Organic Fertilizer Market Size, Trends And Forecast To 2027 \(coherentmarketinsights.com\)](#)

Vermicomposting can be prepared in RCC pits or in turpoline pits or beneath the tree. Care should be taken to never add earthworms in fresh cow dung and maintain moisture at about 70% level. Add earthworms @ 1 kg to a heap of 1-meter long 1 meter wide and height should not be more than 2.5 feet. Watering is to be done after 3 or 4 days regularly till it is ready for harvesting. Conversion ratio is about 45 to 50%. A dose of 10 to 30 kg per plant is to be added.

Ghanjeva amrit can be prepared on pucca floor under shade from fresh cow dung. As it starts drying it is to be bitten with wooden mortar so that fine materials can be prepared. In fruit plants it is to be added @ 1 to 3 kg depending on age of Plant. Bioformulations can be prepared by adding leaves of three four shrubs or trees having anti-insecticidal or fungal properties such as Neema, Dreka, Papaya, Annar, Ipomea etc. available near the farm. After chopping these are to be added in cow urine and a product is prepared. Use the solutions @ 250 to 1 liter in knap sack sprayer. Five to six days old khatti Lassi after dilution in water (5 in 100 litre) can be used to control fungal diseases.

Marketing of these products

All the products after use can be sold to local farmers or may be supplied at long distance.

Government Support in Promotion of Organic Fertilizers

All India Coordinated Research Project on ‘**Long Term Fertilizer Experiments**’ of Indian Council of Agriculture Research (ICAR) over five decades at fixed sites have indicated that continuous use of nitrogenous fertilizer alone had deleterious effect on soil health and crop productivity showing deficiencies of other major and micro-nutrients.

Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development in North-East Region (MOVCDNER) since 2015-16. Under these schemes, farmers are primarily encouraged to adopt organic cultivation using various organic inputs including organic fertilizers and provided end to end from production to marketing of organic produce. Hands-on-training to farmers about on-farm production of organic fertilizers and its use are integral part of these schemes.²⁴

National Project on Organic Farming (NPOF) was implemented as a pilot project during latter half of 10th Plan subsuming “**National Project on Use and Development of Bio-fertilizers**”

²⁴ <https://pib.gov.in/PressReleasePage.aspx?PRID=1808187>

4.4.7. CHPMA

CHPMA Cooperative Societies will be registered under the Himachal Pradesh Cooperative Society Act, 1968. Every CHPMA Cooperative will have its General Body and a Management Committee of elected representatives of CHPMA. To elect the members, the GoC will be divided into different wards and one representative from each ward will be elected as per provision of Himachal Pradesh Cooperative Society Act, 1968. The CHPMA Cooperatives will have a minimum of 100 Project beneficiaries from different Clusters. These cooperatives will have a mandate of “Collective Production and Collective Marketing” of agricultural produce, focusing on sub-tropical fruits. The CHPMA Cooperatives will further form a CHPMA Apex at State level to take their business activities in a wider spectrum.

The capacities of CHPMA members will be developed to sustainably operate and maintain the infrastructure and facilities that are proposed to be created under the Project for production, storage, processing and marketing. The CHMPAs will provide employment opportunities for Cluster members by undertaking various supportive business activities, in addition to production and marketing of fruit produce.

Community Horticulture Production and Marketing Associations (CHPMAs) are Cluster-based associations that are formed under the Himachal Pradesh Cooperative Society Act (1968). The CHPMAs will have a minimum of 200 households in a Group of Clusters, termed as Zones.²⁵ To improve productivity of sub-tropical fruit crops in the State, the Project envisages to adopt a Cluster approach with drip irrigation and proven high-density plantation technologies. Majority of the Project initiatives and activities will be undertaken at Cluster level. The Project activities at Cluster level will be carried out jointly by the DoH and JSV.

The Project will build the capacity of the CHPMAs to sustainably manage the infrastructure that will be developed under the Project for production, storage, processing and marketing. The CHMPAs will provide employment opportunities for Cluster members in management, administrative and technical roles associated farmers by undertaking various other business activities to provide services to the farmers. Various steps involved in formation and development of CHPMA Cooperative Societies are depicted in the figure below.

²⁵ Zones – Zones are group of clusters that will be created for the formation of cooperatives. Various factors for the formation of the zones are to be considered. Continuity of the clusters, availability of a minimum of 200 eligible project beneficiaries/Households, who can become members of cooperative, Geographical area (within a radius of 5-10 km), logistical convenience, etc.

Figure 38: Various steps of CHPMA Cooperative Society Development



Roles & Responsibilities of CHPMA

To enhance productivity of sub-tropical fruit crops in the State, the Project envisages to adopt a Cluster approach with drip irrigation and proven high-density plantation technologies.

- Collectivization of strategy.
- Making an agreement/MoU between the farmers and the Department of Horticulture.
- Formation and development of CHPMA cooperative society.
- Assisting technical teams deputed/hired by the PMU, HPSHIVA and District Implementation Units (DIUs) in doing the participatory survey.
- Formation of Cluster development plan. CHPMA will support an Expert Team/Firm deputed/hired by the PMU and prepare Cluster development plans. A separate plan for each Cluster will be developed outlining various activities to be undertaken at Cluster level.
- Capacity building and to generate awareness amongst the farmers. In order to generate awareness, awareness camps and meetings shall be organized under the Project to generate awareness among the potential members of the CHPMA Cooperative Societies and the other farmers of the nearby areas on mainly two aspects: (i) potential of sub-tropical horticulture and (ii) objectives and targets of the Project.

- Facilitation in making farmer's field by assisting PMU to make necessary facilitation through DIUs for preparation of beds/fields for plantation of fruit plants as per Cluster development plan.
- CHPMA will help in selection of suitable crop. PMU, HPSHIVA shall depute experts/firms for selection of suitable crops and varieties, on the basis of ecological parameters, such as aspect and topography, climatic conditions, soil, drainage and availability of irrigation water, etc.
- Suitable fruit plants based on the soil and other environmental factors will be provided to the farmers through the concerned DIUs. CHPMA Cooperative Society will provide guidance and support and facilitate in making necessary arrangements for protection of fruit plants.
- The CHPMA Cooperative Society/Farmers will facilitate in arranging land for construction of the field level water supply tanks. No acquisition of land will be done for construction of such tanks and the members of the CHPMA Group shall have provide their land for the purpose.
- To ensure water conservation and to efficiently utilize the available water, the PMU shall establish drip irrigation system in every Cluster through DIUs/BIUs. The drip irrigation system shall be handed over to the CHPMA Producer Group/ WUA after completion of the testing of the system and thereafter, the CHPMA Producer Group/WUA shall be responsible for operation and maintenance of the drip irrigation system in their Cluster.
- Multi Stake Holder Network will be created at district level and also at the State level. The Multi stakeholders will include Department of Cooperatives, JSV, buyers, marketing organizations, traders, input suppliers, technical institutions (Krishi Vigyan Kendra's-KVKs and Universities), financial institutions, insurance companies, Mandi's/ HPMC/APMC, relevant central and State government institutions and relevant NGOs/Community Institutions, etc.
- Development of infrastructure facilities for PHM and marketing of fruits in the Cluster/group of Clusters is being made by the PMU/DIUs under the Project. Suitable locations in the Clusters/group of Clusters for construction of Collection Centers, Storage Units (cold storage/CA store), Ripening Chambers, Precooling Units, Integrated Facility Centers, etc. to fulfill the needs of the producers are being identified. CHPMA Cooperative Societies will be instrumental in finding out suitable locations and also in getting the land available for the proposed infrastructure facilities. In addition, the provisions of support for grading, packaging, value addition and retail outlets for selling of fruits, etc. to the farmers/CHPMA Cooperative Societies are being incorporated.

4.5. Output 3

4.5.1. Introduction

Production of subtropical fruits in the State has been traditionally insignificant compared to Apples in the State and also in comparison with the production volumes in rest of the country. The Project recognizes that the steep growth in production of various subtropical fruits will require specific interventions to enable farmers find markets.

By the nature of seasonality in agri, when farmers hit the market, supply in most of the agri/horti commodities out match the market demand, and the perishability factor further accentuates the desperation of the farmers in finding customers soonest upon harvest, thereby the farmers wield limited bargaining power. The multi layered traditional marketing channel involves multiple physical handlings resulting in high quality losses besides the high intermediation costs involved, cost of such inefficiencies discounted in the price offered to the farmers, who have limited options and hence accepts offer available.

Table below presents the margins and costs for Citrus in the report on Value Chain by EY, conveys the situation. Channel A being direct from farmer to consumer, B and C are trade to local traders. It may be noted that the commissions and margins of trade works out to about 74% of the farmer realization, an equal damage on account of costs, some part of it could be saved. There is scope for reducing intermediation margins and saving expenses by shortening the supply chain systems combined with suitable transport systems with reducing multiplicity of transshipments to reduce spoilage. Thereby, the earnings of the farmer could be improved by a minimum of one fifth the traditional trade levels.

Table 27: Marketing efficiency of Citrus among different marketing channels

S. No.	Particular	Channel A	Channel B	Channel C
1.	Farmer's Price	40.00	30.00	28.00
2.	Marketing cost	15.00	22.47	21.33
3.	Marketing Margin	0.00	14.03	20.67
4.	Marketing efficiency	2.67	0.82	0.67

A farmer owned marketing channel can shorten the supply chain retaining only essential trade intermediary reducing the trade margins converting into higher earnings for the farmers. This would compel the trade fraternity to be more efficient in their processes and improve their price to farmers, Traders would be required to be more efficient in their operations to minimize spoilage in transit,

as all inefficiencies hitherto factored in the price given to the farmers would not be possible.

In the past, the State has seen aspirations of farmers in uniting and servicing their consumers directly have met with success largely, however, have faced issues in scaling and sustaining over long period of time. Lahaul Potato Society (LPS) is one such instance, the professional management was not adequately developed with process driven management with necessary control systems maintaining checks and balances, without compromising on delegation of authority needed for quick decision making. LPS could have set itself a greater vision of growing its operations, easily have leveraged its advantages of an early mover to become a major marketeer of a wide range of produce from the region besides potato, Garlic and others.

The intent of the farmer in owning their marketing organization has been successfully realized in the case of dairy sector under the co-op mode of farmer collectives, as also in the case of LPS for potatoes for some period. One of the key differentiating aspects could be the strength of the professional organization in AMUL vis-à-vis LPS, explaining the difference in stature of the two coops which set out nearly at the same time.

Therefore, Output 3 shall focus on developing an Apex marketing organization, implementing commodity wise action plan at Cluster, for ensuring that the entire produce for disposal is effectively marketed at the best realizable price, besides take overall responsibility for efficient supply chain management.

4.5.2. Approach under the Project

As has been noted, efforts of farmers at finding their markets on their own has been happening under various formats of farmer collectives across the country. The approach proposed under the Project is to create a business centric organization, operationally efficient and a competitive market player. In achieving this, the proposed structure would be one of layered, minimal in bureaucracy and a dynamic result oriented flat business organization. Primary object of the Organization would be to ensure evacuation of entire produce into the relevant markets, developing marketing systems to maximize share of market value for the farmers and also reduce post-harvest losses.

Key deliverables of the Business Organization shall be

- Develop and implement the market development plans for the value chains of interest to the Project and also the major horticultural items produced in the geography.

- Set targets to progressively improve the value realization of produce of the farmers, business strategies developed and implemented to achieve this.
- Development of e-commerce portal, market Intelligence management, build brand image positioning the FPC as fair-trade organization and supplier of safe to consume with necessary QA systems.
- Inventory and supplies projections and management of trade settlements.
- Multi stakeholder network operationalization for public-private-producer partnerships identifying market needs and business opportunities.
- Develop annual plan and execute business strategies achieving targeted revenues and profitability, to be self-sustaining and be capable of achieving a larger vision of agribusiness house for horticultural produce of the State.
- Integrate goals for adoption of best practices in farming, traceability systems, harvest and post-harvest as part of business goals, delivering quality produce in sync with the market needs.
- Through trainings, develop appreciation of members of CHPMA Societies on quality grading, branding, traceability, certification, business planning and financial management.
- Appropriately promote value addition facility development at the community, Agro-enterprise. Cluster level facilities may include post-harvest handling, primary processing and storage, and packaging, working in coordination with the concerned Society.
- Deploy necessary IT tools in managing the processes both internal and interacting stakeholders of the business.
- Evolve into a perpetual business organization.

Produce to be Covered

FPC is promoted with the main intent of developing marketing channel for the output of new plantations under the Project, however, considering the large quantum of vegetables which are produced in the seven districts being covered, marketing of vegetables would also be taken up by the FPC. Those vegetables which are predominantly marketed outside the State would be considered. FPC may consider expanding produce range based on the needs of the farmers of the seven districts and business considerations.

Scope of Services of FPC

Some of the activities of the FPC would be as follows grouped under four focus areas:

- **Development of Marketing Channels**
 - Operations would include Virtual markets for connecting national buyers and also physical markets as required under license for private markets.

- Trade arrangements with private e-market/e B2B/2C online players across the country under a MOU, conduct trade, deliveries and payments, coordinate all necessary activities just as any trade intermediary would do.
 - Serve as a back-end organizer and logistics manager for B2B/2C online players across the country, eliminating need for their own supply chain which comes with additional fixed cost.
 - Promote direct sale to major wholesalers across the country, through third party online and offline channels, FPC offers guarantee for delivery, securing payments through a suitable real time margin monitoring system.
 - To penetrate markets directly, FPC would also consider the option of stocking and selling to wholesalers/large buyers in key cities, either under an arrangement or set up its own stocking operation.
 - Establish a quality assurance system for inspection of any problematic consignment of remote buyers to ensure that any genuine issue is settled in time, as also controlling bogus quality claims.
 - Enter into contractual agreements for providing national logistics services through third party service providers.
 - Establish MOUs with agencies offering cost effective testing of residue levels of produce, and also other parameters to establish the quality of fruits, in support of the brand campaign offering safe to consume.
 - Organising sale of C grade fruits to HPMC and other private processors.
- **Store and Sell**
 - Unlike apples, there being a steady stream of supplies of subtropical fruits, storing for months would not make a business case.
 - If a business case exists, FPC can hire Cold stores in metros, for store n sell opportunities.
- **Centralized Agri input and Extension Services**
 - FPC shall consolidate item wise requirements of the Societies at periodic intervals adequately in advance considering the lead time for timely delivery to the farmers. Light farm machinery, tools and equipment shall also be part of the supplies.
 - FPC will negotiate with manufacturers for bargain prices as the procurement shall be in bulk quantities.
 - MOU with the agri input supply companies shall also include provision of technical guidance on use of the agri inputs and technology, as appropriate, specifically for practices to ensure food safety.
- **Corporate and Financial Services**
 - Develop a common accounting and management control systems for implementation by the participating Societies.

- Provide support to the societies in book-keeping and generation of periodic reports for meeting compliance requirements of societies.
- Consolidate financial services needs of the societies, negotiate with institutions to service their needs on a timely manner.

Legal Structure and Arrangement

The CHPMA Cooperative societies (Society) formed at the GoC level shall be the promoters of HPSHIVA Farmers Producer Company (FPC). An FPC under Companies Act, presently enjoys a tax holiday available for 10 years being the most attractive aspect, hence the apex body is to be registered as a FPC under sec 581 of the Companies Act, by virtue of which the shareholders can be only farmers or farmer institutions. CHPMA, being a farmer institution under coop societies act, can be shareholders of FPC, with the approval from the Registrar of Coops of the State.

4.5.3. Governance

The governance process and norms as per the relevant sections applicable for FPCs under the Companies Act shall apply. Aspects of eligibility for owning shares, new shareholders induction, cancellation and transfer of shares, policy for representation of shareholders on the Board, appointment/rotation/retirement of directors/ chairman, limits on perks and benefits of board members/Chairman, capital investment policy, surplus distribution policy shall be part of the Articles and Memorandum, which shall be through a process of consultation. Other aspects of composition and functions of various committees, defining financial limits/authority across levels in the organisation, planning, review and approval of operating plans, other related governance matters could be suitably included in the role of a Board Sub-committee for more active contribution by Directors in the management of the company. Just as any company, this FPC shall also be led by its Board of Directors and management responsible for delivery of results.

In support of building an institution that could stand the test of time, and also to make it absolutely inclusive with equal opportunity for anyone to play leadership roles, the Memorandum and Articles of Association could provide for specific provisions to ensure broad based leadership based on democratic principles.

Considering the public significance of the role to be played by the FPC, there could be nominee directors from the Horticulture Department and any other agencies on the Board of FPC. In addition, a Multi Stakeholder Consultative Committee to be Chaired by the Secretary Horticulture and nominees drawn from Irrigation, NABARD, Commercial Banks, other stakeholders is

recommended, details of the role to be played shall be detailed in a subsequent document. With a view to keep governance to the minimal, there is no proposal to establish additional bodies at District or Taluka levels, considering that the FPC is a business entity, and it needs to stay focused on delivery of its targets and performance.

4.5.4. FPC Organization

FPC shall be managed by a team of professionals, with Head office at Bilaspur or any other suitable location, supply chain & related executives stationed across the Clusters in the districts, similarly the sales teams to be based in key markets across the country.

The CEO would be a competent professional, with leadership qualities to motivate and lead the professionals and equally be able to connect with the FPC Directors, Society trustees in building trust and confidence, therefore is ideal to have a person native to the State who would share the spirit of this initiative with passion and commitment to succeed. Therefore, the choice of the first CEO is most critical; one possible choice could be a native of the State retired from leadership positions in the services and someone with flair for farming and agribusiness. The position could also be rotated initially after 5 years, then reduced to 3 years after the organization stabilizes. The policy of rotation of CEO is considered essential to build an institution that goes beyond the identity of one single person and besides the advantage of every new CEO working towards setting higher standards of performance and achievement.

The CEO to be supported by a team of professionals with relevant experience and qualifications, to lead specific functions such as Supply Chain, Business Development, Quality Assurance, Training, Finance and HR. Organization shall be suitably staffed in each of the functions to service the Clusters, maintain infrastructures and coordinate supply chain activities, so also at the market end in building customer base across key national markets based on the demands of the marketing strategy.

Proposed organization by year 4 is shown in the figure below:

Figure 39 Organization chart of APEX Body

MD & CEO					
Designation	Finance/ Accts/ HR	Supply Chain	Quality Assurance and Training	Business Development	Planned Head Count
HOD	1 HQ	1 HQ		1 HQ	3
Manager	1 HQ	Coordination (1) Cluster Mgt (2) Dist	QA -Fruits HQ	Online/Export (1) Traditional Trade (1) HQ	7
Dy Manager	4 HQ (2) Dist (2)	Operations & Logistics (2) Cluster Management (5) HQ (2) Dists (5)	QA - Veg HQ	Buyer Relations (4) Marketing (2) HQ (2) All India (4)	16
Executive	10 HQ (3) Dist (7)	1 per 200 ha (50) Taluk/Cluster level	3 Post harvest / Training Executive (3)	8 MktIntel and Planning (2) Markets All India (6)	71
	16	59	5	17	98

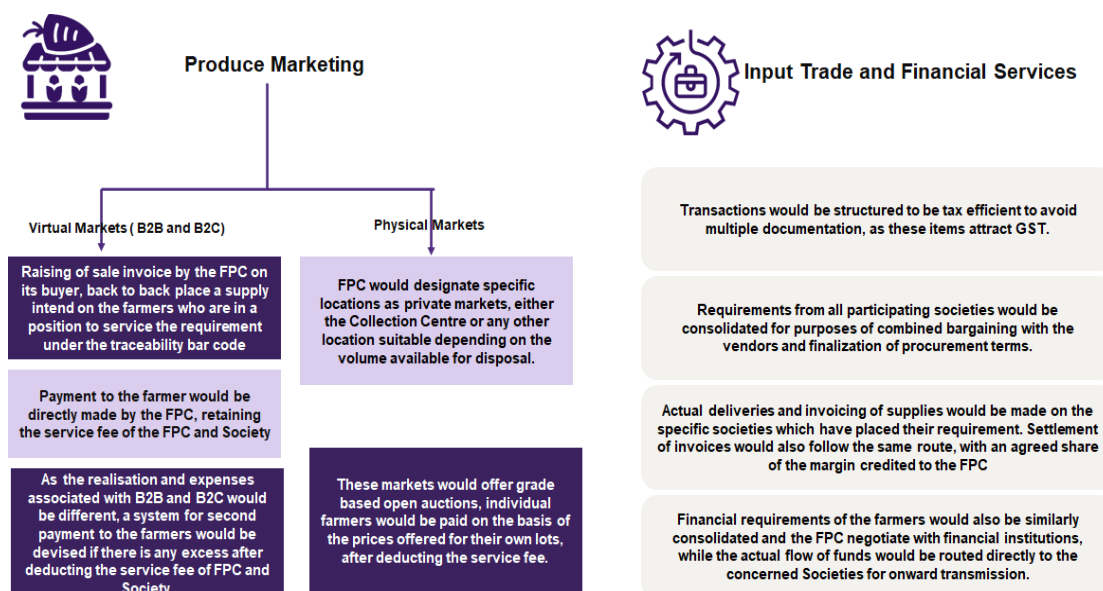
4.5.5. Society Organisation

As regards marketing, Society shall play limited role in order sourcing and mobilization, as the entire process shall be managed centrally by FPC, through its teams at the Cluster and district level. Society shall play a key role in membership enrollment, building relationship amongst the Cluster members, managing financial services for members in need of assistance, consolidate member requirement of agri inputs, facilitate capacity building on aspects of production, quality, post-harvest practices and so on. Senior managers from FPC will closely work with the teams at the Society for a synchronized performance and delivery of results.

The Societies shall have a minimal organizational staff of 4 head count to handle the affairs of each society, however, the concerned teams in FPC shall provide guidance to the Society teams.

The working arrangement between the FPC and Society(ies) shall be akin to the private sector relationship between the Corporate Head Office and the Branch offices, working towards a common business goal under a well-orchestrated strategy. Each of the Societies would earn their share of the revenue for the services rendered by it in the trade value chain operations.

4.5.6. Transaction Structuring



Proposed Aggregation supply chain Infrastructure

Proper sorting and grading at the Cluster level are essential to build a reliable supply chain, obviating further need for physical handling of the fruits, as the packed fruits would be to a specific standard fit for delivery direct to customers or markets. Integrated Facility would serve as transshipment and aggregation for dispatch in high-capacity trucks to distant locations. These facilities can also serve as short term storages, serve as marketplaces for conducting physical and electronic auctions for traders. High and medium quality fruits are taken by markets for sale as fresh fruits, only rejects often in grade C fruits would be taken by the fruit processing units in the State and outside. Considering that even in the long run, the production in the State would continue to be small in comparison to rest of the country, Project does not plan to invest in development of fruit processing facilities. FPC would collaborate with the State owned HPMC in providing competitive sourcing support for grade C fruits and look for opportunities in the private sector as well.

Infrastructure	Nos
Collection Centre (1 per CHPMA Society) for aggregation Agri-Services Warehouse with pickup van facility.	60
Integrated Facility Centre (1 per 1000-1500 ha/ 1 per 100 - 150 Cluster) for sorting, grading, packing, labelling, testing, etc. with reefer van.	13

Business Plan of FPC

- FPC shall begin its operations from the first year of the Project, beginning its marketing services with major vegetables from in the seven designated districts of the Project. In a variety of vegetables, the Project area accounts for over 65% of the State production and hence is of importance to the farmers of the Project area. Besides, the experience would also benefit the FPC organization and gearing up its trade models before the plantations come to fruiting.
- Revenue projections of FOC have been made on the above basis, and the new production growth as the area expands.
- Assumptions of share of produce is modest in vegetables, and in the case of tropical fruits, the share of FPC marketed tapers from 100% in the initial years when the volumes are low to gradually dropping to 70% when production stabilizes.
- Assumptions of wholesale prices are taken at constant current wholesale prices.
- Volume and revenue growth projections for produce marketed is tabulated below.:

	Value Projection (INR Lakhs) to be Marketed by FPC							
	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31
Year	1	2	3	4	5	6	7	8
Sweet Orange	-	-	1,435	3,181	5,596	8,418	11,216	15,903
Guava	-	-	1,298	2,876	5,060	7,611	10,141	14,379
Pomegranate	-	-	742	1,644	2,892	4,351	5,797	8,219
Litchi	-	-	-	-	162	574	1,129	2,134
Persimmon	-	-	90	199	350	526	701	994
Plum	-	-	-	26	73	151	265	464
Mango	-	-	-	61	151	245	387	550
Pecan nut	-	-	-	-	16	47	84	153
Fruits	-	-	3,563	7,985	14,299	21,922	29,719	42,795
Vegetables	1,674	5,576	13,380	24,524	28,410	28,410	28,410	28,410
Total	1,674	5,576	16,944	32,509	42,709	50,331	58,129	71,205

- Based on a service fee of 2% for the FPC and 1% for the Society, the projected service fee earnings are tabulated below:

		23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31
INR Lakhs		1	2	3	4	5	6	7	8
FPO service Fees	2%	33	112	339	650	854	1,007	1,163	1,424
Society Fee	1%	17	56	169	325	427	503	581	712

- It is to be noted that the FPC and Society would earn as high as 15% of the trade value in Agri inputs to be supplied to the farmers in various Clusters, an estimate being worked out. As a ballpark estimate, it can be estimated that the FPO could earn a matching contribution as shown above.
- The head count of the FPC is projected to start with 11 in the first year and peak at 98 by year 4, as also the cost of manpower which is projected at INR 1.08 crore in year 1, moving to INR 5.60 crore by year 5.
- Considering that the major head of expenses is the manpower cost, the service from marketing of outputs as shown above and the additional revenues from distribution of Agri inputs by year 4 could result in a positive cash flow.
- Project support to FPC is estimated at INR 12 crore, as follows:
 - Manpower cost of the organization for the first 3 years, which is estimated at INR 8 crore.
 - Initial Capitalization for working capital estimated at INR 2 crore.
 - Capex for office set up, equipment and technology support estimated at INR 2 crore.
 - Provisions for capacity building, exhibitions, development of BCT based traceability and related systems are budgeted under the Project support, hence not listed herein.
- Project funding to FPC shall be by way of grant of INR 12 crore, phased over three years, which would be INR 3 crore in the first year, another INR 4.70 crore in second year and INR 4.30 crore in the third year.
- FPC shall be asset light, managing the infrastructures developed in the Project for its operations, under suitable arrangements.

4.5.7. Upgradation of existing processing units

As per estimated postharvest losses (18-25%) of fruits and vegetables, the State suffers losses of at least INR 1 crore per year due to lack of proper infrastructure and poor postharvest management. By up-gradation of units and involving all its Processing-cum-Training Centers (PTCs) in the procurement of market surplus small quantities of fruits and vegetables of the local farmers will help to save the losses estimating INR 7.92 crore per year by curtailing 20% of postharvest losses.

There are 8 fruit processing units of the DoH and the Project aims to upgrade 3 units out of these 8 units. The machinery technology currently being used in these units have become obsolete and needs modernisation. The Sale Counters which are located in the units are not efficient enough to deal with mass processing. The Community Canning Service building infrastructure is not up to the desired standard. At present, there are five satellite centers under these units called) which require some upgradation and also require an addition of office-cum-residences for the staff. This units aim to serve the public by carrying out the following tasks: -

- Processing of farmer's market surplus produce (fruits and vegetables) into processed products and sell their product through their own sale shops.
- Providing community canning services whereby farmers get their produce processed into various products on nominal charges for their own consumption and
- Training on preservation to farmers, entrepreneurs, and in-plant training to students.

The PTCs also provide CCS and training services to the farmers. A proposal has been made to enhance capacity of one unit from present 120 MT to 200 MT per annum. This will assist the farmers in processing their market surplus produce which will going to increase as a result of number of Clusters of different fruits being established under HPSHIVA and HPHDP projects. The PTCs will also serve as 'Collection Centers' where the collected produce will be converted into semi-finished products and subsequently will be processed into final products in the main processing plant. In addition, the up-graded fruit processing plants will help in increase in the range of quality processed products, food sample analysis facilities, which will in turn lead to increased income of the farming community, employment generation. This shall also include setting up of ideal training center for the in-plant training for the students of Agriculture, Food technology etc. from various institutions.

4.5.8. Incubation and Training Centre

Under the Project an incubation and training centre named as 'HPSHIVA Incubation and Training Centre' shall be set up with the overall objective of providing capacity building and technical support to the farmers, CHPMAs, WUAs and other key stakeholders such as officials of DoH and JSV on subtropical horticultural crops. The proposed centre shall have the following:

- Demonstration farms for sub-tropical horticulture.
- State of art training facilities including latest modern technologies.
- R&D lab.
- Incubation centre for CHPMAs and FPOs.
- Farmer's accommodation and exhibition area.

The responsibilities of the centre shall include the following:

- Promote sub-tropical horticulture value chains.
- Promotion of good agricultural practices amongst the farmers.
- Promotion of producer groups and entities like FPOs, FPCs and CHMPA's
- Capacity building on improved packaging, handling and post-harvest management practices.
- Building of educational institution and research facilities to impart knowledge about various horticultural crops to the farmers and educate them about the production techniques, improving crop quality, processed product development, etc.
- Promotion of new innovative technologies across post-harvest, value addition, traceability etc.
- Support for training, demonstration of food processing, value addition and development of new products.
- Provide training to both farmers as well as the employees of DoH for the management of post-harvest.
- Serve as a centre for idea generation, pre and post investment incubation services for opportunities in horticulture sub sector as also other related sub sectors of Agriculture.
- Carrying out demonstrations of various horticultural and other relevant crops in order to promote the latest agricultural practices. This will act as a tool to do applied research on agricultural technologies & undertake trials before their transfer to farmers and these demonstrative plots will developed by the assistance of various horticulture university.
- Provide innovative extension activities, technology assessment & refinement by conducting various activities like kisan mela, study trips, setting up of community radio talk shows, etc.
- Launch of various programs and activities to create an entrepreneurial ecosystem and encouraging youth and women participation.

5. Environmental and Social Impact Assessments

5.1. Environmental Impact Assessment

5.1.1. Introduction

As the Project involves civil works activities for establishing/ expanding/ rehabilitating irrigation schemes and land/ site preparation for horticulture development, solar fencing and installing drip irrigation systems, which could lead to minor to moderate adverse environmental impacts, a rapid environmental impact assessment (REIA) has been carried out following ADB's REIA screening checklist. For the current 4,000 ha being designed, there are 290 horticulture plantation Clusters and 190 irrigation schemes. Thus, REIA has been conducted for sample strategic sites that give a detailed understanding of all probable impacts that may occur due to proposed Project activities. The impact assessment study addresses the environmental regulatory requirements of the State and the country as well as the environmental safeguard requirements of the ADB. Herein a summary of the detailed assessment has been presented.

The assessment has been carried out through a review of Project documents, field visits, and detailed discussion with DOI and DOH, CHPMA, farmer-beneficiaries and other sector experts. A screening checklist was prepared following ADB's REA checklist adopted to conduct the initial screening (see Appendix 1). As per a detailed assessment of operational PRF Clusters, the functional irrigation schemes, and a detailed study of Project design documents as well as applicable relevant environmental national and State laws/ regulations, it is concluded that some of the Project activities may adversely impact the surrounding environment at a moderate level. Thus, the project has been categorized as a Category B Project as per ADB's SPS policy document, 2009.

The following list of Project activities that have been considered while assessing the environmental impacts and thereby arriving at environmental mitigation and monitoring plan as in the Table below:

Table 28: Project activities for assessing environmental impacts

Sl. No.	Project activities
Output 1: Irrigated area expanded and sustainably operated	
1	Intake structure and raw water pump/ Renovation and augmentation of existing irrigation facility.
2	Raw water rising main/ replacement of existing pipeline (if required).

3	Sedimentation tank/ De-siltation of existing tank.
4	Clearwater sump and construction of pump house/ Replacement of pumping machinery for existing infrastructure (if required).
5	Clearwater rising main/ replacement of existing pipeline (if required)
6	Construction of Main Delivery Tank (MDT).
7	Setting of Cluster level tank (prefabricated) (may not require for gravity-based system).
8	Training/ Capacity building: for JSV.
9	Training/ Capacity building: for Water Users Association (WUA) for raise awareness on water use efficiency, waste reduction etc.
10	SCADA and instrumentation.
Output 2: Climate resilient subtropical horticultural production systems adopted	
11	GIS mapping and land management plan.
12	Site clearance.
13	Field preparation.
14	Nursery development.
15	Plantation.
16	Laying of drip within the Cluster.
17	Mulching.
18	Fertigation.
19	Pest control.
20	Intercropping and Bee Keeping.
21	Plant tagging.
22	Solar fencing of the Cluster.
23	Training/ Capacity building: for DoH staffs.
24	Training/ Capacity building: for farmers (CHPMA) on organic fertilizer production or sell.
Output 3: Market access for subtropical horticulture farmers developed	
25	Post-harvest facility at community level including primary storage, packaging, and grading.
26	Integrated Facility Centers including packhouse, processing, cold storage, and packaging facilities at district level. (It will be through convergence of govt. schemes as and when required).

5.1.2. Stakeholder Consultation

The team has conducted extensive consultations with all relevant stakeholders during field visits in the Project preparation process, including the Department of Forest, Irrigation (now JSV), Public Works, and NABARD. The objective of these consultations was to understand the scope of their participation and

sectoral interventions under the Project and the potential social and environmental risks and issues involved. Since the focus of the Project is on marginalized communities, the Project also consulted the disadvantaged and vulnerable people: small and marginal farmers, scheduled castes households, scheduled tribes, women-headed households as well as households designated below the poverty line. These households are more constrained than others to access benefits from the Project and participate more fully in the planning and consultations. Consultations held as part of the Project preparation, including safeguards documents, saw large-scale participation from the communities and these disadvantaged and vulnerable groups. The table below summarizes the institutions and agencies consulted and the engagement topics during the Project preparation.

The Project has also developed a Stakeholder Engagement and Communication Strategy (SCEP), which adopts a systematic, transparent, and participatory approach to stakeholder engagement and information disclosure, mechanism for stakeholder feedback, and implementation of an accessible and responsive grievance redressal mechanism. The SCEP also aims to facilitate stakeholder feedback and engagement on Project design and implementation, including identifying and mitigating environmental and social risks and impacts.

Table 29: Summary of stakeholders and issues discussed

Stakeholders	Main topic discussed
Jal Shakti Vibhag (formerly known as DIPH), Department of Forest, Public Works Department	Goals/objectives the DoH wants to achieve with the project • Tentative design of the Project components to meet the required expectations. • Strategies to achieve the goals. • Monitoring mechanism for the Project. • Implementation arrangement for the Project. • Project preparation timeline and the documentation required, such as the environmental and social management plan, the stakeholder communication and engagement plan and the compliance with gender requirements of the Asian Development Bank. • Feedback mechanism and grievance redressal.
NABARD and FIs	• Consultations on potential synergies and cross-sectoral collaboration on the overlapping issues and the potential inclusion in the Project design. • Area of synergy for improved finance to farmers and entrepreneurs / priority sector lending. • Extension supports to farmers in accessing finance/credit.

Stakeholders	Main topic discussed
Cluster farmers (Male & Female farmers for agriculture, horticulture)	• Project details and possible interventions to improve agriculture/horticulture production, including crops selection. • Key impediments to agriculture/horticulture production. • Existing markets; price and quality of agriculture inputs and requirements. • Input requirements – technical and financial support, access to credit/finance, infrastructure (storage and transport). • Grievance redress mechanism. • Stakeholders' opinion about the Project.
Private sector	• Inputs to the beneficiaries for horticulture value chain development. • Ways to improve product quality and shelf life • Infrastructure requirements – sorting/grading facilities, cold chain.

5.1.3. Adopting Global Best Practices for EIA

- ADB's Irrigation Sub-Sector Guidance note: ADB is committed to achieve the SDGs (Sustainable Development Goals 2015) and to increase its support for irrigation to improve food security. In its guidance note to irrigation sub-sector the key features and risk assessment methodology are well explained which will provide a framework for preparation of EARF.
- World Bank guidance note on Governance in Irrigation and Drainage: This resource book provides guidelines how irrigation governance can help address rural poverty, mitigate climate change and other environmental related impacts. The approach provided in this book can be helpful and used for scheme level diagnosis, organizational restructuring and evaluation and monitoring of small-scale irrigation as well mega irrigation project.
- Besides those mentioned above, IFC's General EHS Guideline and industry specific EHS Guideline for Perennial Crop Production will also referred during preparation of EARF.
- ILO Labor Standard will also be referred for document preparation.

5.1.4. Observations from Field Visit

Field visits were undertaken as part of the preparatory work to understand the current agricultural/ horticulture practices, environmental baseline status, perceptions of key stakeholders about the Project and further assess the need for their capacity building and institutional strengthening. The field visits were followed by stakeholder consultations with primary stakeholders, i.e., the farmer beneficiaries. A detailed survey questionnaire in line with ADB's REIA

screening checklist was prepared to capture the environmental baseline condition, social structures, gender composition and participation in the Cluster formation, climate impacts and anticipated environmental impacts etc. The key understanding from the survey feedback and observations during the Cluster visits are listed below:

Observations for Irrigation Schemes

- Currently functional and to be rehabilitated irrigation schemes are likely to have minimal environmental impact. Operational/ Functional schemes are those which are in working condition and in which water has reached up to delivery tank and some minor repair/ replacement of infrastructure components are envisaged. Existing/ Non-functional schemes are not in working condition and some of the components such as pumps, repair/rehabilitation/augmentation of source, rising main rehabilitation, and replacement of the non-functional pieces of machinery are required. The degree of rehabilitation is scheme specific.
- The new schemes (108) which will be constructed by tapping water from the source to the main delivery tank at the Cluster level will have minor to moderate environmental impacts. The typical activities included are diversion of water, construction of intake structure, site clearance, field preparation, laying of pipeline, construction of main delivery tank (MDT) etc.
- If the water is being tapped from major river sources, i.e., Beas or Sutlej, clearances from BBMB will be required.
- Schemes being developed on rain-fed water streams/canals will require flood protections.
- Laying of pipes will lead to adverse impacts on the land it passes through – at times through forest and private land. Due clearances will be obtained, and all necessary mitigation measures will be applied. The irrigation Department, however, tries to follow standard instruction of avoiding forest and private lands; Land can be brought back to its original status after laying pipes underneath at the sub-surface level.
- The MDT of RCC material will be either next to the Cluster or within the Cluster hence no major impact is anticipated.
- In discussion with all Departments, it has been ensured that all eco-sensitive zones within the 7 districts (as mentioned in the EARF) will be avoided by the Project; The Project will strictly follow the exclusion list and site selection criteria while finalizing the irrigation schemes.

Observations for Horticulture

- Site clearance for Cluster development involves tree felling. The protected category of trees for H.P., prohibited for felling will be abided by. Replantation activities will not be required as tree felling will be restricted to 5/ farmer/ year as mentioned in H.P. Land Preservation Act, 1972 as Amended in Feb 2021.
- Pest after rainy season increases; no pest control measures have been taken during field preparation; Farmers apply pesticides and fertilizers; however, they do not follow management practices to avoid contamination and health issues.
- Construction activities will involve engagement of local labors as well as influx of migrant workers, which may pose safety and security threat; compliance with labor management procedures is suggested.
- Participation of women workers in construction as well as regular activities of Cluster development are also noted. Social issues such as resource partitioning, common access, access to common property resources need to be considered during the Cluster formation.
- Knowledge sharing and training is required regarding the sustainable use of water resources, use of fertilizer and biological control of pests, etc.
- Occupational and community health and safety issues need to be taken care of during construction phase.
- Climate change impact on the proposed interventions need to be considered during designing of new Clusters.
- Due diligence analysis of new irrigation schemes covering design, construction specification, climate and disaster risk assessment needs to be conducted.
- In addition, hydrological and ecological assessment of irrigation schemes needs be conducted to ensure the sustainability of source and downstream impact, if any.

5.1.5. Anticipated Risks and Impact

5.1.5.1. Construction Phase Impact

- **Impact on surface water quality**
New irrigation scheme development involves construction of check dam/ LIS from existing irrigation canal/ small rivulets/ Khud. Construction activities may lead to temporary degradation of surface water quality due to increase in turbidity and chemical contamination from construction materials, this in turn may cause negative impact on aquatic ecology. Runoff from stockpile area may also contaminate the downstream surface water quality. However, this is limited to construction phase only and considering the smaller structure requirement, the distribution of the impact will also be limited.

The functional and non-functional schemes do not have any impact on surface water quality, as in both the cases, the source is already identified, and no new construction is required on river/ canal.

- **Impact due to site clearance and field preparation**

Impact due to site clearance and field preparation during horticulture production are minimal as the existing farmland or barren land will only be considered for this purpose. No major change in land use or topography is anticipated for this purpose. Few trees felling may be required for site clearance purpose, list of protected categories of trees for the State will not be considered for felling.

- **Impact due to pipe-laying activities**

Pipelaying will be done mostly along the existing Row, will not cause any impact on existing infrastructure, no encroachment of land is anticipated for this purpose. Few trees felling may be required for laying of pipeline. Generation of dust, increase noise level, temporary disruption to traffic movement, blockage of access may be anticipated at few cases.

- **Impact due to construction of MDT**

The locational impact due to construction of MDT is minimal, as it will be planned in Government land only, thus no land acquisition is required. No forest land will also be considered for this purpose. The construction activity may have following anticipated impacts:

- Change in land use or topography is not anticipated as the vacant government land will only be considered for this purpose.
- Increase dust level and degradation of ambient air quality is anticipated due to excavation of foundation, stock piling, transportation of material, DG set operation, settling of batching plant, concrete mixer etc. Emission from fuel combustion will also occur during this phase resulting additional degradation of air quality and inducing occupational as well as community health impact.
- Noise, vibration, and emissions will occur due to transportation of materials and operation of machineries.
- Improper management of solid and hazardous waste generated from construction activities may cause impact on nearby surface water quality, soil contamination in adjacent areas. Unplanned disposal of domestic solid waste generated from worker's camp may cause odor and vermin problem.
- Hauling of construction material and equipment may create accessibility issues in the surrounding areas, temporary traffic congestion due to narrow village road.

- **Impacts due to setting of distribution tank and laying of drip within the Cluster**

They are minimal as prefabricated smaller tank will only be considered as design option. Smaller area of land requirement for setting of these tanks will be fulfilled by private land donation, no land acquisition or involuntary displacement is required for this purpose. Laying of drip within Cluster will not cause any impact on surrounding environment.

- **Encroachment to critical habitat, protected forest area, high value area, cultural heritage site**

It will not be anticipated as Cluster located nearby to any such sites will be screened out at planning phase only.

- **Social Impact**

Conflict may be anticipated due to resource partitioning and rational usage of available water. Construction phase impact to nearby community is also anticipated due to temporary traffic congestion, access blockage during pipe laying etc. The construction and in-field land preparation will create opportunities for employment at the local level.

- **Community health issue**

Construction dust, noise, use of local roads for transportation of materials, waste disposal, influx of migrant worker may in turn cause community health issues if not properly mitigated.

- **Occupational health and safety**

Occupational hazard may arise from working in height, during the excavation work and due to movement of construction vehicle. Lack or inadequate use of safety gear may contribute to accidents that may result in trauma and other casualties.

5.1.5.2. Operational Phase

- **Environmental and Natural Resources Management** – Rehabilitation of irrigation schemes will bring significant positive impacts for the rural population and to the environment and natural resources management. Integrated management approach of water ensuring efficiency and best practices will generally contribute to reduction of the loss of natural resources and ensure a sustainable management of the landscape.
- **Socio-economic** – The proposed irrigation schemes will result in a highly positive impact on the rural communities engaged in agriculture. Diversification from existing agricultural practices to high value horticulture production will result in higher incomes and consequently better life conditions. Rehabilitation of access road will improve safety and access to markets reach bringing improvement in livelihoods.
- **Human Health** – Horticulture production will lead to increased use of agrochemicals. Poor handling and application of agrochemicals will increase risks to human health due to exposure to pesticides and chemical fertilizers.

Disposal of hazardous waste may contribute to public health problems. However, use of organic fertilizer and giving emphasis on biological control of pest will reduce the impact.

- **Soil and water pollution** –Use of agrochemicals may adversely affect the soil and water environment due to contamination and leaching.
- **Erosion and water logging** – weak maintenance of irrigation infrastructures may lead to local flooding, inducing soil erosion.
- **Climate change resilience** – Horticulture best practices and the introduction of climate resilient crops will contribute to soil restoration and management, sustainable use of water resources resulting in increasing social and natural resilience.

5.1.6. Correlation of the impacts of Project activities with the environmental attributes

Table 30: Impact of projects activities with environmental attributes

#	Activities	Impacts											
		Surface water	Air quality	Noise quality	Soil conservation	Nutrient management	Solid waste	Pest management	Use of pesticides	Use of fertilizer	Occupational health and safety	Community health and safety	Aquatic ecology
Construction Phase													
•	Initial Survey	✓			✓								
•	Field Preparation				✓								
•	Pipe laying activities		✓	✓									
•	Construction of MDT		✓	✓								✓	
•	Setting up of distribution tank	✓										✓	
•	Laying of drip	✓										✓	
•	Encroachment to critical habitat												
•	Social Impact	✓			✓								
•	Communicational health issue											✓	
•	Occupational health and safety											✓	

#	Activities			Impacts									
		Surface water	Air quality	Noise quality	Soil conservation	Nutrient management	Solid waste	Pest management	Use of pesticides	Use of fertilizer	Occupational health and safety	Community health and safety	Aquatic ecology
Operation phase													
1.	Unit operation activities	✓			✓						✓	✓	
2.	Raw material management		✓	✓	✓							✓	
3.	Product Logistics		✓	✓	✓							✓	
4.	Individual Movement	✓	✓	✓			✓					✓	
5.	Utilization of natural resources	✓	✓	✓	✓							✓	✓

5.1.7. Suggested Mitigation Measures

Table 31: Suggested risk mitigation plan

Impacts	Suggested Measure
Degradation of surface water quality and Watershed Management	Select a construction methodology that is least disturbing, and appropriate for the in-situ site condition, and able to complete the construction work in minimum time. Schedule the construction works during the lean period only and ensure that works is completed before onset of monsoon. Erect temporary barriers/coffer dam to form enclosed construction area with least disturbance. Allow adequate time to settle the solids prior to pumping out water; only clear/clarified water shall be pumped back into the water body/reservoir; any silt laden water should be pumped to a silt pond only. Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies. Avoid/minimize use of fuels, chemicals, and lubricants; ensure no spillage; and have an equipment spill and containment plan on-site. Determine irrigation water requirements of the crop by following best practice guidelines; Maintain a water management logbook to keep the water usage rationale; use drip irrigation technique to avoid evaporation loss; Reduce seepage losses in supply channels by lining them or using closed pipes.
Degradation in ambient air quality	• Comply with the Air Act, 1981 in controlling air pollution from construction activities. • Damp down the soil and any stockpiled material on site by water sprinkling. • Use tarpaulins to cover the loose material (soil, sand, aggregate etc.) when transported by trucks. • Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water and unloading inside the barricaded area. • Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition. • Apply water and maintain soils in a visible damp or crusted condition for temporary stabilization • Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process. • Avoid open burning during land preparation, weed control, and post-harvest treatments; Check PUC

Impacts	Suggested Measure
	status of construction vehicles and machineries; Prohibit burning of pesticide-treated agricultural wastes and by-products. • <u>For pipe laying activities</u> - Barricade the construction area using hard barricades on both sides and provide dust/wind screen; Initiate site clearance and excavation work only after barricading of the site is done; Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area; Limit the stock piling of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area; Undertake the work section wise: 100 – 200 m section should be demarcated and barricaded.
Noise Quality	Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; Horns should not be used in front of hospital and schools unless it is necessary to warn other road users or animals of the vehicle's approach; Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimize sound impact to surrounding sensitive receptor; Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times; use of acoustic DG set; keep the machinery in good working condition;
Soil conservation and Management	Minimize soil compaction, damage, or disturbance by using appropriate land preparation machinery; Replenish soil organic matter by recycling crop residues, compost, and manures.; Employ erosion control management practices; Use flow control valves and diversion channel to reduce erosion.

Impacts	Suggested Measure
Nutrient Management	Use green manures, mulching techniques to maintain soil cover, reduce the loss of nutrients, replenish soil organic matter, capture and/or conserve soil moisture; Draw up balanced fertilizer programs; Conduct periodic soil analysis to detect changes in soil fertility, inform decisions on fertilizer application rates, and avoid unsustainable nutrient depletion and over-fertilization.
Solid waste disposal and management	Prepare and implement a Construction Waste Management Plan, as far as possible utilize the debris and excess soil in construction purpose, avoid stockpiling any excess spoils at the site for long time. Stockpile should not cause any obstruction to natural waterway, If disposal is required, the site shall be selected preferably from barren, infertile lands; site should have located away from residential areas, forests, water bodies and any other sensitive land uses, Domestic solid wastes should be properly segregated in biodegradable and non- biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit at workers' camp sites for disposal of biodegradable waste; non- biodegradable / recyclable material shall be collected separately and sold in the local recycling material market, Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed of in disposal sites approved by PCB, recycle residues and other organic materials by leaving the materials on site or through composting (and spreading); Disperse (or mulch) large vegetative structures.
Pest Management	Identify the main pests affecting crops in the region, assess the risks to the operation, and determine whether a strategy and capacity is in place; apply early-warning mechanisms for pests and diseases; Select resistant varieties and use the cultural and biological control of pests, diseases, and weeds to minimize dependence on pesticide (chemical) control options.
Use and Management of Pesticides	Ensure that any pesticides used are manufactured, formulated, packaged, labeled, handled, stored, disposed of, and applied according to the FAO's International Code of Conduct on Pesticide Management; Do not purchase, store, use, or trade pesticides that fall under the World Health Organization's (WHO) Recommended Classification of Pesticides by Hazard Classes 1a (extremely hazardous) and 1b (highly hazardous) or Class II (moderately hazardous).

Impacts	Suggested Measure
Use of fertilizer	Implement a suitable training program for personnel that are transporting, handling, loading, storing, and applying fertilizers.
Occupational Health and Safety	Develop and implement site-specific occupational health and safety (OHS) Plan and COVID 19 management plan; ensuring all workers are provided with and use personal protective equipment like helmet, gumboot, safety belt, gloves, nose/ face mask and ear plugs; ensure EHS training for all site personnel; documentation of work-related accidents; Secure all installations from unauthorized intrusion and accident risks; Provide supplies of potable drinking water; Ensure moving equipment is outfitted with audible back-up alarms; Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to and easily understood by workers, visitors, and the public as appropriate.
Community Health and Safety	Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency); Enforce strict speed limit (20-30 kilometer per hour or kmph) for playing on unpaved roads, construction tracks; Night-time haulage will be by exception only, as approved by the PMU to minimize driving risk and disturbance to communities; Temporary traffic control (e.g. flagmen) and signs will be provided where necessary to improve safety and provide directions; All drivers will undergo safety and training; Public access to all areas where construction works are on- going will be restricted through the use of barricading and security personnel; Warning signs, blinkers will be attached to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation.

5.1.8. Safeguard Documentation

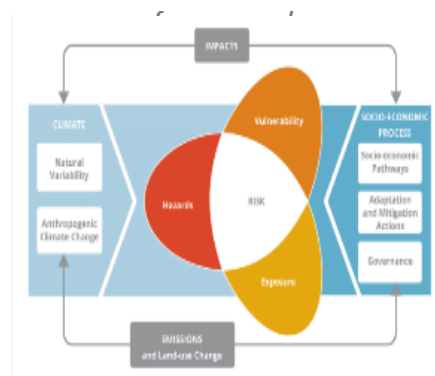
- An EARF is being prepared as a guideline to the borrower on the scope, approach, and results expected for the Project's environmental matters. EARF also provides the framework of an exhaustive list of impacts with recommended mitigation measures and monitoring activities that can be used during the implementor to undertake site-specific IEEs. The choice of Clusters and irrigation schemes will be made through selection criteria to ensure that the Project will not be categorized as A for environmental safeguards. The list of exclusions will also be given in the EARF.
- One IEE Report is being prepared to cover all off-farm macro irrigation-based activities.
- For on-farm activities (i.e., preparation of horticulture fields, solar fencing, and installation of drip irrigation systems) an Environmental Management and Monitoring Plan is being prepared.

5.2. Climate Change Impact

5.2.1. Climate Risk Assessment

The State is located in the northwest part of the Indian Himalayan Region (IHR), with hilly terrain, perennial rivers, and significant forest cover; these renders the State an inherent vulnerability to climate change. The consequences of climate change are expected to critically impact water resources, ecosystem services and agricultural/horticulture dependent rural communities; all of which are critical towards attaining sustainability in the Project initiatives as well as the well-being of the participating farmers.

Figure 40: IPCC AR5 vulnerability assessment



To understand and map the climate risk and thereby design climate-resilient Project components, a detailed Climate Risk Analysis using the IPCC ²⁶ approach defined under Assessment Report 5 (AR5) ²⁷ has been applied (Figure above). This section summarizes the detailed findings on current and projected climate change trends, potential climate hazards, natural resource

²⁶ Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental body of the United Nations responsible for advancing knowledge on human-induced climate change.

²⁷ The SREX and IPCC AR5 vulnerability assessment framework where the risk of climate-related impacts results from the interaction of the climate-related hazards with vulnerability and exposure of human and natural systems (Field et al., 2014; Oppenheimer et al., 2014).

vulnerability and therefore measures adopted for strengthening climate resilience and reducing GHG emissions.

Climate Hazards

The Project districts of the State are prone to various climate-induced hazards including landslides, flash floods, hailstorms, droughts, and forest fires having a different likelihood of occurrence as listed below in Table 1²⁸. Additionally, as per the BIS²⁹ seismic zonation map, the State falls in Zone IV (*High Damage Risk Zone*) and V (*Very High Damage Risk Zone*), making it more susceptible to landslides.

Table 32: Climate Hazard Profile of the Project Districts

Districts	Flash floods	Cloud burst	Landslides	Hailstorms	Droughts	Extreme Rainfall	Forest Fires
Kangra	H – M	H - M	VH	L	H - M	H - M	H - M
Mandi	H – M	H	VH - H	M	H - M	H	M
Hamirpur	M – L	L	M - L	L	M	L	M
Bilaspur	L	--	L	M	M	L	H - M
Solan	L	M	H	L	L	M	L
Sirmour	M	H - M	VH - H	M	M	H	H
Una	H	H	H / L	M	H	M	H / L

VH- Very High, H – High, M – Moderate, L – Low

Source – Himachal Pradesh State Disaster Management Authority

From the above tabular analysis, it is apparent that irrigation schemes to be developed/ rehabilitated under the Project will have high exposure to cloud burst leading to flashfloods and landslides. Similarly, the horticultural fields are likely to get exposed to droughts, hailstorm, extreme rainfall and if near to the forest may also get exposed to forest fires.

Climate Change Trends

The State is rapidly progressing towards achieving high economic growth while ensuring environmental sustainability and addressing the cross-cutting concerns of climate change. The Himachal Pradesh State Strategy & Action Plan on Climate Change, 2021, provides the state-wide and cross-sectoral climate change impact and vulnerability assessment, and formulate adaptation

²⁸ Source – Himachal Pradesh State Disaster Management Authority

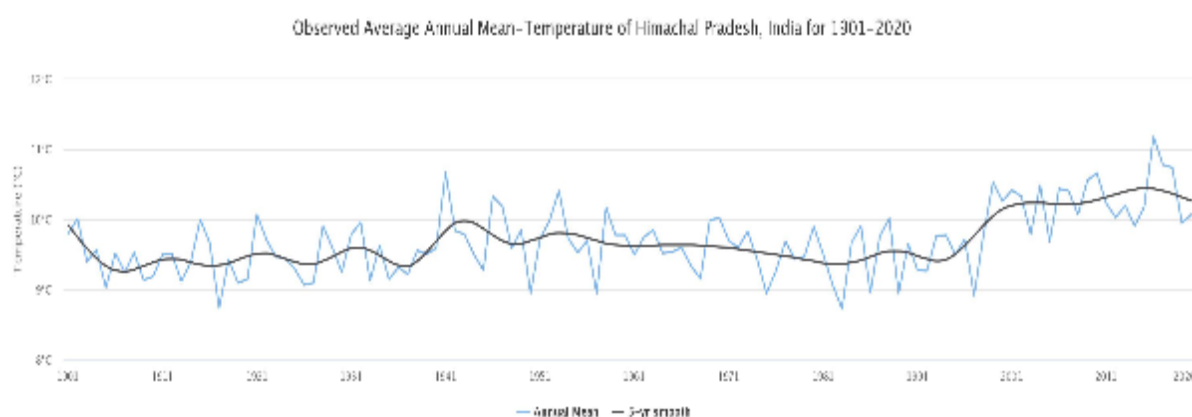
²⁹ Bureau Indian Survey (BIS) seismic zonation map - <https://hpsdma.nic.in/Index1.aspx?lid=1180&lsid=1184&pid=70&lev=3&langid=1>

and mitigation strategies to be carried out by various Departments of the State government.

Temperature

As per latest State action plan on climate change and temperature data trend reported by World Bank's Climate Change Knowledge Portal (CCKP)³⁰, shows that the State has been experiencing increasing trend of temperature in last one century (0.79°C/100 years, see figure below). with significant increasing trend in minimum temperature (1.47°C/100 years) and relatively lower increasing trend (0.31°C/100 years) in maximum temperature. This warming trend is highest during the post-monsoon season (maximum reached 22.07°C) followed by the winter season (7.15°C). Temperature increases in HP have been observed to be more pronounced in daily minimum temperatures than in daily maximum. Increases in both minimum and maximum temperatures have been observed across the majority of the districts.

Figure 41: Observed Average Annual Mean Temperature (1901 - 2020)



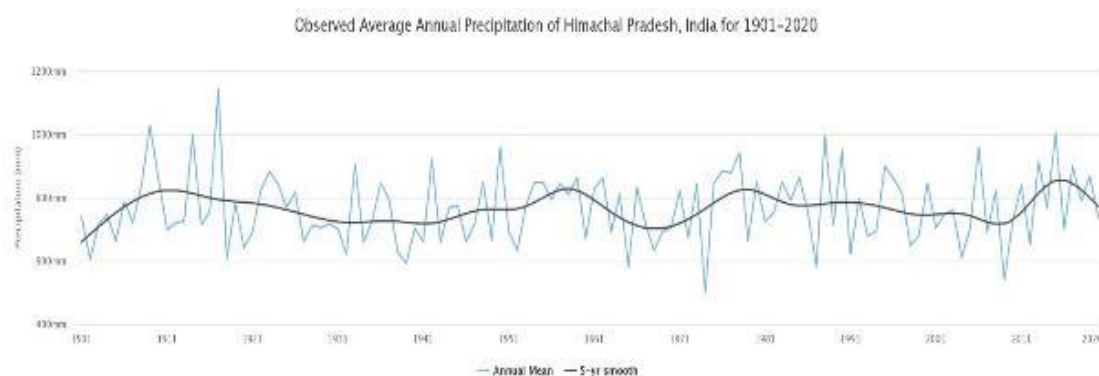
Source: World Bank's Climate Change Knowledge Portal

Rainfall

The rainfall received in an area is an important factor in determining the amount of water available to meet various demands, such as agricultural, industrial, domestic water supply and for hydroelectric power generation. The southwest (SW) monsoon, which brings about 66% of the total rainfall over the State, is critical for the availability of fresh water for drinking and irrigation. From the above trend analysis, it can be concluded that there is no significant change in amount of annual rainfall received by the State. However, it is more important to see if the total rainfall received by the State is concentrated in few months and days and therefore there is an increase in the intensity of rainfall.

³⁰ <https://climateknowledgeportal.worldbank.org/download-data>

Figure 42: Observed Average Annual Mean Precipitation (1901 - 2020)



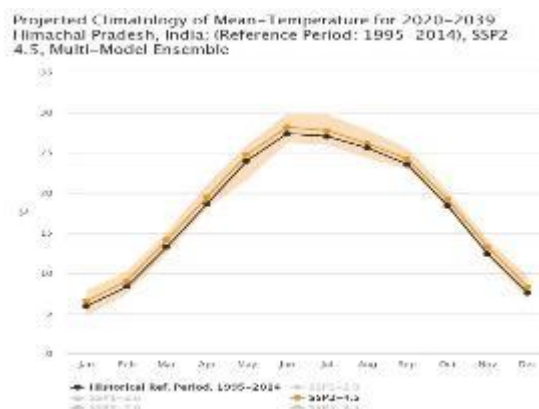
Source: World Bank's Climate Change Knowledge Portal

5.2.2. Projected Climate Scenarios

Temperature

Temperatures in HP are projected to increase by approximately 1.5°C by 2040-2059 under both RCP4.5³¹ and SSP2 4.5³² emissions pathway. Temperatures will continue to be high during and post-monsoon season, with highest touching the 30°C. by 2050. There will be more hotter nights during summer and hot winters as compared to baseline. This indicates a warming condition to prevail in the State leading to more glacial melt, high evapotranspiration, drought like conditions in plains and heavy precipitation at the hills. Hotter days also imply adverse impacts on horticulture, specially delayed flowering and pest infestation.

Figure 43: Project Mean Temperature



Source: World Bank's Climate Change Knowledge Portal

³¹ Representative Concentration Pathway (RCP) 4.5 concentration of carbon that delivers global warming at an average of 4.5 watts per square meter across the planet. The RCP 8.5 pathway delivers a temperature increase of about 2.4°C by 2100, relative to pre-industrial temperatures.

³² SSP2 represents a "middle of the road" scenario historical patterns of development are continued throughout the 21st century. The SSPs were designed to reflect worlds in which mitigation and adaptation challenges vary from low to very high.

Rainfall

Average annual rainfall for IPCC AR5 RCP4.5 scenario is projected to increase by 5.9% towards mid-century (MC). In monsoon season (JJAS) highest rainfall increase is projected. While in winter (JF) and pre-monsoon season (MAM) rainfall decrease is projected towards as compared to baseline (1995-2014) under IPCC AR5 RCP4.5 scenario. The 1-day maximum precipitation and the 5-day maximum precipitation are also projected to increase for most of the districts implying that there will concentrate rainfalls leading to flash flood conditions which may also trigger landslides. Heavy precipitation days and very heavy precipitation days are projected to increase for all the districts, especially in Bilaspur and Sirmour. This implies more cloud burst, flash floods and landslides in vulnerable areas. Most of the districts, except Bilaspur and Solan, show an increase in surface runoff contributing to streamflow. Similarly, the evapotranspiration rate is also expected to increase in all Project districts. Together with increased run-off and evapotranspiration, it is highly likely that drought conditions will get enhanced if the runoff coefficient is not managed.

5.2.3. Field Observations

- Past incidences of rivulet drying or river changing course within 5 years of scheme operation (summer and winter droughts recorded in past 10 years in many blocks).
- Some sites have high incidence of damages during flood events.
- Most of the rivulets get inundated during heavy rainfall days.
- Chances of contamination from nearby villages in form of fertilizer or insecticide leachates.
- BBMB is nearing to its full capacity; GW sources will be explored too.
- Incidence of failed coordination for opening floodgates between dams has been recorded.
- Grid powered pumps is used for lift-irrigation; JICA has a demonstration plot with solar power (hybrid).
- Pest like termites, mites, nematodes, flies were mentioned by the farmers
- High loss of crops due to hailstorm noted in few districts - Mandi, Kangra, Solan.
- Unsafe hilly slopes.

5.2.4. Detailed Activity Planned and Way Forward

Irrigation schemes being developed under the Project are likely to get exposed to climate hazards like flash floods, landslides, dam failures and drying up sources for a longer time period. Similarly, the horticultural fields will have to withstand more extreme rainfall events during the rainy season, while droughts during winter and summer, pest infestations and hailstorms.

Keeping these points in mind, the following measures are being incorporated into the Project design:

Table 33: Resilience Building Action Plan

Objectives	Resilience Building Action Plan
Improved Irrigation and Drainage	• High flood levels are studied properly with consideration of high return period and structure being design as per data results. • Land-use pattern around the structures is studied to ensure not landslide zone near. • Upstream and downstream usage considered with minimum flow availability. • Prioritize drought-sensitive farming and ecosystems for irrigation. • Build capacity to integrate climate change scenarios in water resources policy planning. • Employ technical measures to improve water use efficiency. • Explore water re-use techniques, rainwater harvesting and sustainable drainage. • Use of farm ponds, farm drainage. • Consider investments on small and medium reservoirs and projects for irrigation;
Optimize crops and land management practices	• Adjusting cropping practices to fit selected crops and targeted rainfall. • Encouraging investments in sustainable land use practices • Keeping options for diversifying horticulture crops including vegetable production to increase resilience to variable climate conditions. • Promote land tenure and property rights reform to strengthen local natural resource management. • Provide farmers with new cultivars that are drought and heat tolerant. • Develop new insurance instruments to address climate risks. • Restrict harmful agricultural practices that increase erosion and reduce soil fertility. • Investing in early control and detection systems for pests and diseases.

Objectives	Resilience Building Action Plan
Operation and maintenance	• Increase repair and maintenance budgets for physical infrastructure, such as storage facilities and access roads • Increase inspection frequency to ensure structures are enduring climate change. • Pressures. • Build capacity of the WUA such that they own and maintain the irrigation schemes;
Build training and information systems	• Build capacity to better understand and cope with climate change impacts on. • institutions and rural communities. • Increasing access to climate information, including long-term weather forecasting and better seasonal forecasts to guide the selection and timing of seasonal crops. • Develop early warning systems that provide daily weather predictions and seasonal forecast. • Improve training and education efforts related to sustainable horticulture and the use of more efficient irrigation techniques.
Strengthen policies, planning and systems	• Integrate climate information into system planning. • Improved coordination of policies and programs between horticulture Department and other government agencies on ways to deal with climate change. • Strengthen Departments of disaster risk management and meteorology to improve information on which to make decision.

5.3. Poverty & Social Analysis

5.3.1. Country Context

India's Gross Domestic Product (GDP) growth was already slowing when the COVID-19 outbreak unfolded. Real GDP growth moderated from an average of 7.4 percent during FY15/16-FY18/19 to an estimated 4.0 percent in FY19/20.³³ The growth deceleration was primarily due to (i) shocks to the financial sector and (ii) a decline in private consumption growth. Against this backdrop of pre-existing weaknesses, the outbreak of COVID-19 had a significant impact, with real GDP contracting by 7.3 percent in FY20/21. On the fiscal side, the general government deficit widened significantly in FY20/21,

³³ Government of India. Ministry of Statistics and Program Implementation (MOSPI). National Accounts Data, National Statistical Office.

owing to higher spending and low revenues.³⁴ With the easing of Covid-19 restrictions, GST collections for July, August, and September 2021 have crossed INR 1 lakh crore mark. The robust Goods and Services Tax (GST) revenues are expected to continue as the economic recovery gathers momentum. Given the significant uncertainty on epidemiological developments, real GDP growth for FY21/22 is likely to be in the range of 7.5 to 12.5 percent.³⁵ The expected recovery will put India among the world's fastest-growing economies. India's GDP grew by 20.1 percent from April to June 2021.

Although India has made remarkable progress in reducing absolute poverty in recent years, the COVID-19 outbreak has delayed the course of poverty reduction.³⁶ Between 2011-12 and 2017, India's poverty rate is estimated to have declined from 22.5 percent³⁷ to values ranging from 8.1 to 11.3 percent.³⁸ However, recent projections of GDP per capita growth, taking into account the impact of the pandemic, suggest that poverty rates in 2020 have likely reverted to estimated levels in 2016.³⁹ Labor market indicators from high frequency surveys, including from the Centre for Monitoring Indian Economy (CMIE), suggest that vulnerability has increased, particularly for urban households. Overall, the pandemic and its economic impacts are estimated to have raised urban poverty, creating a set of “new poor” that are relatively more likely to be engaged in the non-farm sector.

5.3.2. State Context

The State over the years has made great strides in reducing extreme poverty and has emerged as one of the States with the best human development outcomes in India; COVID-19 adversely affected the economic growth. A sharp decline in poverty heralded the greatest change towards social inclusion in the State. This occurred especially in rural areas, where over 90 percent of the State's population lives. Between 1993–94 and 2011, rural poverty in the State declined from 36.8 percent to 8.5 percent— a fourfold decline, impressive by any standard. While rural poverty continued to decline after 2004, urban poverty changed only marginally between 2004 and 2011. This poverty decline, moreover, benefitted all social groups across rural

³⁴ Government of India. Ministry of Finance. 2022. Union budget 2021.

³⁵ World Bank Global Economic Prospects. July 2021.

³⁶ World Bank projections. The Government of India has deployed significant resources for social assistance, including towards urban poor households and migrants.

³⁷ Government of India. National Sample Survey Office (NSSO). 2012. Consumption Expenditure Survey 2011-12.

³⁸ World Bank estimates. Poverty and Shared Prosperity Report, 2020.

³⁹ World Bank estimates. Macro Poverty Outlook, 2020.

and urban areas.⁴⁰ The State with 0.652 HDI⁴¹ occupies the third spot in the first five i.e., after Kerala and Delhi and before Goa and Punjab. The State's prosperous and fast-growing economy is hit hard by the pandemic covid-19 and is expected to have a negative growth of 6.2 percent in the current financial year 2020-21.

Majority of the State's landholding is small and marginal. The State has the highest proportion of the population (90% as 2011 census) in rural areas. Out of the total geographical area of 55.67 lakh ha the area of operational holdings is about 9.44 lakh ha and is operated by 9.97 lakh farmers. The average holding size is about 0.95 ha. Distribution of land holdings according to 2015-16 Agricultural Census shows that 88.86 percent of the total holdings are of small and Marginal farmers. About 10.84 percent of holdings are owned by Semi Medium and Medium farmers and only 0.30 percent by large farmer.

Despite being a rainfed area, the State's economy is dependent mainly on agriculture/horticulture, and any fluctuation in the production of food grains affects the economy significantly. The State's economic growth is still governed by agriculture activities, despite shifting from agriculture to industries and services. Agriculture which comprises agriculture, horticulture, and livestock production, accounts for the largest single share in the State domestic product (GSDP);^{42,43} and provides direct employment to about 70 percent of total workers of the State.⁴⁴ Though, the contribution of agriculture in total State Domestic Product has declined from 57.9 percent in 1950-51 to 10.05 percent in 2019-20; the declining share of the agriculture sector does not affect the importance of this sector in the State economy as the growth in the primary industry of the State economy is still determined by the trend in agriculture and horticulture production. The State has emerged as a leading producer of fruits and offseason vegetables. The State's average yields are comparable with other hill States but are much lower than the States in the plains. Most of the agriculture is subsistence type and depends on the climatic conditions for good harvests. Cultivable area in the State accounts for nearly 15 percent of the total geographical area and out of this, only 10 percent is under plough and is being tilled by 9,60,765 land holders (2010-11 Census).

⁴⁰ The World Bank Report. Scaling the Heights: Social Inclusion and Sustainable Development in Himachal Pradesh.

⁴¹ The Human Development Index (HDI) is a composite index of outcome indicators in three dimensions: a. A long and healthy life, as reflected in life expectancy at birth. b. The acquisition of education and knowledge, as reflected in the mean years of schooling (adjusted for out of school children) and literacy rate (age 7 years and above). c. The standard of living and command over resources, as reflected in the monthly per capita expenditure adjusted for inflation and inequality.

⁴²

About 10 percent of the total GSDP comes from agriculture and its allied sectors

⁴³ State Government of Himachal Pradesh, Department of Economics and Statistics. 2018/2021. Economic Survey of Himachal Pradesh. 2017-18 and 2020-2021. Shimla

⁴⁴ State Government of Himachal Pradesh, Department of Economics and Statistics. 2018/2021. Economic Survey of Himachal Pradesh. 2017-18 and 2020-2021. Shimla

About 81% of the total cultivated area in the State is rainfed with a gross irrigated area of 1.87 lakh ha. and a net irrigated area of 1.06 lakh ha.⁴⁵

Horticulture in HP has been responsible for many positive outcomes in employment, trade, transportation, wages, and poverty reduction. Employment in horticulture as a percentage of all agricultural jobs in HP increased from 0.9 percent to 28 percent between 1983 and 2009-10.⁴⁶ Crop diversification has made a significant impact on income and employment among small and marginal farmers. The expansion of area cultivated with non-food grain crops was a significant factor influencing the growth of rural non-farm employment in the State. The area under fruits, which was 792 ha in 1950-51 with a total production of 1,200 tones, increased to 2,33,300 ha during 2019-20, and the entire fruit production was 8.45 lakh tones, while during 2020-21 (up to December 2020) it has been reported as 4.82 lakh tones.

Notwithstanding the significant potential of horticulture production in HP to contribute to higher economic growth and poverty reduction objectives, the State faces several sectoral and institutional challenges which need to be addressed more systematically if the full potential is to be realized and translated into sustainable development impacts. The agriculture sector's contribution to the State's gross value is a mere 15 percent. This has been mainly due to (i) uneconomical agriculture, mainly in the subtropical region of the State⁴⁷; (ii) limited access to appropriate production technologies, including elite planting materials, leading to low productivity; (iii) insufficiently developed water management systems, leaving the State's horticulture almost entirely dependent on rainfall despite available water resources; (iv) high post-harvest losses, paired with low-value addition, exacerbated by inadequate storage, processing, and marketing capabilities; (v) limited institutional capacity for the development of micro, small and medium enterprise (MSME) in agro-processing; (vi) crop losses from wild and stray animal attacks preventing farming; (vii) adverse impact of climate change due to erratic and extreme rainfall conditions along with a rise in temperature leading to increased incidences of pests, and (viii) curtailed access to medium and long-term financial capital. While the total volume of banking sector credit to the agriculture sector is significant, and a substantial number of farmers have access to credit, just 21 percent of the banking sector loan portfolio in agriculture was medium and long-term (over one year) in 2014-15. This share

⁴⁵ Manish Anand, Fellow, TERI, 2015: Green Growth and Agriculture in Himachal Pradesh

⁴⁶ Kumar, A., Kumar, S., & Singh, D. K. Shivjee (2011) Rural employment diversification in India: Trends, determinants and implications on poverty. *Agricultural Economics Research Review*, 24, 361-372. 5 India census. 2011.

⁴⁷ The World Bank. <https://www.worldbank.org/en/news/press-release/2015/01/28/himachal-pradesh-has-effectively-balanced-economic-growth-with-social-inclusion-says-new-world-bank-report>.

has steadily decreased from 63 percent in 2010-11.⁴⁸ Addressing these constraints to horticulture development will require a predictable and supportive policy environment for private sector development, better access to product and input markets, and improved farmer's access to horticultural extension services and financial services.

Compared to men, women have higher control over land resources but low in the sale and purchase of land. Women form approximately 50% of the State's rural population, 42% of the labor force in the State, and 56% of the total cultivators' population; however, their participation in the farming sector is mainly labor oriented.⁴⁹ Studies⁵⁰ indicate that women's access of resources over the use of land was high in the State (70%), more than the male members of the family, but low in sale and purchase of land. Women even do not get a direct share or control of farming income as the land ownership is under the name of male members of the households.⁵¹ Reforms in the Panchayati Raj Act, which is related to the local self-government system for rural areas in India, and in some of the regulations for participatory irrigation management have enforced reservation stipulations for women in the elected entities, leading to increased participation of women in decision-making processes.

In terms of political representation, elected women representatives in the Panchayati Raj Institutions and urban local bodies have significantly increased due to many women actively entering Politics in the State. In the 3243 Gram Panchayats, 1639 (50.54 percent) seats were occupied by women in the 2011 Panchayat elections. Out of total seats occupied by women, 987 (60.21 percent) were occupied by general women, 421 (25.68 percent) scheduled caste women, 104 (6.34 percent) scheduled tribe women, and 127 (7.74 percent) occupied by OBC women. Similarly, out of a total of 77 Chairman Panchayat Samities seats, 42 seats (54.54 percent) of the seats in this category have been occupied by women. Out of the total 12 seat chairpersons of Zila Parishad seats, 6 (50 percent) of the seats have been occupied by women in the 2011 elections.⁵²

⁴⁸ In 2014-15, the banking sector provided over INR 2517 crore (US\$ 387 million) in financing for agriculture (including horticulture) and allied activities to around 200,000 farmers and the banking sector's loan portfolio to this sector was INR 6711 crore (just over US\$ 1 billion).

⁴⁹ Government of Himachal Pradesh. Department of Economics and Statistics. 2017–2018. Statistical Abstract of Himachal Pradesh. Shimla

⁵⁰ Government of India. Indian Council of Agriculture Research. Department of Agricultural Research and Education. Annual Report 2012–13: Empowering Women in Agriculture (<https://icar.org.in/files/reports/icar-dare-annual-reports/2012-13/women-in-agriculture-12-13.pdf>)

⁵¹ Government of Himachal Pradesh. Planning Department. 2017. Patterns and Context of Rural Livelihoods in Himachal Pradesh. Shimla

⁵² Government of Himachal Pradesh. Department of Statistics and Economics. Women and Men in Himachal Pradesh.

Impact channels and expected systemic changes. The Himachal Pradesh Subtropical Horticulture, Irrigation, and Value Addition (HP-SHIVA) Project aim to directly benefit the State's small and marginal farmers in the subtropical areas by increasing their income through the following interventions: (i) introducing innovative climate and disaster risk resilient designs in irrigation schemes and water use management; (ii) employing a market-driven approach through establishing farmers' marketing organizations, empowering farmers groups, and developing public-private or producer-private partnerships; and (iii) integrating climate-resilient technologies and holistic natural resource management practices into farm management (soil health, fertilization, pesticide use, water saving).

5.4. Land Acquisition

Land acquisition will not be required for Cluster formation as the ownership of the land will remain with the Cluster farmers. However, land acquisition might be required (based on the site condition) for installation of main tank and laying water pipeline from source to main tank and main tank to Cluster land. Consultant will explore all possible options to avoid land acquisition in such cases, including locating the main tank in government land/Cluster land etc.

5.5. Resettlement and Rehabilitation

The Project will be implemented without private land acquisition hence no physical displacement is anticipated in this Project. However, livelihood of certain marginal farmers may be affected temporarily (mainly the marginal farmers) due to this Project and the same would be addressed by providing substance allowance to such families.

6. Project Cost Estimate and Phasing

6.1. Cost Estimate

6.1.1. Assumption

Output 1	• Irrigation Schemes: Cost estimates are based on model detailed engineering and design estimates prepared for each type of scheme viz functional, non-functional, and new. • SCADA: Cost estimates are based on market rates.
Output 2	• Horticulture Plantation – Technical specifications, quantities and rates have been from the PRF packages i.e., CS-03, CS-04, CS-09 and DOH. • GIS Land Mapping – Cost estimates are based on market and expert consultations. • Digital Agri Services – Cost estimates are based on the market rates. • Capacity Building of DOH - The Training Cost estimates are based on the State Schemes. • Capacity Building of CHPMA farmers - The Training Cost estimates are based on the State Schemes. • Capacity Building of JSV and WUAs: Cost estimates are based on market rates and Department's similar programmes in the past • Training on Intercropping & Beekeeping - The Training Cost estimates are based on the State Schemes. • Support for establishing Organic Fertilizer – The Training Cost estimates are based on the State Schemes. • Nursery Development – Cost estimates of CS03 package • Carbon Credit Exploration – Cost estimates are based on primary research and industry consultations.
Output 3	• Value Chain Infrastructure – Cost estimates have been taken from CS-03 package. • Building Institutional capacity of CHPMA & Apex Body - Training Cost estimates are based on the State Schemes. • Market Development and Promotion- Cost estimates are based on the prevalent market rates. • Incubation and Training Centre - Cost estimates have been taken in consultation with the Department.
Project Management	• PMU Administrative Cost – Staff Salaries cost is assumed as per DOH and JSV rules and regulation, • Taxes- @ 12% of the works and goods contract. • Contingencies - @5% of the Total Project Cost.

6.1.2. Estimate

Sr. No.	Project Components	Project		Beneficiaries		TOTAL COST	
		INR cr	million USD	INR cr	million USD	INR cr	million USD
1	Output 1	297.81	37.50	-	-	297.81	37.50
1.1	Rehabilitate and Construct Irrigation Scheme					-	-
1.1.1	For first 4,000 ha	247.81	31.21			247.81	31.21
1.1.2	For next 2,000 ha	50.00	6.30			50.00	6.30
2	Output 2	673.24	84.78	447.21	56.32	1,120.45	141.10
2.1	Horticulture Plantation						
2.1.1	Land Preparation	111.99	14.10			111.99	14.10
2.1.2	Planting Material	82.39	10.28			82.39	10.28
2.1.3	Mulching			42.00	5.29	42.00	5.29
2.1.4	Drip Irrigation & System	227.72	28.68			227.72	28.68
2.1.5	Horticulture Input	32.10	4.04	48.15	6.06	80.25	10.11
2.1.6	Horticulture Tools	17.04	2.15	25.56	3.22	42.60	5.36
2.1.7	Solar Fencing	177.72	22.38			177.72	22.38
2.1.8	Labour			330.00	41.56	330.00	41.56
2.2	GIS Land Mapping	2.00	0.25			2.00	0.25
2.3	Digital Agri Services	2.25	0.28	1.5	0.19	3.75	0.47
2.4	Capacity Building of DOH and JSV	1.80	0.23			1.80	0.23
2.5	Capacity Building of farmer of CHPMA and WUA	9.22	1.16			9.22	1.16
2.6	IEC Material	2.5	0.31			2.5	0.31
2.7	Capacity Building on Safeguards	0.50	0.06			0.50	0.06
2.8	Training on Intercropping & Beekeeping						
2.9	Training on Organic Fertilizer Production and sales	0.87	0.11			0.87	0.11
2.10	Nursery Development and Training	1.75	0.22			1.75	0.22
2.11	Consultancy for research and study on climate resilient crops, climate vulnerability, PoP refinement & leveraging carbon credit	2.90	0.37			4.50	0.60
3	Output 3	69.98	8.81	4.79	0.60	74.76	9.41
3.1	Value Chain Infrastructure						
3.1.1	Collection Centre	19.15	2.41	4.79	0.60	23.94	3.01
3.1.2	Integrated Facility Centre						
3.1.3	Upgrading Processing Unit	12.00	1.51			12.00	1.60
3.1.4	New Processing Unit						
3.2	Formation of Apex Body and Training for CHPMA Societies	21.42	2.70			21.42	2.70
3.3	Market Development and Promotion by APEX body	3.90	0.49			3.90	0.49
3.4	Establishment of Incubation and Training Centre (Centre of Excellence)	13.50	1.70			13.50	1.70

Sr. No.	Project Components	Project		Beneficiaries		TOTAL COST	
		INR cr	million USD	INR cr	million USD	INR cr	million USD
4	Project Management	209.15	26.34	-	-	209.15	26.34
4.1	PMU Administrative Cost						
4.1.1	PMU	12.00	1.51			12.00	1.51
4.1.2	PIU - DOH	1.20	0.15			1.20	0.15
4.1.3	PIU - JSV	28.13	3.54			28.13	3.54
4.1.4	DIU - DOH	88.44	11.14			88.44	11.14
4.1.5	Recurring Operating Expenses (office maintenance, travel, visit, etc.	40.19	5.06			40.19	5.06
4.2	PMU Independent Consultants	3.60	0.45			3.60	0.45
4.3	Consultancy Packages						
4.3.1	Project Design Consulting for additional 2,000 ha.	4.00	0.50			4.00	0.50
4.3.2	Construction Supervision	15.00	1.89			15.00	1.89
4.3.3	Project Implementation and Support	8.00	1.01			8.00	1.01
4.3.4	CHPMA, WUA formation & Capacity Building	4.00	0.50			4.00	0.50
4.3.5	APEX Business Capacity Building	4.00	0.50			4.00	0.50
4.3.6	Internal Audit Services	0.60	0.08			0.60	0.08
	Total Project Cost	1249.68	157.37	452.00	56.92	1,701.68	214.29
	Contingencies	41.03	5.17			41.03	5.17
	Physical	24.83	3.13			24.83	3.13
	Prices	16.20	2.04			16.20	2.04
	Financial Charges during implementation	1.54	0.19			1.54	0.19
	Commitment Charges	1.54	0.19			1.54	0.19
		Project Cost (Govt. + ADB)		Beneficiaries Contribution		Overall Project Cost	
	TOTAL OVERALL COST	1,292	163	452	57	1,744	220

6.2. Means of Financing

The total Project cost (excluding the beneficiary contribution) works out to be INR 1,824 crore. The cost of Output 2 is the highest i.e INR 913 crore followed by Output 1 with a cost of INR 358 crore and Output 3 with a cost of INR 77 crore.

Table 34: Output wise cost

All figures in INR crore

Project Components	Project Cost			Beneficiary Contribution	Overall Cost
	ADB	Govt.	Total		
Output 1	266	32	298	-	298
Output 2	617	55	673	447	1,120
Output 3	70	0	70	5	75
Project Management	39	170	209	-	209
Output wise cost	992	257	1250	452	1,702
Contingencies	38	3	41		41
Financial Charges	0	2	2		2
Total Cost (INR Cr)	1,030	262	1292	452	1,744
(Million USD)	130	33	163	57	220

Indicative Financing Plan

Out of the total Project cost 80% shall be contributed by ADB in the form of loan. The State Government shall have a 20% share.

Table 35: Indicative Financing Plan

Financing Plan			
Source	Project Loan (INR crore)	Project Loan (million US\$)	Share (%)
Asian Development Bank	1030	130	80%
Government of Himachal Pradesh	262	33	20%
Total	1292	163	100%

7. Economic and Financial Analysis

7.1. Introduction

The quantitative economic and financial analysis focused on three core sub-projects and envisaged outputs to be undertaken during the seven-year implementation period – evolution of complementary irrigation system in Sirmour, Solan, Kangra, Bilaspur, Hamirpur, Una and Mandi districts, horticulture plantation related initiatives, establishment of complementary post-harvest infrastructure in the related districts. The core sub-Project being the establishment of sub-tropical horticulture plantation across 6,000 ha.

7.2. Rationale for Government involvement

The beneficiaries are marginal and small farmers with limited capacity to invest in necessary irrigation as well as preliminary plantation investment. Hence, government support by way of fiscal assistance and subsidy is required. Furthermore, assistance by way of support in marketing and other capacity building is also required at the Project level. Agriculture in Himachal Pradesh accounted for 13.61% of State domestic product 2021-22 with a negative growth rate of 8.6% majorly due to the impact of covid. Small and marginal farmers account for 87.95%. The overall agriculture production is 16.75 lakh MT while the horticulture production was 6.98 lakh MT in 2021-22. Apples make up the largest volume (79%) of fruit produced in the State constituting 49% of the total area under fruit cultivation. The average agriculture income in the State is INR 12,153 per month and is above the national average of INR 10,218 per month as per NSS⁵³ 2019 data. However, the agriculture income of sub-tropical farmers is lower than the tropical farmers which was further validated by the baseline survey of the Project area i.e., INR 1,693 per month⁵⁴ (INR 20,316.94 per year for 0.39 ha, average landholding offered by farmers towards Project for plantation).

The State has also developed a Vision 2030 document, namely, “Drishti Himachal Pradesh 2030: Sustainable Development Goals”. Key highlights herein in the context of the agriculture and allied sector include:

- Targeted increase in vegetable related productivity from 21 MT/ha to 27 MT/ha and fruits related productivity from 5 MT/ha to 25 MT/ha by 2030.
- Increasing cropping area under organic cultivation from 17,000 ha to 30,000 ha.
- Increase area under protected cultivation from 15 lakh ha to 23 lakh ha.
- Reduce % of water losses in the irrigation sector from 35% to 15%.

⁵³ [NSS 2019 \(Page 129\)](#)

⁵⁴ Baseline Survey 2022

7.3. Goals of the plan

The Project would have an overall impact by way of upgrading and strengthening the sub-tropical horticultural practices that would increase the rural household incomes of farmers. The Project would strengthen the climate resilient activities practiced within the State to bring around the Sustainable transformation of traditional farming systems into modern hi-tech high productive ones.

Paddy and maize are widely cultivated in the Project regions but has relatively low commercial value and high irrigation water requirements. Rainfall in the region is inadequate for extensive and adequately remunerative cultivation. The Project will help conserve scarce water resources by facilitating crop diversification into far higher revenue yielding horticulture crops including Guava, Citrus, Pomegranate, Litchi, Persimmon, Pecan nut, Mango, and Plum. Modern farm management practices will be deployed. These crops have higher commercial value and are also less water intensive.

7.4. Without-Project and With-Project Scenarios

Output – 1: Irrigated area expanded and sustainably operated. The Project will support the establishment and management of 162 irrigation schemes. It will provide irrigation facilities to 6,000 ha of new area for sub-tropical horticulture production by 15,000 farmers. The Project will design, build and operationalize irrigation schemes

Output – 2: Climate resilient sub-tropical horticultural production systems adopted. The Project's key interventions to promote the development of sub-tropical horticulture value chains will include activities (i) horticulture plantation (ii) GIS mapping and digital services (iii) Capacity Building of farmer of CHPMA and WUA, DOH and JSV (iv) training on bee keeping and other vegetable production (v) Nursery Development and Training and (vi) research and study on climate resilient crops, climate vulnerability, PoP refinement & leveraging carbon credit

Output – 3: Market access for subtropical horticulture farmers developed. This output aims to increase profitability of horticulture farming in subtropical areas of the State. The activities include: (i) value addition facility development at the community (ii) APEX body formation (iii) Establishment of Incubation and Training Centre (Centre of Excellence)

The analysis considered the following project benefits: i) increase in income and benefit to farmers by the diversification initiative into High Density horticulture production.

Diversified cropping pattern. The consultants have estimated the per Ha crop budget for the potential horticulture crops including Guava, Citrus, Pomegranate, Litchi, Persimmon, Pecan nut, Mango and Plum. “With Project” cropping pattern takes into consideration total water availability, water requirement of each horticulture crop and the market demand and price of expected output. With the Project, horticulture crops are the crops to be produced. However, without the Project, paddy and maize will continue to be the dominant crops. The yield and income per ha with the Project have been compared with the “without Project” income per ha, i.e., the net benefit of diversification into more remunerative horticulture produce from paddy and maize is captured.

Table 36: Crop budget in the Project area

Items	Without Project	With Project	
	Net operating income (Avg. per year)	Net operating income (For Year 16)	Cropping mix for targeted project area
Prevailing cropping mix (Paddy, Wheat, Maize, Gram)	INR 52,095 / ha		
Guava		INR 810,431 / ha	30%
Pomegranate		INR 611,439 / ha	10%
Citrus		INR 613,029 / ha	35%
Litchi		INR 782,513 / ha	15%
Persimmon		INR 525,359 / ha	2.50%
Plum		INR 355,402 / ha	3.50%
Pecan nut		INR 1,473,490 / ha	1.50%
Mango		INR 459,709 / ha	2.50%

With regard to “without Project” estimates, the data from the baseline survey has been incorporated to estimate the net operating income per ha of different commodity combinations i.e., paddy-wheat, paddy-gram, maize-wheat, maize-gram.

The cultivated area for each crop is multiplied by the specific crop’s per ha income to derive the overall income from each crop in the Project area. The sum of all crop net incomes is the total agricultural income in the Project area. The income is computed in this way with and without Project scenarios, and the difference in income represents the obvious incremental Project benefits.

7.5. Project Costs

Table 42 presents the estimated financial costs of the three sub-projects of the Project activities at 2021 price level. Each activity has several sub-activities. The main or core sub-project comprises output 2 which is Horticulture Plantation related investment and costs. Output 1 represents supporting irrigation schemes and Output 3 represents supporting value chain infrastructure and soft (capacity building and market promotion) interventions. Project management is considered as an underlying cost. Each element of cost has different composition of tradeable, non-tradeable and labour content. Since the tradeable, non-tradeable and labour content have been estimated in financial terms, in the economic analysis they were converted to economic values using appropriate conversion factors as outlined in section 7.6.

Certain components such as training related to intercropping and beekeeping and nursery development under Output 2 and establishment of integrated facility center and processing unit under Output 3 will be leveraged through various central as well as State government schemes. This will further provide incremental benefit to overall project.

7.6. Methodology and assumptions

The economic cost and benefit analysis (CBA) was conducted using ADB's *Guidelines for the Economic Analysis of Projects*⁵⁵. The major assumptions were as follows:

- The Project life was taken to be 20 years including a 5-year implementation period.
- The economic costs and benefits were valued in Indian Rupee (INR), using the domestic price level numeraire.
- Produce is considered as import substitutes and therefore valued at domestic market prices. Conversion factors are developed to adjust market prices of inputs to economic values. Taxes are ignored as are import duties, labor which is unskilled is adjusted by the shadow wage rate factor (SWRF).
 - Standard Wage Rate Factor = 0.85 for labor costs which is INR 340, which is the average wage rate of India.
 - Standard conversion factor = 0.87 for investment costs related to land development and solar fencing and power.
 - Standard conversion factor = 0.97 for all other investments costs and operating costs including micro irrigation system, mulching sheet, planting material and even *fertilizer* etc. The average tax (GST) in India is about 12% (2021) which is waived on exports, and the average

⁵⁵ ADB. 1997. Guidelines for Economic Analysis of Projects. Manila, Philippines

customs / import tariff is about 15% (2021) on imports. Export taxes are levied on a few commodities at the rate of over 25%.

- No conversion factor adopted for *horticulture produce*.
- The economic opportunity cost of capital is considered at 9%.

Output 1: Irrigation scheme related complementary sub-project. 4% of investment outlay as operating expenditure post implementation period up to 20th year.

Output 2: Horticulture plantation related main or core sub-project. post implementation period up to 20th year.

Output 3: Value chain infrastructure and others related complimentary sub-project. 10% of infrastructure investment costs as operating expenditure post implementation period up to 20th year.

Project management. The total Project management outlay is estimated at 5 years. This component comprises PMU administrative costs, consultancy costs and contingencies.

Project - FIIR & EIRR

FIRR	16.06%
EIRR	17.45%

7.7. Sensitivity analysis

A sensitivity analysis considered several alternate scenarios. The analysis considered an increase in investment cost by 10%, decrease in output price by 10% and a 10% decrease in output yield. The analysis revealed the Project to be robust to adverse changes with both FIRRs and EIRRs being well above 9 per cent.

Table 37: Sensitivity analysis

Scenario	FIRR	EIRR
Base case	16.06%	17.45%
10% increase in investment cost	13.85%	15.13%
10% decrease in price of produce	13.14%	15.02%
10% decrease in yield of produce	13.14%	15.02%

7.8. Sustainability analysis

Financial sustainability assessment and management. The Department of Horticulture (DOH) and Jal Sakhti Vibhag (JSV) are the executing agencies as well as implementing agencies for the Project.

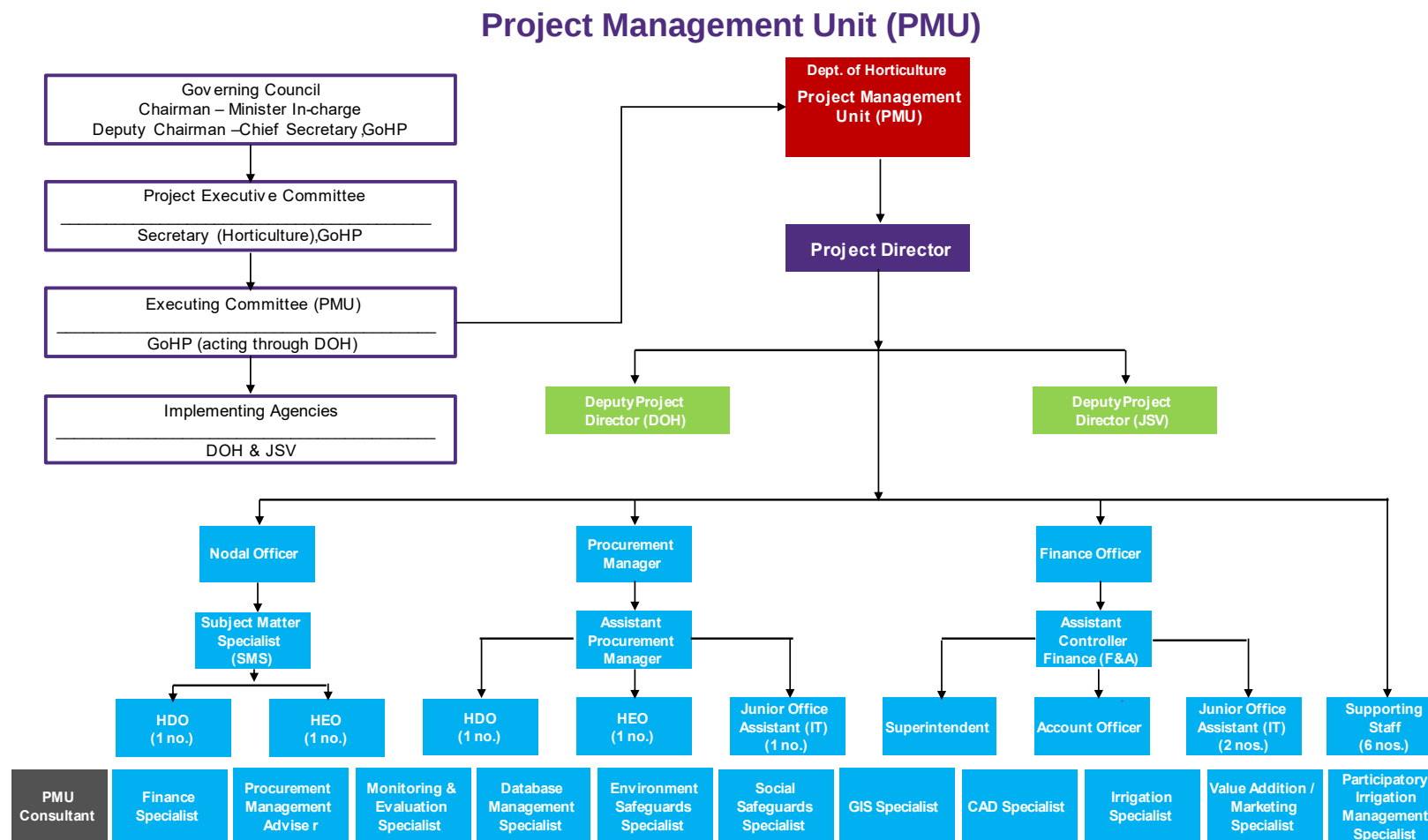
Operational expenditures. The operating expenditure for the Horticulture plantation will be contributed by the beneficiary farmers themselves. The operating expenditure for the irrigation scheme related sub-project will be met with by existing schemes of the JSV. The operating expenditure for the value chain infrastructure and other related sub-project will be met with by the envisaged Farmer Producer Organisation that is Apex institution representing beneficiary farmers.

Upon Project implementation, the plantations and the value chain infrastructure and others related facilities are expected to be self-financed through user / service charges imposed on beneficiary farmers and others utilising the facilities.

Institutional sustainability assessment and management. The Project is to be implemented with close coordination between the DoH and JSV. The Project design will also engage necessary technical expertise in value chain development, agriculture, and engineering to both support effective implementation as well as strengthen institutional capacities.

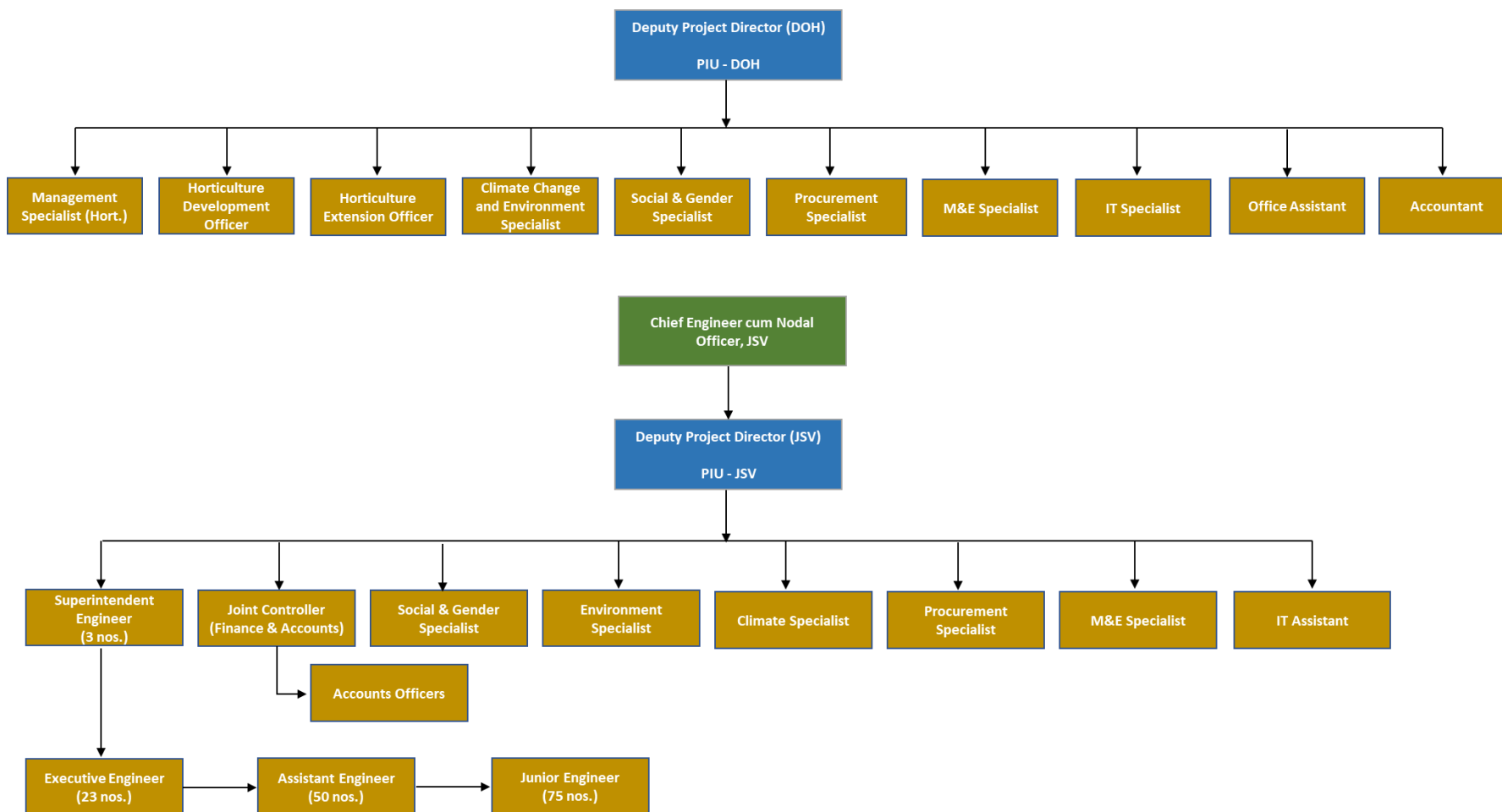
8. Project Implementation

8.1. Project Organization Structure

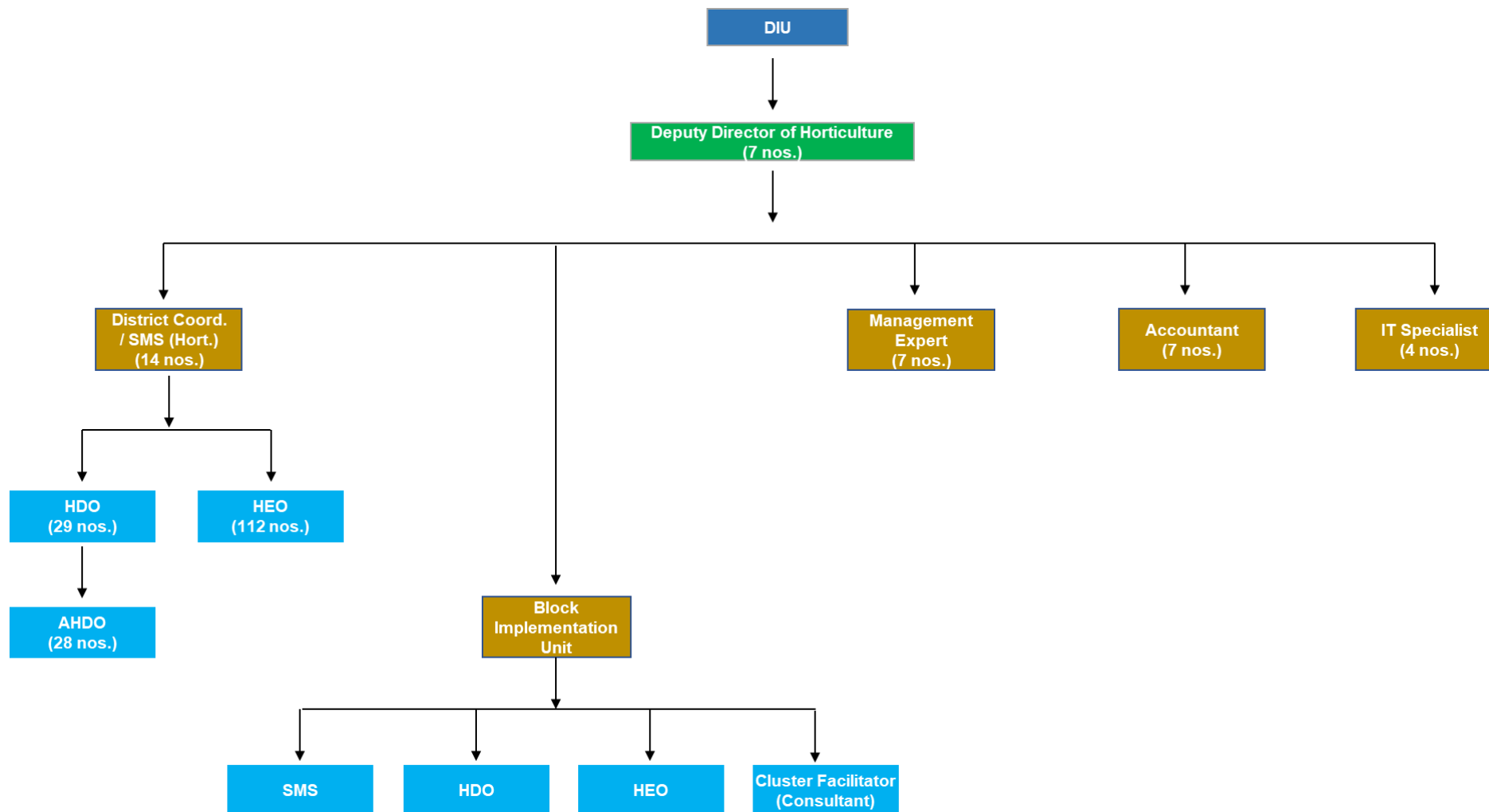


Project Implementation Unit (PIU)

PIU – 1: DOH; PIU – 2: JSV



District Implementation Unit (DIU) - DOH



8.2. Roles & Responsibilities

8.2.1. Oversighting Bodies

The Project will consist of a two-tier administrative system comprising of Governing Council and Project Executing Committee.

The Governing Council will be Chaired by the Minister and includes the following members: Chief Secretary, GOHP as Deputy Chair; Additional Chief Secretary for Finance; Principal Secretary for Agriculture; Secretary for Horticulture acting as Member Secretary for GC; Secretary for JSV, Vice Chancellor for Dr. Y. S. Parmar University of Horticulture and Forestry Solan; Director of Horticulture; Director of Agriculture; Engineer in Chief (Projects) JSV and Project Director (HPSHIVA).

The Project Executing Committee will be chaired by Secretary for Horticulture, GOHP and the members will include Secretary (Irrigation and Public Health) GOHP, Director of Horticulture, HP; Engineer-in-Chief (Projects) for JSV; Director of Agriculture; Advisor for Planning Department; Director of Research for YSP UHF Solan; Managing Director for HPMC; Managing Director of HPSAMB; Project Director of the PMU acting as the Member Secretary to the EC; DOH and JSV Project Directors; Nodal officer; Finance Officer and Procurement Manager for PMU.

Governing Council – Roles & Responsibilities

- Overall coordination of the sector investment Projects in the State.
- Inter Departmental coordination of the Project.

Executive Committee – Roles & Responsibilities

- Overall coordination of the Project.
- Provide necessary policy guidance related to Project implementation.
- Provide clearance and authorization for Project budgets.
- Overall procurement plan and major changes thereof.

8.2.2. Executing Agency

The PMU (Project Management Unit), headed by the Project Director, will coordinate, and oversee the implementation of the Project.

DOH (Department of Horticulture) shall act as the executing agency for the Project and shall be responsible for overall coordination, implementation, and monitoring of the Project.

Roles & Responsibilities

- Oversee Project execution, supervision, and management.
- Oversee and monitor Project implementation as well as the adequacy of overall Project funding.
- Project account management by establishing and maintaining Project account, submitting withdrawal applications and administer statement-of-expenditure and maintain supporting documents.
- Complete loan financial records.
- Monitor and periodically provide updated procurement plan to ADB.
- Oversee procurement of Goods, Works, Consulting services and non-consulting services.
- Project progress reports.
- Final approval of contract awards, based on recommendations of PIUs (as may be the case).

All the correspondences with the Project Director will be routed through PIU DOH & JSV.

8.2.3. PMU / PIU of DOH staff

Nodal Officer

- Liaising with DOH, JSV, Government of India and stakeholders.
- Coordinate Project planning implementation, review, supervision, and management.
- Responsible for designing, monitoring and execution of different field activities in coordination with District Coordination Units and PIUs at PMU level.
- Examine and respond to grievances / complaints.
- Collect necessary inputs to prepare quarterly and annual Project progress reports, environmental and social monitoring reports, and the Project completion report at PMU level.
- Any other responsibility which may be assigned from time to time.

Procurement Manager

- Responsible for all procurement related activities under the Project.
- Responsible for methods, preparations, review, procurement plan and Bidding / RFQ process for non-consulting services and consulting services.
- Carry out quality assurance review to ensure that sub - projects meet established Project standards.
- Monitor and provide updated procurement plan to ADB.

Management Expert (Hort.)

- Responsible for providing services related to horticulture expertise such as planting material, technical guidance, GIS mapping, market analysis, value addition, environmental guidelines, etc. as per the Project requirement from time to time.

Finance Officer:

- Responsible for budget estimates, expenditure, and all other financial transactions, accounts and audit reporting as per Project requirement.

PMU Consultants:

The list of PMU Consultants for DOH is as under:

- Finance Specialist.
- Procurement Management Advisor.
- DB Management Specialist.
- Environment Safeguard Specialist.
- Social Safeguard Specialist.
- Monitoring & Evaluation Specialist.
- GIS Specialist.
- CAD Specialist.
- Irrigation Specialist.
- Value addition / Marketing Specialist

8.2.4. PIU (Implementing Agencies)

Two Project Implementation Units (PIUs), one in DOH and the other in JSV, will be established under PMU headed by DOH and JSV Deputy Project Directors.

Roles & Responsibilities

- Oversee day-to-day Project execution, supervision, management, monitoring and evaluation.
- Consultant recruitment and procurement of goods, works, consulting and non-consulting services.
- Collect necessary inputs to prepare quarterly and annual Project progress reports, environmental and social monitoring reports, and the Project completion report.
- Carry out quality assurance review to ensure that subprojects meet established Project standards.

- Open, operate and maintain the advance account and supervise sub accounts, consolidate Project accounts and financial statements and process payments to contractors / consultants / suppliers.
- Conduct financial, environmental, and social due diligence for proposed subprojects as necessary in consultation with PMU / relevant government agencies.
- Carry out Project grievance redressal mechanism at district level.
- Evaluation and contract award recommendations.
- Any other responsibility, as may be assigned.

8.2.5. DIUs

The DIUs will be responsible for implementation of all Project activities at the district level, as well as any other responsibility, as may be assigned.

8.2.6. BIUs

The BIUs will be responsible for implementation of all Project activities at the block level, as well as any other responsibility, as may be assigned.

8.2.7. Asian Development Bank

The Asian Development Bank (ADB) will monitor and review overall implementation of the Project in consultation with the EA, IAs, Government of Himachal Pradesh and Government of India.

8.2.8. Water User Association (WUA)

Water User Association (WUAs) will be composed of villagers and elected by villagers.

Roles & Responsibilities

- Ensure community engagement in irrigation system design.
- Prepare seasonal water use plans for WUG irrigation area.
- Monitor water use by group members.
- Form higher level organizations that progressively take up the management of irrigation scheme.
- Establish subcommittees (water management, O&M, etc.).
- Record water fee collection and report to block / district JSV.

8.2.9. Community Horticulture

Community Horticulture Production and Marketing Associations (CHPMAs) are stakeholder associations to be formed in the Clusters with the intention of building their capacities for business, facilitate linkage with market and development of investment plans for subtropical horticulture value addition

and market development. CHPMAs will be composed of and elected by the villagers.

Roles & Responsibilities

- Coordinate beneficiary male and female farmer horticulture development planning.
- Collect beneficiary farmer cash or in-kind (poor household) contribution.
- Submit application to PMU for Horticulture crop establishment grant financing.
- Manage the allocation of grant financing to group members.
- Coordinate group member capacity building programs.
- Liaise with public and private sector market operators.
- Form higher level organizations to establish public – private Partnerships for value addition and improved market access.

8.3. Implementation support to EAs/IAs

8.3.1. CHPMA Facilitators

- Support the DOH to establish CHPMA societies within the DOH.
- Implement CHPMA Development Plan that schedules the institutional development and training.
- Establish systems and procedures to monitor the progress of CHPMA establishment and training.
- Create a series of fora at district and State level for key stakeholder engagement
- Monitor and implement post-harvest value chain processes and adhere to norms of apex body
- Ensure that information on the CHPMA development and management program are incorporated into the Project MIS and GIS systems

8.3.2. WUA Facilitators

- Support JSV to establish a unit for WUA
- Implement a WUA Development Plan that schedules the institutional development and training of the WUAs
- Establish systems and procedures to monitor the progress of WUA establishment and training
- Advise and prepare recommendations on participation of the WUAs in aspects of planning and design of irrigation construction activities
- Monitor WUA construction contracts
- Provide support to JSV Design Unit for each scheme, including field testing of equitable means of water management, irrigation scheduling,

volumetrically measured cost recovery and other aspects of system management and infrastructure handover

- Ensure that information on the WUA development and management program, including digitally recorded system water use, are incorporated into the Project MIS and GIS systems

8.3.3. Capacity Building

- Monitor gap analysis of the current extension schemes of DOH and JSV during Project execution
- Assessment of current planning and design practices and procedures of DOH and JSV
- Development and implementation framework of capacity building, technical assistance, and training of trainers and design at State, district, and lower levels
- Develop relevant training materials for the agreed capacity building program
- Provide a training of trainers for DOH horticulture specialists and JSV irrigation specialists
- Supervise a district level training program implemented by the Trained Trainers

8.3.4. Knowledge Partner (Horticulture Technology) – Dr. Y. S. Parmar University of Horticulture and Forestry

- Create necessary audio-visual materials of POPs for dissemination with the farmers
- Assess the training needs of targeted farmers
- Select POP's trainers in consultation with the DOH, and organize training of trainers in POPs-based technology and its application
- Assist DOH in organizing training of farmers through selected trained trainers
- Create a network of crop/fruit experts for supporting the farmers in the use of POPs.
- Support DOH in developing a website or modules for knowledge website to host the POPs and related knowledge material for public access

8.4. Project Procurement

Project Procurement (both procurement planning and procurement implementation) is an integral component of successful project implementation and therefore key to all activities under the HPSHIVA Project.

The procurement strategy to be adopted for the HPSHIVA project is being currently formulated as part of the Strategic Procurement Plan (SPP) that will form the basic planning document for developing the Detailed Procurement Plan for the project.

At the pilot PRF Project preparation stage, the Procurement Risk Assessment (PRA) and the Strategic Procurement Plan (SPP) was completed and the PRF Project is being satisfactorily implemented based on these documentary building blocks. The PRA and SPP for the new HPSHIVA Ensuing Loan Project is essentially an extension and consolidation of the earlier PRA and SPP of the PRF Project with fine tuning and improvements based on the learning curve experiences of the PRF Project.

It is important to mention that at the PRF formulation stage after the due process of Procurement Risk Assessment (PRA), the project procurement risk was classified as 'Category B' (Low to Moderate). Since the PRF Project is being satisfactorily implemented (with the support of a PMU which was formally instituted and made operational for the PRF stage project implementation) without any major procurement related lapses or glitches, and further since the PMU is staffed by experienced DoH staff supported by qualified consultants/specialists with appropriate experience in the required fields, the Procurement Risk Assessment (PRA) being currently carried out for the HPSHIVA Ensuing Loan Project is likely to be even more positive (i.e. even lower risk than at the PRF Project stage) in its final outcome and the ADB Category B classification is likely to be maintained.

On the basis of the PRA and SPP for the HPSHIVA Ensuing Loan Project (which is currently under finalization), the following key procurement parameters will be instituted as part of the Project Procurement Implementation:

The project will include procurement packages for (i) Works (ii) Goods (iii) Consultancy Services and (iv) Non-Consultancy Services.

Based on the Project Detailed Design and Engineering carried out as part of the Project Investment Preparation Plan, the following major procurement packages would need to be implemented as part of the overall project:

Works

- Lift Irrigation Works (from Water Source to Hydrants of Modular Water Tanks feeding Drip Irrigation Systems), to be undertaken by Jal Shakti Vibhag (JSV), formerly known as Department of Irrigation and Public Health (DIPH),
- Drip Irrigation Works (from Modular Water Tanks to Field Level Drip Irrigation/Micro Irrigation Systems) to be undertaken by DoH
- Animal Proof Solar Fencing Works, to be undertaken by DoH
- Field Preparation Works, to be undertaken by DoH

Goods (all to be undertaken by DOH)

- Planting Materials
- Plant Inputs (Fertilizers/Insecticides/Nutrients)
- Farming Field Level Tools & Implements

Consultancy Services (all to be undertaken by DoH as EA and PMU)

- Design Consultancy for 2,000 ha
- Individual Specialist Consultants/Advisors for PMU/PIU
- Project Implementation and Support
- Construction Supervision
- CHPMA, WUA formation & Capacity Building
- APEX Business Capacity Building
- GIS Land Mapping
- Digital Agri Services
- IEC – Services for digital and creative content preparation
- Assistance in Carbon Financing/Credit
- Research on climate Adaption and study on climate resilient varieties
- Research on PoP refinement
- Services for Internal Auditing

Non-Consultancy Services

- Vehicle Hiring Services (for project implementation and monitoring purposes)
- Hiring of Statutory Audit firm (CAG empanelled CA firm)

Project Implementation Strategy

As agreed with ADB during the Fact-Finding Mission, the HPSHIVA Project Implementation Period for the HPSHIVA Ensuing Loan Project is planned for a 5-year period commencing in September 2022 and till August 2027.

As part of the HPSHIVA Project Implementation Strategy, it is decided that out of the total project coverage area of 6,000 Ha, an initial coverage area of 4000 Ha will be taken up for procurement planning and implementation under the current PRF through use of Advance Contracting under Retroactive Financing. This is referred to as the 1st Phase of the Project.

For procurement planning purposes, the area of 4000 Ha is subdivided into smaller coverage areas of procurement packaging/lot sizing taking into account the efficiency in carrying out the field implementations and the capacity of contractors/suppliers/vendors to execute such contracts keeping in view their available financial and execution capacities.

The above sub-division of coverage areas will form the basis for the procurement planning and implementation for the 1st Phase of the HPSHIVA Project especially for Works Packages both under DoH and JSV,

The remaining area will be taken up for procurement implementation once the detailed design and procurement package costings are finalized after the Project Design Firm is recruited and is mobilized on the job in Q1 2023. For the 2nd Phase of the Project.

Procurement Preparedness

In terms of Procurement Preparedness, the following table projects the list of procurement packages planned for implementation in the 1st Phase of the Project

Package Detail	Dept.	Status	Bid Value
Works			
(CWH/SF/SLN/Lot – 01 to Lot – 11) Field preparation	DOH	Bid Document prepared and ready for tendering.	Estimated value INR 74.66 Cr To be bid out as a single tender with 11 lots
(CWH/IRG/SLN/Lot – 01 to Lot 11) Drip Irrigation	DOH	Bid Document prepared and ready for tendering.	Estimated value INR 145.48 Cr

Package Detail	Dept.	Status	Bid Value
			To be bid out as a single tender with 11 lots
Lift Irrigation Schemes (CWJ/IRG/SLN – 01, CWJ/IRG/SMR – 01, CWJ/IRG/HMR – 01 and 2, CWJ/IRG/BLS – 01 and 2, CWJ/IRG/MND – 01 and 2, CWJ/IRG/KNG – 01 and 2, CWJ/IRG/UNA – 01)	JSV	Bid Document prepared and ready for tendering.	Estimated value INR 268.13 Cr The Irrigation works undertaken by JSV is to be bid as 11 separate tender packages.
Goods			
GH/PM/Lot – 1 - Planting Material (1 st Year of Planting)	DOH	Bid document prepared and ready for tendering	Estimated Value To be bid out as one tender with multiple lots
GH/PM/Lot – 2 - Planting Material (2 nd Year of Planting)	DOH	Bid document will be prepared in Q3 2022	To be bid out as one tender with multiple lots
GH/PI/Lot – 1 - Plant Input (1 st Year of Planting)	DOH	Bid document prepared and ready for tendering	To be bid out as one tender with multiple lots
GH/PI/Lot – 2 - Plant Input (2 nd Year of Planting)	DOH	Bid document will be prepared in Q3 2022	To be bid out as one tender with multiple lots
GH/FTI 01 - Farmer Tools and Implements	DOH	Bid document prepared	To be bid out as one tender
Consultancy Services			
Project Implementation Support Consultancy	DOH	Bid document prepared	To be bid out as one tender
Construction Supervision	DOH	Bid document prepared	To be bid out as one tender
Project Design for next 2,000 ha	DOH	In progress	

Details of Major Procurements and Bid Notification Plan for the initial 18-month period

Package Number	General Description	Estimated Value (INR Cr)	Tentative Advertisement Date
WORKS			
CWJ/IRG/SLN – 01	Irrigation Services by JSV ⁵⁶	31.64	Q3 2022
CWJ/IRG/SMR – 01		17.24	
CWJ/IRG/HMR – 01		14.00	
CWJ/IRG/HMR– 02		23.34	
CWJ/IRG/BLS – 01		23.11	
CWJ/IRG/BLS – 02		15.61	
CWJ/IRG/MND – 01		50.53	
CWJ/IRG/MND– 02		8.93	
CWJ/IRG/KNG – 01		35.31	
CWJ/IRG/KNG – 02		27.30	
CWJ/IRG/UNA - 01		18.41	
	Sub Total	265.43	
CW13A	Drip Irrigation	145.48	Q3 2022
CW14A	Animal Proof Solar Composite Fencing	114.14	Q3 2022
CW12A	Field Preparation	74.66	Q3 2022
	Works Package Total	599.71	
GOODS			
GH/PM/Package 1	Planting Material (1 st Year of Planting)	25.74	Q3 2022
GH/PM/Package 2	Planting Material (2 nd Year of Planting)	38.99	Q4 2023
	Sub Total	64.73	
GH/PI/Package 1	Plant Input (1 st Year of Planting)	21.40	Q3 2022
GH/PI/Package 2	Plant Input (2 nd Year of Planting)	10.70	Q4 2023
	Sub Total	32.10	
GH/FTI 01	Farmer Tools and Implements	11.36	Q3 2022
	Goods Package Total	108.19	

⁵⁶ Lift Irrigation tender – SOP and lightening work will be conducted internally by department. Hence the tender amount will be less than the mentioned amount

Package Number	General Description	Estimated Value (INR Cr)	Tentative Advertisement Date
Consultancy			
CS01	Construction Supervision	15.00	Q3 2022
CS02	Project Design Consultancy for next 2,000 ha	4.00	Q3 2022
CS03	Internal audit	0.60	Q4 2022
CS04	Agtech Service platform & Land Database establishment	4.25	Q4 2022
CS05	Technical Studies on climate studies, climate resilient varieties, POP refinement and carbon financing	2.90	Q4 2022
CS06	CHPMA Formation support	18.81	Q4 2022
CS07	CHPMA business capacity building	26.90	Q4 2022
CS08	Project Implementation and Support Consulting	8.00	Q3 2022
CS09	PMU support Individual Consultant	3.60	Q3 2022
CS10	Architectural Design Firm for CoE	1.00	Q3 2022
CS11	IEC Consultant	2.50	Q3 2022
CS12	Nursery Certification Training	0.75	Q4 2022
Consultancy Total		88.31	

Note: The above are the major procurements and does not include the exhaustive list of procurement packages. It is likely that some minor procurement packages may also be required and will be covered in the initial 18-month period

All procurement would, prima facie, be carried out in consonance with the applicable ADB procurement guidelines and procedures.

It would also be necessary to ensure that procurement procedures used do not have any direct conflict with the public procurement principles laid down by the Government of Himachal Pradesh (GOHP)

Procurement of Works packages and Goods packages will be done through the Himachal Pradesh State e-procurement portal; using e-procurement, as already being practised by the Government of Himachal Pradesh (GOHP).

For Works packages Single Stage Two Envelope (1S2E) method will be adopted. This is as per procedure currently practised by GOHP and approved by ADB.

For Goods contract either Single Stage Two Envelope (1S2E) method or Request for Quotation (RFQ) method (based on the estimated value of the package and as may be indicated in the approved Procurement Plan) will be adopted. This is as per procedure currently practiced by GOHP and approved by ADB.

Consultancy packages (for Firms) are to be procured through Quality and Cost Based Selection (QCBS) (90:10) or through other ADB approved selection modes including, inter alia, LCS, CQS, CQS as would be agreed upon with ADB during the loan negotiation and loan agreement stage.

As currently mandated by ADB, all procurements of Consultancy Services will not be through the Himachal Pradesh e-procurement portal (as this has not yet been approved by ADB for use on ADB funded consultancy services) but in line with currently applicable procedures through ADB CMS and subsequent offline procedures.

Consultancy packages (for Individual Consultants) are to be procured through Individual Consultant Selection (ICS) mode of selection (through advertising on the ADB's CMS portal and also advertised in the national media for wider publicity). However, Expressions of Interest submitted by Individual Consultants will mandatorily be through the ADB's CMS portal. This is as per procedure currently required by ADB.

For the Works contracts the Standard Bid Document (SBD) for Small Works as published by ADB (December 2021) will be used.

For Goods contract either Standard Bid Document (SBD) for Goods (1S2E) as published by ADB (December 2021) OR RFQ Goods (January 2020) will be used.

For Consultancy packages (for Firms), the Standard Request for Proposal (SRFP) as published by ADB (November 2020) will be used.

As in line with the procurements carried out during the PRP Project, the provision of 'Standstill Period' will not be used.

The details of the packages, the method of procurement and the timelines will be summarised in the Procurement Plan which will be an integral part of the ADB and GOHP agreed PAM (Project Administration Manual) and the subsequent Financing Agreement that would be signed between the ADB and the GOI/GOHP.

8.5. Monitoring & Evaluation

8.5.1. Baseline Survey

A baseline study to understand the livelihood mix of potential project participants was proposed in all the 28 blocks spread over 7 districts. Using the frame of around 342 clusters already formed or where process of Cluster formation has been initiated, and indicative areas where 580 (approximately) clusters will be formed, a sample of 82 clusters has been covered. In each cluster, a sample of 10 to 15 farmers were selected randomly, and information from the household regarding livelihood mix was compiled using a structured questionnaire, administered by investigators, specially trained for the same.

Information on the land parcel which potential participant is likely to share for proposed Cluster was collected in detail to know the crop mix in either season, production, or input cost to arrive at the estimated income from the said parcel. Information on other land parcels (if any) of the household was also compiled on net basis, as recalled by the household. So also, the information on other livelihood sources such as service, labor, trade, business, etc. was collected.

The performance indicator for the project activity at the outcome level is agriculture income of at least 80% of project households from the parcel of land in the project improved by xx%. The baseline was arrived at, based on result of the baseline study. At the output level, namely expansion and operation of irrigated area, increased production of climate resilient subtropical horticulture and development of market access for subtropical horticulture produce are to be initiated ab initio, and hence, the baseline is zero and the target will be decided after formation of Clusters.

Based on the findings of the baseline survey, the average annual agricultural income per household from 0.39 ha of land (to be contributed to the project) was estimated and found out to be ₹ 20,316.94⁵⁷. Detailed baseline report is attached at [Annexure 5.4](#).

⁵⁷ Based on the baseline survey of 1016 farmers from 82 clusters, covering all the 28 blocks in the 7 project districts.

8.5.2. Periodic Monitoring and Impact Assessment

A MIS based system to track the progress of the Project and ensuring delivery of inputs will be developed. The indicators from the design monitoring framework will be monitored using periodically updated MIS quarterly, half yearly and annually.

The mid-term impact assessment will involve tracking of the income from the Project activities of participating farmers, wherever plantation is in fruit bearing stage. In addition, other progress indicators will also be tracked and mid-course correction, if any, will be recommended. An end term impact assessment will be conducted in the last quarter of the Project and achievement of indicators in results framework will be tracked.

8.6. Implementation Timelines

Table 38: Implementation Timeline

Sr. No.	Project Components	2022 - 2023				2023 - 2024				2024 - 2025				2025 - 2026				2026 - 2027			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Output 1																				
1.1	Rehabilitate and Construct Irrigation Scheme																				
1.1.1	For first 4,000 ha																				
1.1.2	For next 2,000 ha																				
2	Output 2																				
2.1	Horticulture Plantation																				
2.1.1	Land Preparation																				
2.1.2	Planting Material																				
2.1.3	Mulching																				
2.1.4	Drip Irrigation & System																				
2.1.5	Horticulture Input																				
2.1.6	Horticulture Tools																				
2.1.7	Solar Fencing																				
2.2	GIS Land Mapping																				
2.3	Digital Agri Services																				
2.4	Capacity Building of DOH and JSV																				
2.5	Capacity Building of CHPMA ad WUA farmers																				
2.6	IEC Material																				
2.7	Capacity Building on Safeguards																				
2.8	Training on Intercropping & Beekeeping																				
2.9	Training on Organic Fertilizer Production and sales																				
2.10	Nursery Development and Training																				

Sr. No.	Project Components	2022 - 2023				2023 - 2024				2024 - 2025				2025 - 2026				2026 - 2027			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2.11	Consultancy for research and study on climate resilient crops, climate vulnerability, PoP refinement & leveraging carbon credit																				
3	Output 3																				
3.1	Value Chain Infrastructure																				
3.1.1	Collection Centre																				
3.1.2	Integrated Facility Centre																				
3.1.3	Upgrading Processing Unit																				
3.1.4	New Processing Unit																				
3.2	Formation of Apex Body and Training for CHPMA Societies																				
3.3	Market Development and Promotion																				
3.4	Establishment of Incubation and Training Centre (Centre of Excellence)																				
4	Project Management																				
4.1	PMU Administrative Cost																				
4.2	Consultancy Service																				

9. Annexure

9.1. Volume 1 of 5

Annexure 1.1: Detailed Project Costing

Sr. No.	Project Components	Project Subcomponents	Quantity	Unit	Rate	Total Cost		
					(in Rs)	(in Rs)	cr INR	million US\$
1	Output 1. Irrigated area expanded and sustainably operated					297.81	37.503	
1.1	Build or upgrade irrigation schemes	Irrigation Scheme for 4,000 ha (162 schemes) - Functional (33), Non-Functional (19), New (110) with SCADA	4,000	Ha	6,19,531	247,81,22,775	247.81	31.207
1.2		Irrigation Scheme - 2,000 ha	2,000	Ha	2,50,000	50,00,00,000	50.00	6.296
2	Output 2. Climate resilient subtropical horticultural production systems developed					672.74	84.717	
2.1.1	Capacity Building of DOH / JSV	Training Program DOH	224	nos.	26,000	58,24,000	0.58	0.073
2.1.2		Exposure / Study Visit of DoH (outside state)	112	nos.	46,000	51,52,000	0.52	0.065
2.1.3	Horticulture Inputs (1 st year) Farmer - 60%; project - 40%	Exposure / Study Visit of DoH (international)	28	nos.	2,50,000	70,00,000	0.70	0.088
2.2	IEC Material	IEC & Knowledge Management (CHPMA & WUA) (Audio, Video, poster, brochure, banner, etc.)	1	lump sum	250,00,000	2,50,00,000	2.50	0.315
2.3.1	Capacity Building of	Training of Trainers	60	societies	26,000	15,60,000	0.16	0.020

Sr. No.	Project Components	Project Subcomponents	Quantity	Unit	Rate	Total Cost		
					(in Rs)	(in Rs)	cr INR	million US\$
2.3.2	CHPMA / WUA members Safeguards Training Capacity Building on Intercropping and Beekeeping	Training on PoP	400	clusters	24,000	96,00,000	0.96	0.121
2.3.4		Exposure Visit of farmers (within state) - (3-4 days) - 5 per cluster	2,000	farmers	10,000	2,00,00,000		-
2.3.5		Exposure Visit of farmers (outside state) - (5-7 days) 3 per cluster	1,200	farmers	50,000	6,00,00,000		-
2.3.6		Exposure Visit of farmers (international) - (5-7 days)	28	farmers	2,50,000	70,00,000		-
2.3.7		Cluster Facilitators (1 per co-operative society for 3 years)	60	nos.	13,50,000	8,10,00,000	8.10	1.020
2.4		Training on Environment, Gender and Social Safeguards awarness	1	lump sum	50,00,000	50,00,000	0.50	0.063
2.5.1		Training on Intercropping (3-4 days)	5,000	farmers	5,000	2,50,00,000		-
2.5.2	Drip System Training on organic fertilizer	Training on BeeKeeping, etc. (3-4 days)	1,000	farmers	5,000	50,00,000		-
2.6		Promotion and Training on organic fertilizer production and sales	400	cluster	21,750	87,00,000	0.87	0.110
2.7	GIS Mapping		GIS mapping of land & it's management	1	lump sum	200,00,000	2,00,00,000	2.00
2.8	Digital AgriTech Services	Digital Agri Tech Services for farm management including blockchain traceability (first 3 years)	15,000	farmers	1,500	2,25,00,000	2.25	0.283

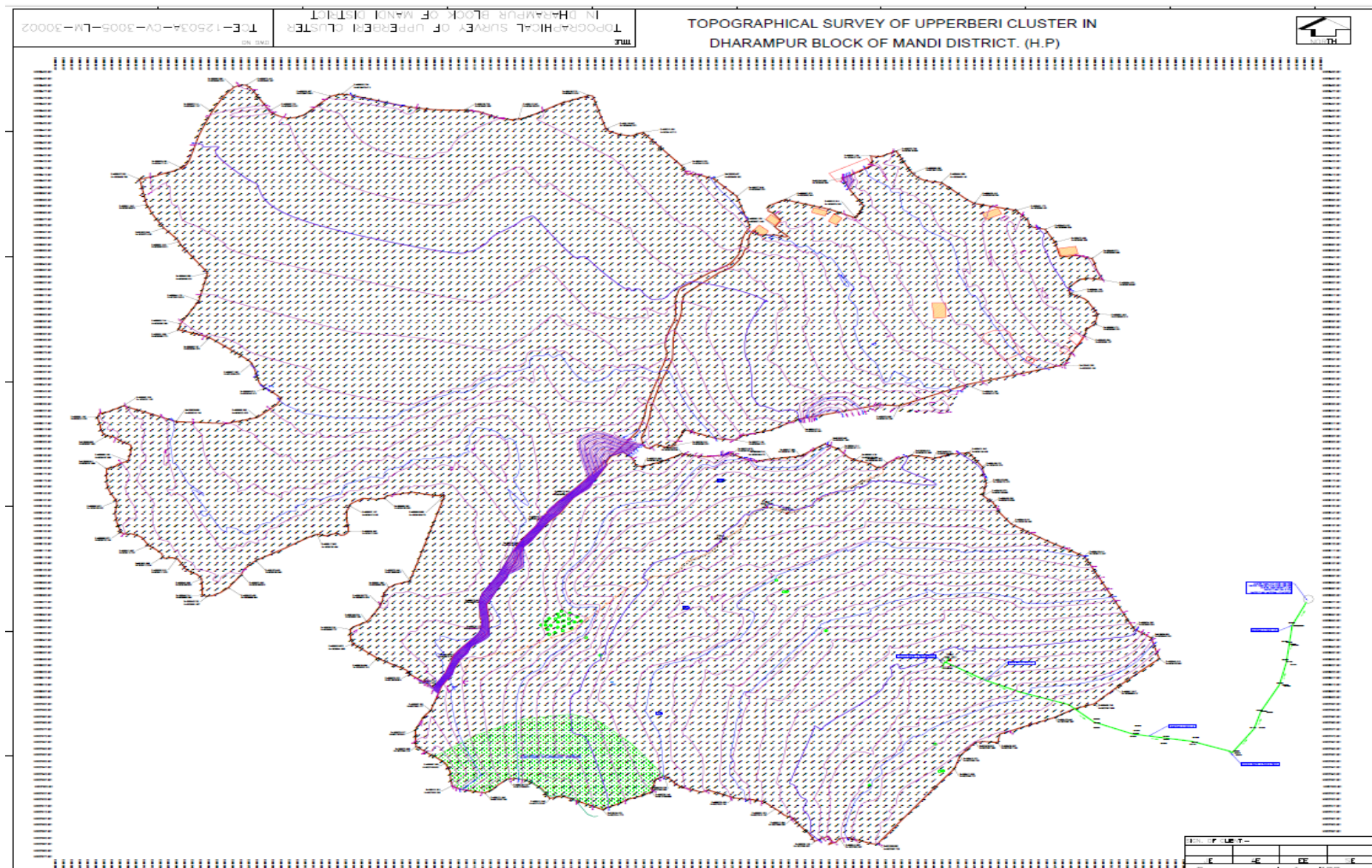
Sr. No.	Project Components	Project Subcomponents	Quantity	Unit	Rate	Total Cost		
					(in Rs)	(in Rs)	cr INR	million US\$
2.9.1	Horticulture Plantation	Land Preparation, Layout, Bed making & Pit digging	6,000	Ha	1,86,643	111,98,56,500	111.99	14.102
2.9.2	GIS Mapping	Mulching	6,000	Ha	70,000	42,00,00,000		-
2.9.3	Digital AgriTech Services	Horticulture Inputs (1 st Yr) Farmer - 60%; project - 40%	6,000	Ha	1,33,750	80,25,00,000	32.10	4.042
2.9.4	Capacity Building of CHPMA members on horticulture production	Tools & equipments (1st year) Farmer - 60%; project - 40%	400	cluster	10,65,000	42,60,00,000	17.04	2.146
2.9.5		Planting Material						-
2.9.5.1		Citrus	24,96,667	plants	175	43,69,16,667	43.69	5.502
2.9.5.2		Guava	21,40,000	plants	100	21,40,00,000	21.40	2.695
2.9.5.3		Litchi	6,01,875	plants	80	4,81,50,000	4.82	0.606
2.9.5.4		Pomegranate	7,13,333	plants	75	5,35,00,000	5.35	0.674
2.9.5.5		Plum	1,00,313	plants	250	2,50,78,125	2.51	0.316
2.9.5.6	Capacity Building of DOH	Mango	1,78,333	plants	100	1,78,33,333	1.78	0.225
2.9.5.7		Pecan Nut	44,583	plants	300	1,33,75,000	1.34	0.168

Sr. No.	Project Components	Project Subcomponents	Quantity	Unit	Rate	Total Cost		
					(in Rs)	(in Rs)	cr INR	million US\$
2.9.5.8		Persimmon	1,00,313	plants	150	1,50,46,875	1.50	0.189
2.9.6.1	Capacity building and expansion of Water User Association (WUA)	Drip Irrigation with solar pump	6,000	Ha	3,79,534	227,72,02,012	227.72	28.677
2.10		Animal proof composite fencing	12,00,000	metre	1,481	177,72,00,000	177.72	22.380
2.11		Labour						-
2.11.1	Capacity Building of JSV Consultancy for research works	Labour - Investment Cost	6,000	Ha	2,00,000	120,00,00,000		-
2.11.2		Labour - Operation Cost	6,000	Ha	3,50,000	210,00,00,000		-
2.13.1		Assistance for leveraging Cabon Credit	1	lump sum	100,00,000	1,00,00,000	1.00	0.126
	IEC Material	Geospatial climate vulnerability mapping	1	lump sum	40,00,000	40,00,000	0.40	0.050
	Safeguards Training	POP Update by University & Interational Experts	1	lump sum	75,00,000	75,00,000	0.75	0.094
2.13.2	Capacity Building on Intercropping and Beekeeping Horticulture Nursery Development	Study on climate resiliant crops, monitoring of existing plantation and refining PoPs	1	lump sum	75,00,000	75,00,000	0.75	0.094
2.14.1		Imported Planting Material and plantation	10,000	plants	1,000	1,00,00,000	1.00	0.126

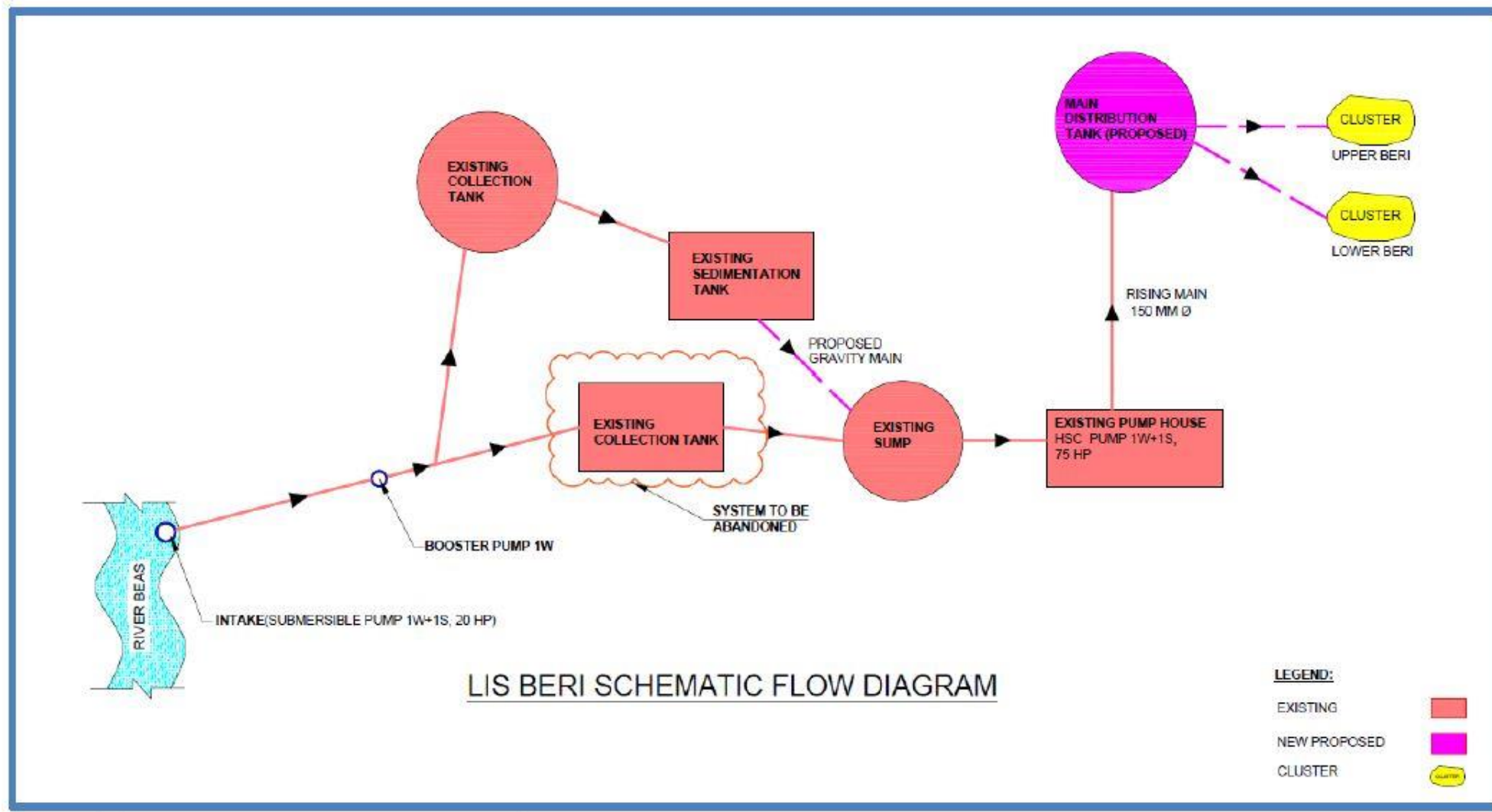
Sr. No.	Project Components	Project Subcomponents	Quantity	Unit	Rate	Total Cost		
					(in Rs)	(in Rs)	cr INR	million US\$
2.14.1	Training on organic fertilizer	Training support on Nurseries	1	lump sum	75,00,000	75,00,000	0.75	0.094
2.14.1	Horticulture Nursery Development Capacity Building of DOH / JSV	Upgradation of existing nurseries	30	nos.	10,00,000	3,00,00,000		-
2.14.2		Creation of new nurseries	9	nos.	254,44,444	22,90,00,000		-
2.14.3		Upgradation of tissue culture lab	1	nos.	20,00,000	20,00,000		-
2.14.4		Creation of tissue culture lab	1	nos.	552,00,000	5,52,00,000		-
3	Output 3. Market access for subtropical horticulture farmers developed						69.98	8.812
3.1.1	Post Harvest Facilities	Collection Centre (80%)	60	nos.	39,90,000	23,94,00,000	19.15	2.412
3.1.2		Integrated Facility Centre	10	nos.	425,60,000	42,56,00,000		-
3.1.3		Upgradation of existing processing units	3	nos.	400,00,000	12,00,00,000	12.00	1.511
3.1.4		New processing units	7	nos.	600,00,000	42,00,00,000		-
3.2.1	Building Institutional capacity of CHPMA	Apex Body (4 years)	1	lump sum	1900,00,000	19,00,00,000	19.00	2.393
3.2.2		CHPMA / FPO Society Mangement Support	60	CHPMA	18,00,000		-	-
3.2.3		Training Program CHPMA Society	720	staff	26,000	1,87,20,000	1.87	0.236
3.2.4		Exposure Visit (outside state)	120	staff	46,000	55,20,000	0.55	0.070

Sr. No.	Project Components	Project Subcomponents	Quantity	Unit	Rate	Total Cost		
					(in Rs)	(in Rs)	cr INR	million US\$
3.3.1	Market Development and Promotion	Development of Digital portal of B2B and B2C sales	1	lump sum	50,00,000	50,00,000	0.50	0.063
3.3.2		Buyer Seller Meet - 2 per year	10	lump sum	10,00,000	1,00,00,000	1.00	0.126
3.3.3		Trade fair and Exhibitions (International)	3	nos.	10,00,000	30,00,000	0.30	0.038
3.3.4		Trade fair and Exhibitions (Domestic)	6	nos.	10,00,000	60,00,000	0.60	0.076
3.3.5		Branding and Promotion	3	lump sum	50,00,000	1,50,00,000	1.50	0.189
3.4.1	Others Post-Harvest Facilities	HPSHIVA Incubation and Training Centre (Centre Of Excellence)	1	lump sum	1350,00,000	13,50,00,000	13.50	1.700
4	Project Management Administration & Contingencies						209.15	26.338
4.1	PMU Management & Administration	PMU Staff Salary					-	-
4.1.1		PMU	5	years	2,40,00,000	12,00,00,000	12.00	1.511
4.1.2		PIU - DOH	5	years	24,00,000	1,20,00,000	1.20	0.151
4.1.4		DIU - DOH	5	years	1768,80,000	88,44,00,000	88.44	11.137
4.1.3		PIU - JSV	5	years	562,50,000	28,12,50,000	28.13	3.542
4.1.5		Recurring Operating Expenses for PMU & PIUs (Office maintenance, stay and travel, meeting, visits, etc.)	1	lump sum	4018,51,942	40,18,51,942	40.19	5.060
4.2	PMU Independent Consultants	Financial Management (1), Procurement (1) & M&E(1)	5	years	72,00,000	3,60,00,000	3.60	0.453

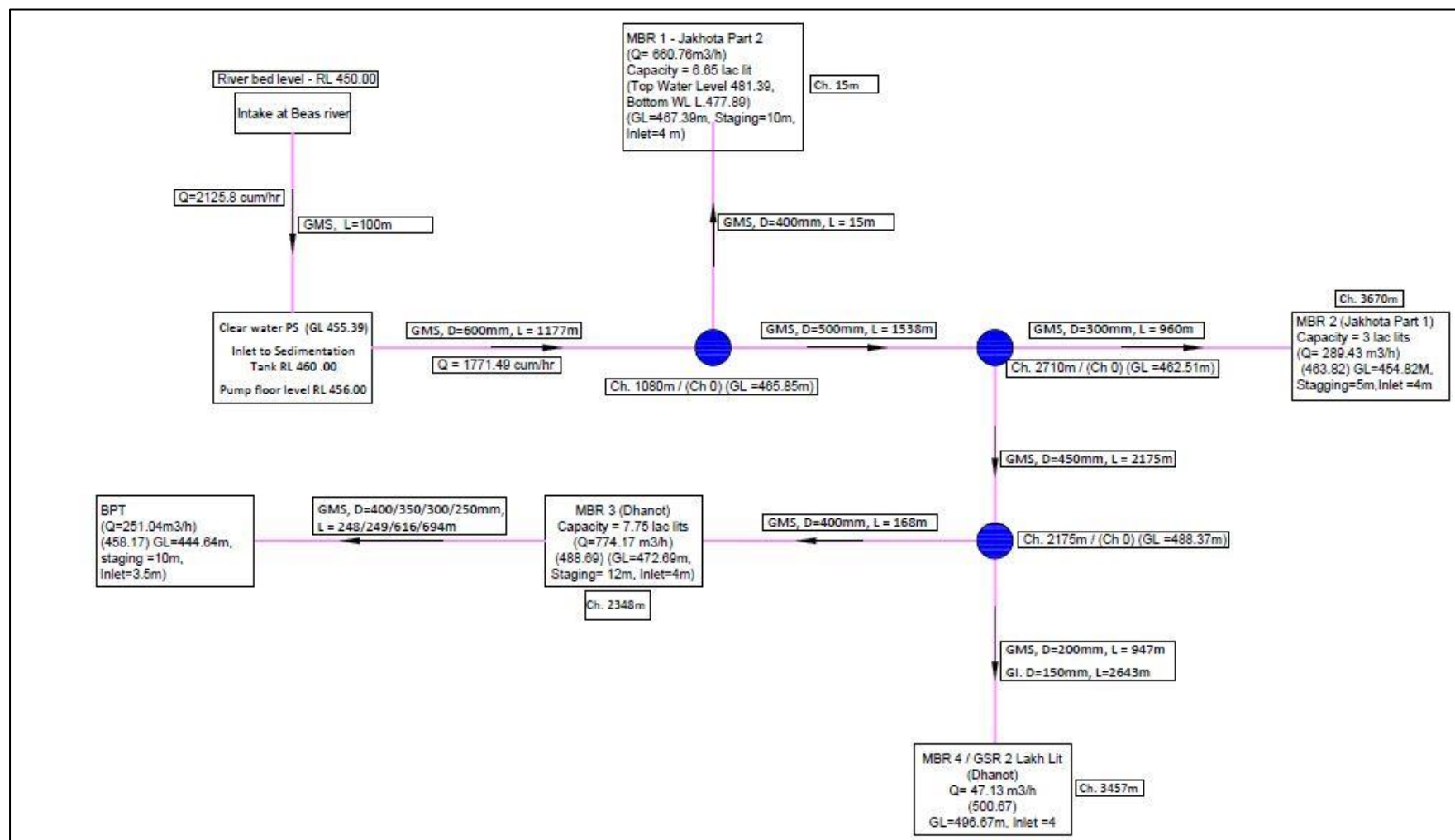
Sr. No.	Project Components	Project Subcomponents	Quantity	Unit	Rate	Total Cost		
					(in Rs)	(in Rs)	cr INR	million US\$
4.3.1	Consultancy Services	Project Design Consulting for additional 2,000 ha.	1	lump sum	400,00,000	4,00,00,000	4.00	0.504
4.3.2		Construction Supervision	1	lump sum	1500,00,000	15,00,00,000	15.00	1.889
4.3.3		Implementation Support	1	lump sum	800,00,000	8,00,00,000	8.00	1.007
4.3.4		CHPMA, WUA formation	1	lump sum	400,00,000	4,00,00,000	4.00	0.504
4.3.5		APEX Business Capacity Building	1	lump sum	400,00,000	4,00,00,000	4.00	0.504
4.3.7		Internal Audit Services	1	lump sum	60,00,000	60,00,000	0.60	0.076
		Project Cost					1,249.68	157.37
	Contingencies	Physical					24.83	3.13
		Price					16.20	2.04
	Financial Charges	Commitment Charges					1.54	0.19
		TOTAL PROJECT COST					1,292	163



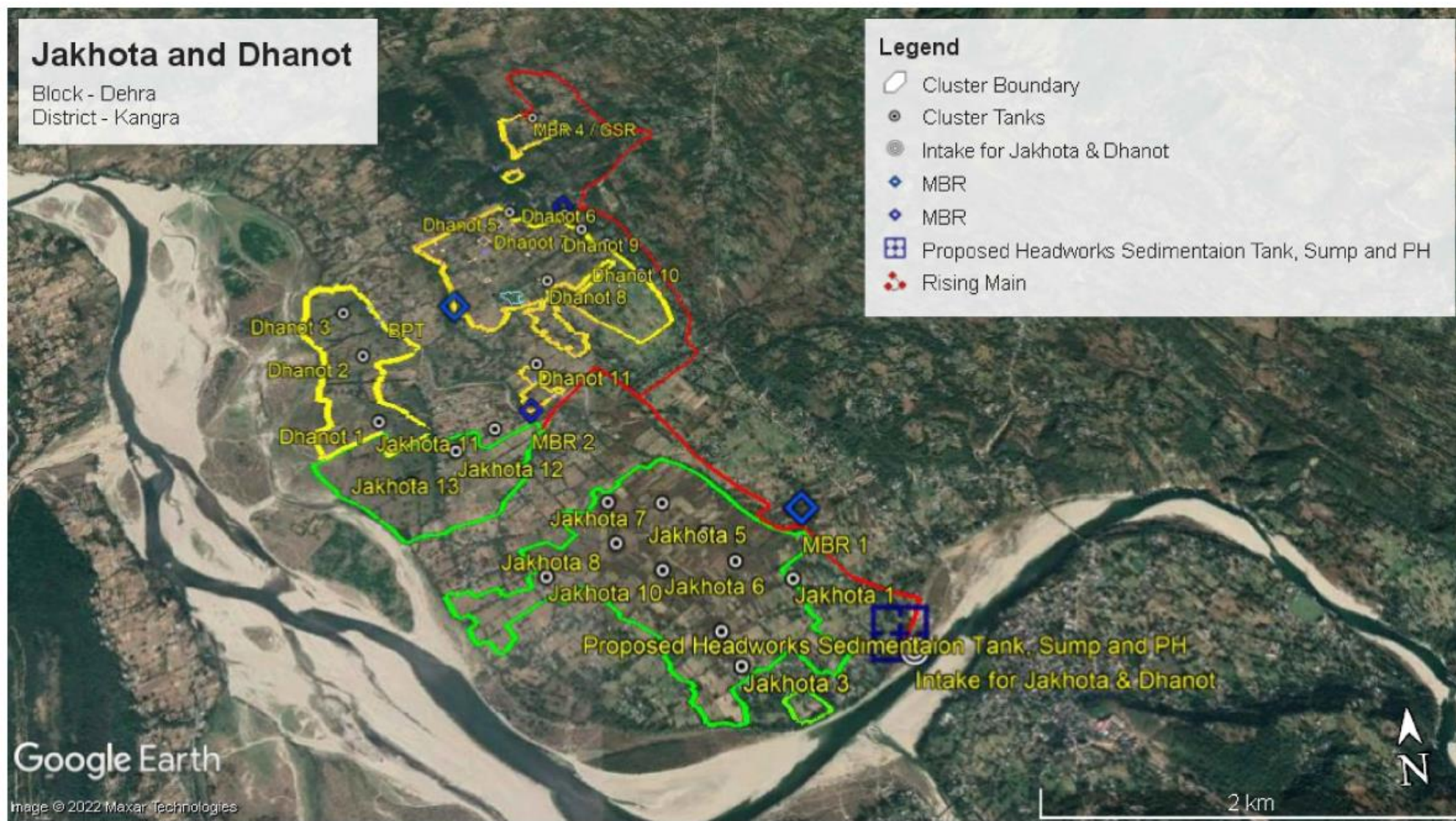
Schematic Drawing – Functional Scheme (Cluster – Upperberi)

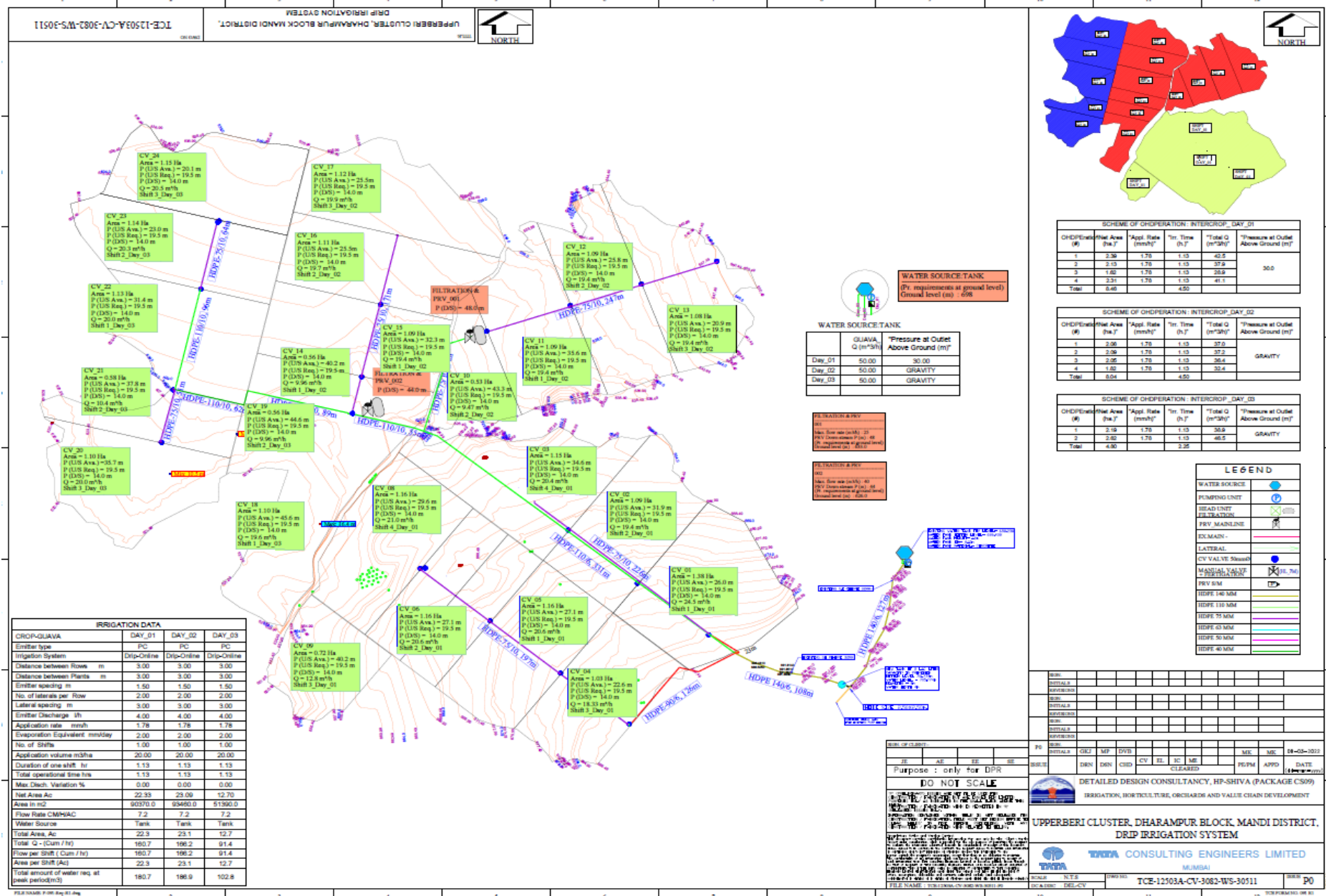


Schematic Drawing – New Scheme (Jakhota & Dhanot)

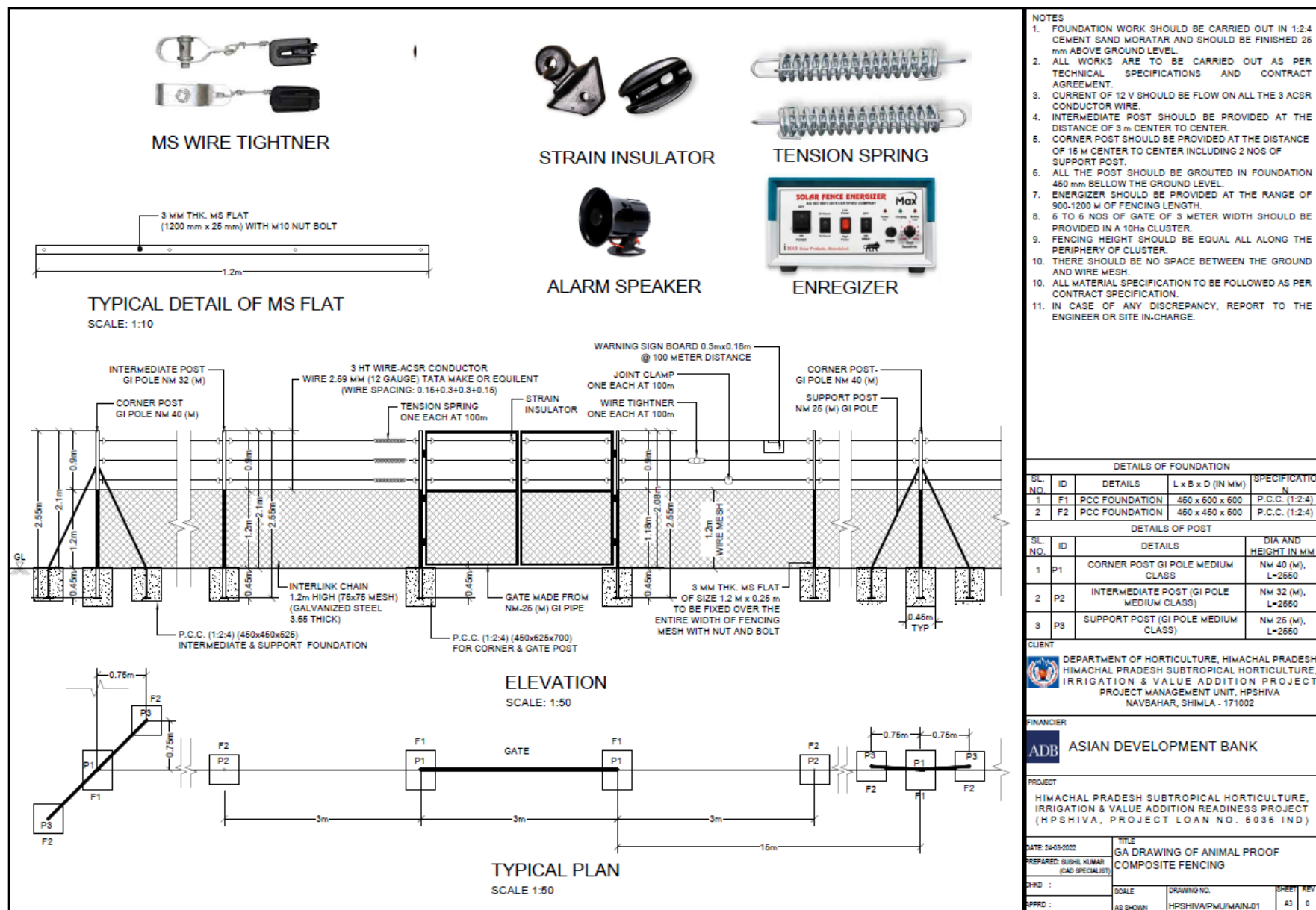


Key Plan - New Scheme (Jakhota and Dhanot)

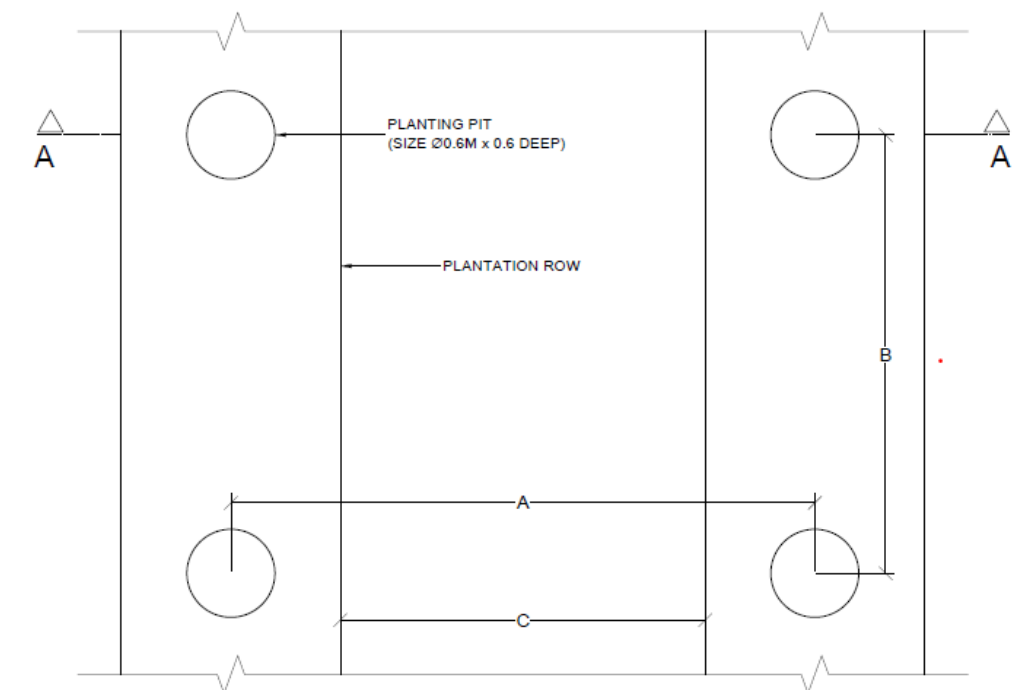




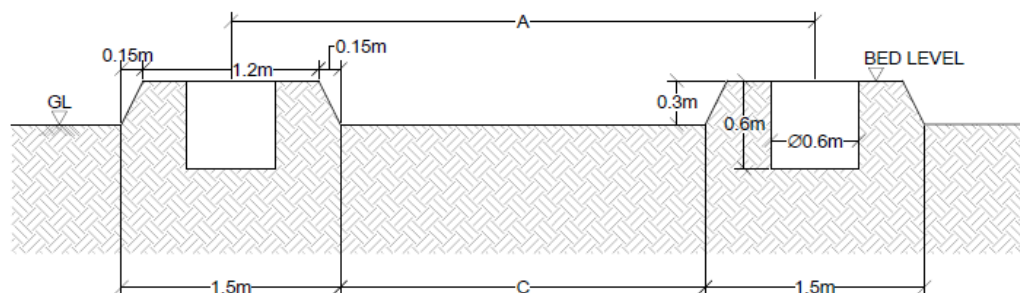
Animal Proof Composite Fencing



Land Preparation



TYPICAL PLAN OF PLANTING ROW



SECTION A-A

NOTES:

1. ALL DIMENSIONS ARE IN METER
2. WIDTH OF BED SHOULD BE 1.5 AT BOTTOM AND 1.2 M AT TOP.
3. HEIGHT OF THE BED SHOULD BE FINISHED AND COMPACTED AT 0.3 M FROM GROUND LEVEL.
4. EXCAVATION FOR PREPARATION OF BED SHOULD NOT EXCEED 0.15 METER. THE EXCAVATED EARTH SHOULD BE USED FOR THE BED PREPARATION.
5. PLANTATION BED SOIL SHOULD BE COMPACTED IN LAYER.
6. DEPTH OF THE PIT WOULD BE CALCULATED FORM THE TOP OF THE BED.
7. IN CASE OF DISCREPANCY, REPORT TO THE SITE INCHARGE.
8. SPACING BETWEEN TWO ROW WOULD BE USED FOR THE COMMUTING, MAINTENANCE AND INTER CROPPING.

SPACING

SL. NO.	NAME OF CROP	ROW SPACING IN M (A)	PLANT SPACING IN M (B)	BED SPACING IN M (C)
1	CITRUS	3	3	1.50
2	GUAVA	3	3	1.50
3	LITCHI	4	4	2.50
4	POMEGRANATE	3	3	1.50
6	KIWI	4	3	2.50
6	PERSIMON	4	4	2.50
7	PLUM	4	4	2.50
8	MANGO	3	3	1.50
9	PECAN NUT	6	6	4.50
10	AVOCADO	4	4	2.50

CLIENT

DEPARTMENT OF HORTICULTURE, HIMACHAL PRADESH
HIMACHAL PRADESH SUBTROPICAL HORTICULTURE,
IRRIGATION & VALUE ADDITION PROJECT
PROJECT MANAGEMENT UNIT, HPSHIVA
NAVBAHAR, SHIMLA - 171002

FINANCIER

ADB ASIAN DEVELOPMENT BANK

PROJECT

HIMACHAL PRADESH SUBTROPICAL HORTICULTURE,
IRRIGATION & VALUE ADDITION READINESS PROJECT
(HPSHIVA - PRF, PROJECT LOAN NO. 6036 IND)

DATE: 19-03-2022

PREPARED: SUSHIL KUMAR
(CAD SPECIALIST)

CHKD :

APPRD :

TITLE
TYPICAL CROSS SECTION DETAILS
FOR BED PREPARATION

SCALE : 1:30
DRAWING NO. : HPSHIVA/PMU/MAIN-02
SHEET : 03
REV : 0

Annexure 1.3: Cluster wise crop mapping (with area & irrigation type)

S	Package / Lot	District	Block	Cluster Name	Area (ha)	Coordinates Latitude	Coordinates Longitude	Irrigation Scheme Type	Irrigation Scheme Name	Cluster Crop
1	Lot 01	Solan	Kunihar	Chunad	16.35	31.1209520	76.9228190	New	LIS Chunad	Guava
2	Lot 01	Solan	Kunihar	Daseran	33.46	31.2503040	76.8963960	New	LIS Daseran	Citrus
3	Lot 01	Solan	Kunihar	Datti	13.75	31.2134310	76.9420040	New	LIS Datti	Plum
4	Lot 01	Solan	Kunihar	Giana	6.69	31.2425140	76.9737100	New	LIS Giana	Pomegranate
5	Lot 01	Solan	Kunihar	Jailang	9.65	31.0959000	76.9157610	New	LIS	Guava
6	Lot 01	Solan	Kunihar	Pajeena	14.26	31.2721670	76.9850940	New	LIS Pajeena	Citrus
7	Lot 01	Solan	Kunihar	Sai	6.74	31.1488890	76.8725000	New	LIS Sai	Guava
8	Lot 01	Solan	Kunihar	Ser-Delag	21.56	31.1533620	76.9355280	New	LIS Ser-Dalag	Guava
9	Lot 01	Solan	Nalagarh	Badhal	6.42	31.0984840	76.7622940	New	LIS	Guava
10	Lot 01	Solan	Nalagarh	Baduan Bharmana	18.06	31.0449850	76.7702580	New	LIS	Guava
11	Lot 01	Solan	Nalagarh	Batiakh	15.13	31.1605360	76.7945030	New	LIS Batiakh	Guava
12	Lot 01	Solan	Nalagarh	Beli khol 1	10.17	30.9866740	76.7266440	New	LIS Beli Khol	Guava
13	Lot 01	Solan	Nalagarh	Beli khol 2	16.20	30.9828890	76.7315530	New	LIS	Guava
14	Lot 01	Solan	Nalagarh	Doli	16.91	31.1708330	76.7888890	New	LIS Doli	Guava
15	Lot 01	Solan	Nalagarh	Kosri	22.09	31.0101200	76.8425670	New	LIS	Guava
16	Lot 01	Solan	Nalagarh	Palli	12.17	31.1459720	76.7060620	New	LIS Palli	Guava
17	Lot 01	Solan	Nalagarh	Sour	37.12	31.1769440	76.7955560	New	LIS Sour	Guava
18	Lot 02	Sirmour	Nahan	Bajari	13.99	30.5927800	77.1897200	New	LIS Bajari	Litchi
19	Lot 02	Sirmour	Nahan	Bhogpur	8.49	30.5728960	77.1906700	New	LIS Bhogpur Simbawala	Guava
20	Lot 02	Sirmour	Nahan	Budriyon	16.10	30.5378070	77.1979490	New	LIS Budriyon	Guava
21	Lot 02	Sirmour	Nahan	Dungi Sher	9.68	30.6331220	77.3480010	New	LIS Dungi Sher	Guava
22	Lot 02	Sirmour	Nahan	Goant	8.00	30.6558490	77.2859330	New	LIS Goant	Guava
23	Lot 02	Sirmour	Nahan	Judag	12.61	30.5991440	77.769969	New	LIS Judag	Guava
24	Lot 02	Sirmour	Nahan	Kherichandan 1	14.41	30.6259140	77.3581800	New	LIS Kherichandan	Guava
25	Lot 02	Sirmour	Nahan	Kherichandan 2	13.81	30.6174200	77.3715110	New	LIS Kherichandan	Guava
26	Lot 02	Sirmour	Nahan	Rama	6.88	30.5508190	77.3764260	New	LIS Rama	Guava
27	Lot 02	Sirmour	Nahan	Simbalwala	9.99	30.5863380	77.1845020	New	LIS Bhogpur Simbawala	Guava
28	Lot 02	Sirmour	Paonta Sahib	Amboya Chandela	10.33	30.5243430	77.7123600	New	LIS	Guava
29	Lot 02	Sirmour	Paonta Sahib	Fatehpur	6.61	30.4940750	77.5566460	New	LIS Fatepur	Guava
30	Lot 02	Sirmour	Paonta Sahib	Gyayaniwala	10.87	30.5032040	77.7398930	New	LIS Gyayaniwala	Guava
31	Lot 02	Sirmour	Paonta Sahib	Khara	8.95	30.5065430	77.6084380	New	LIS Khara	Guava
32	Lot 02	Sirmour	Paonta Sahib	Killour	21.88	30.5327570	77.8181110	New	LIS Killour	Guava
33	Lot 02	Sirmour	Paonta Sahib	Puruwala	13.93	30.4637380	77.5755580	New	LIS Puruwala	Guava
34	Lot 02	Sirmour	Paonta Sahib	Upper Bhuddi	21.72	30.5014260	77.7479500	New	LIS upper Buddi	Guava
35	Lot 03	Hamirpur	Bamsan	Parol	17.51	31.6497620	76.6184810	Non Functional	LIS Dera Parol	Citrus

Himachal Pradesh Sub-tropical Horticulture, Irrigation & Value Addition (HPSHIVA) - Detailed Project Report

S	Package / Lot	District	Block	Cluster Name	Area (ha)	Coordinates Latitude	Coordinates Longitude	Irrigation Scheme Type	Irrigation Scheme Name	Cluster Crop
36	Lot 03	Hamirpur	Bamsan	Sachuin	8.68	31.8683350	76.6308310	Functional	LIS Sachuin	Pomegranate
37	Lot 03	Hamirpur	Bhoranj	Balor-Sangrawar	33.45	31.6268820	76.6432340	New	LIS Balor Sangrawar	Guava
38	Lot 03	Hamirpur	Bhoranj	Jol	19.72	31.6337430	76.7088790	New	LIS Jol	Guava
39	Lot 03	Hamirpur	Bhoranj	Lagmanwin	6.90	31.6251300	76.6715900	New	LIS Lagmanwin	Guava
40	Lot 03	Hamirpur	Bhoranj	Lambagram/Palasi	18.17	31.588658	76.6022060	New	LIS Lambagram	Guava
41	Lot 03	Hamirpur	Bhoranj	Mundkhar tulsi	27.99	31.5936210	76.6912690	New	LIS Mundkhar	Guava
42	Lot 03	Hamirpur	Bhoranj	Samlog	22.69	31.6227510	76.6457390	New	LIS Samlog	Guava
43	Lot 03	Hamirpur	Bijhari	Bhalat	11.52	31.4920300	76.4871000	New	LIS Bhalat	Pomegranate
44	Lot 03	Hamirpur	Bijhari	Ghangot	8.42	31.4952320	76.5229680	Non Functional	LIS Ghangot	Pomegranate
45	Lot 03	Hamirpur	Bijhari	Kalwal	15.75	31.4570500	76.5652800	Non Functional	LIS Kalwal	Pomegranate
46	Lot 03	Hamirpur	Bijhari	Lafran	13.96	31.4749800	76.5990500	New	LIS Lafran	Pomegranate
47	Lot 03	Hamirpur	Bijhari	Seri-Bhakredi	14.88	31.5377100	76.4730400	Non Functional	LIS Seri bhakredi	Pomegranate
48	Lot 04	Hamirpur	Hamirpur	Bakarti	29.97	31.6617860	76.4901360	Non Functional	LIS Bakarti	Citrus
49	Lot 04	Hamirpur	Hamirpur	Branda	7.90	31.6721200	76.4592200	Non Functional	LIS Nalti Branda	Citrus
50	Lot 04	Hamirpur	Hamirpur	Haar	14.90	31.6588410	76.4705580	Non Functional	LIS Jangal Ropa Haar	Citrus
51	Lot 04	Hamirpur	Hamirpur	Jangal ropa	22.20	31.6568780	76.4868810	Non Functional	LIS Jangal Ropa Haar	Citrus
52	Lot 04	Hamirpur	Hamirpur	Neri	7.44	31.6925660	76.4650990	Non Functional	LIS Neri	Citrus
53	Lot 04	Hamirpur	Nadaun	Baag Bharmoti	6.10	31.7612000	76.3513500	New	MIP Nadun Left Bank	Citrus
54	Lot 04	Hamirpur	Nadaun	Bhabran 1	11.22	31.7347590	76.3203030	New	LIS Bhabran	Citrus
55	Lot 04	Hamirpur	Nadaun	Bhabran 2	13.90	31.7415310	76.3310210	New	LIS Bhabran	Citrus
56	Lot 04	Hamirpur	Nadaun	Bhalana Rei	18.21	31.7599610	76.5073170	New	LIS Pung Khad	Guava
57	Lot 04	Hamirpur	Nadaun	Choru (Bhoo-I)	6.20	31.7932690	76.4261960	New	LIS Bhoo	Citrus
58	Lot 04	Hamirpur	Nadaun	Kaloor	9.74	31.7686160	76.3136250	New	LIS kaloor	Citrus
59	Lot 04	Hamirpur	Nadaun	Kashmir	6.70	31.6281670	76.4002750	New	LIS kashmir	Citrus
60	Lot 04	Hamirpur	Nadaun	Kushiar-I	15.80	31.6612200	76.3728700	New	LIS Kushiar Galol	Citrus
61	Lot 04	Hamirpur	Nadaun	Lohardha	5.00	31.7675210	76.4243680	New	MIP Nadun Right Bank	Citrus
62	Lot 04	Hamirpur	Nadaun	Manjot 1 & 2	9.40	31.7675900	76.4464900	New	LIS Salasi Nallah	Citrus
63	Lot 04	Hamirpur	Nadaun	Pansai 1 & 2	56.40	31.6809830	76.4003740	New	LIS Pansai	Citrus
64	Lot 04	Hamirpur	Nadaun	Phal Palsi	28.20	31.6230280	76.4102880	New	LIS Palsi	Citrus
65	Lot 04	Hamirpur	Nadaun	Rail	6.20	31.7457800	76.4211700	New	MIP Nadun Right Bank	Citrus
66	Lot 04	Hamirpur	Nadaun	Sadhwan	8.80	31.7346300	76.4071800	New	MIP Nadun Left Bank	Citrus
67	Lot 04	Hamirpur	Nadaun	Sai Lower	19.00	31.7243330	76.3875920	Non Functional	MIP Nadun Left Bank (NF)	Citrus
68	Lot 04	Hamirpur	Nadaun	Tung (Baloh)	14.10	31.6994570	76.3567410	New	LIS Mann Khad	Citrus
69	Lot 04	Hamirpur	Sujanpur	Beri-1	9.30	31.8781320	76.5577550	Non Functional	LIS Beri Kudana	Pomegranate

Himachal Pradesh Sub-tropical Horticulture, Irrigation & Value Addition (HPSHIVA) - Detailed Project Report

S	Package / Lot	District	Block	Cluster Name	Area (ha)	Coordinates Latitude	Coordinates Longitude	Irrigation Scheme Type	Irrigation Scheme Name	Cluster Crop
70	Lot 04	Hamirpur	Sujanpur	Beri-2	12.40	31.8756730	76.5559820	Non Functional	LIS Beri Kudana	Pomegranate
71	Lot 04	Hamirpur	Sujanpur	Bhahru (Paur)	7.10	31.8730010	76.5517260	Non Functional	LIS Bharu Jator	Pomegranate
72	Lot 04	Hamirpur	Sujanpur	Bir Baghera	7.00	31.8626580	76.5323840	Non Functional	LIS Paur	Guava
73	Lot 04	Hamirpur	Sujanpur	Kheri	12.80	31.8882400	76.5966760	Non Functional	LIS Kheri	Pomegranate
74	Lot 04	Hamirpur	Sujanpur	Kudana	7.90	31.8713050	76.5636850	Non Functional	LIS Bharu Jator	Citrus
75	Lot 05	Bilaspur	Ghumarwin	Bhadrog (Seu)	8.88	31.4654100	76.6944980	New	LIS Bhadrug	Citrus
76	Lot 05	Bilaspur	Ghumarwin	Bhapral	7.11	31.5243820	76.6915950	New	LIS Bhapral	Guava
77	Lot 05	Bilaspur	Ghumarwin	Chharal Daloli	19.29	31.5235950	76.7033140	New	LIS Charal Daloli	Citrus
78	Lot 05	Bilaspur	Ghumarwin	Chhiber	16.99	31.4162500	76.7298990	New	LIS Chhiber	Citrus
79	Lot 05	Bilaspur	Ghumarwin	Dehra	17.90	31.5800730	76.7141190	Functional	LIS Dehrakot	Citrus
80	Lot 05	Bilaspur	Ghumarwin	Kashol Balh	8.84	31.4848180	76.6917050	Non Functional	LIS Kasol	Citrus
81	Lot 05	Bilaspur	Ghumarwin	Kasol	20.53	31.4835320	76.6979350	Non Functional	LIS Kasol	Citrus
82	Lot 05	Bilaspur	Ghumarwin	Kasol Kanjeen	6.20	31.4761130	76.6902020	Non Functional	LIS Kasol	Citrus
83	Lot 05	Bilaspur	Ghumarwin	Kathalag droun	20.57	31.5752180	76.7159640	Functional	LIS Dehrakot	Guava
84	Lot 05	Bilaspur	Ghumarwin	Kot	30.66	31.5909280	76.71565300	New	LIS	Guava
85	Lot 05	Bilaspur	Ghumarwin	Lower Lanjhta	11.61	31.5071130	76.6882580	Functional	LIS Lajanta	Litchi
86	Lot 05	Bilaspur	Ghumarwin	Massour/Maloh	6.57	31.5157140	76.7220990	New	LIS Massour/Maloh	Citrus
87	Lot 05	Bilaspur	Ghumarwin	Mehri Kathla	14.46	31.5475660	76.7190090	Non Functional	LIS Mehria Kathla	Citrus
88	Lot 05	Bilaspur	Ghumarwin	Nalti Parnal	8.77	31.5466650	76.7091100	Non Functional	LIS Nalti Parnal	Citrus
89	Lot 05	Bilaspur	Ghumarwin	Samsai	5.34	31.5303320	76.6444640	New	LIS Samsai	Guava
90	Lot 05	Bilaspur	Ghumarwin	Sandhiar (Chhat)	18.97	31.4341190	76.6232040	New	LIS ShiarrChhat)	Guava
91	Lot 05	Bilaspur	Ghumarwin	Talwara - 2 (Upper & Lower)	11.26	31.5324640	76.7028190	Functional	LIS Talwara	Citrus
92	Lot 05	Bilaspur	Ghumarwin	Talwara - 3 (Phase 2)	6.91	31.5378630	76.7038220	Functional	LIS Talwara	Citrus
93	Lot 05	Bilaspur	Ghumarwin	Thandora	7.41	31.5149550	76.6744870	Functional	LIS Lajanta	Litchi
94	Lot 05	Bilaspur	Sadar-Bilaspur	Dugga Har (Manjher)	11.43	31.2491300	76.8244220	New	LIS Jarad Khad	Citrus
95	Lot 05	Bilaspur	Sadar-Bilaspur	Kainthal (Manjher)	6.38	31.2472930	76.8266950	New	LIS Jarad Khad	Citrus
96	Lot 05	Bilaspur	Sadar-Bilaspur	Karot	21.92	31.3310360	76.8203160	New	LIS Karot	Citrus
97	Lot 05	Bilaspur	Sadar-Bilaspur	Khod ka kyar	21.49	31.2461480	76.8218250	New	LIS Jarad Khad	Citrus
98	Lot 05	Bilaspur	Sadar-Bilaspur	Kothi (Majher)	8.67	31.2488920	76.8198170	New	LIS	Citrus

Himachal Pradesh Sub-tropical Horticulture, Irrigation & Value Addition (HPSHIVA) - Detailed Project Report

S	Package / Lot	District	Block	Cluster Name	Area (ha)	Coordinates Latitude	Coordinates Longitude	Irrigation Scheme Type	Irrigation Scheme Name	Cluster Crop
99	Lot 05	Bilaspur	Sadar-Bilaspur	Kotlu	14.23	31.3200370	76.8172490	New	LIS Kotlu	Guava
100	Lot 05	Bilaspur	Sadar-Bilaspur	Loharda /Deoth	23.02	31.2468470	76.8307620	New	LIS Jarad Khad	Citrus
101	Lot 05	Bilaspur	Sadar-Bilaspur	Salnu	27.79	31.4174630	76.8035340	New	LIS Salnu	Citrus
102	Lot 06	Bilaspur	Jhandutta	Balh Sihna	32.14	31.4174980	76.5898240	New	LIS Balh Sinha	Guava
103	Lot 06	Bilaspur	Jhandutta	Fagog	22.83	31.4019880	76.6246240	Non Functional	LIS Fagog	Citrus
104	Lot 06	Bilaspur	Jhandutta	Fagog Banjholi	12.33	31.4020740	76.6190810	Non Functional	LIS Fagog	Citrus
105	Lot 06	Bilaspur	Jhandutta	Jhandu	16.06	31.3667010	76.6442440	New	LIS Jhandu	Guava
106	Lot 06	Bilaspur	Jhandutta	Kosarian	30.59	31.4348390	76.5073290	New	LIS Kosrian	Citrus
107	Lot 06	Bilaspur	Jhandutta	Lehar	25.23	31.3401950	76.6478590	New	LIS Leher	Guava
108	Lot 06	Bilaspur	Jhandutta	Tihri	29.15	31.4285000	76.6408010	Non Functional	LIS Tihri	Pomegranate
109	Lot 06	Bilaspur	Jhandutta	Tikkari Kotlu	23.65	31.3692510	76.6520490	New	LIS Tikkari Kotlu	Guava
110	Lot 06	Bilaspur	Swarghat	Bassi	12.44	31.3112500	76.5106640	Functional	LIS Changer	Citrus
111	Lot 06	Bilaspur	Swarghat	Dulhet- 2 (or 3)	29.62	31.3649990	76.4728070	Functional	LIS Changer	Citrus
112	Lot 06	Bilaspur	Swarghat	Ghattewal	28.26	31.3347190	76.4928600	Functional	LIS Changer	Citrus
113	Lot 07	Mandi	Chauntara	Dhelu(Har)	9.97	31.9910860	76.7678280	New	LIS Dhelu	Guava
114	Lot 07	Mandi	Chauntara	Dol	33.29	31.8476770	76.7641590	New	LIS TW2	Litchi
115	Lot 07	Mandi	Chauntara	Golwan	17.19	31.9830900	76.6997760	New	LIS Golwan	Guava
116	Lot 07	Mandi	Chauntara	Khadiyal	23.24	31.8648880	76.7563890	New	LIS TW2	Litchi
117	Lot 07	Mandi	Chauntara	Kothi – I (Balh)	9.30	31.8585010	76.7461050	New	LIS TW1	Guava
118	Lot 07	Mandi	Chauntara	Kothi - II	8.30	31.8645460	76.7409580	New	LIS TW1	Citrus
119	Lot 07	Mandi	Dharampur	Aarli Paryal	9.87	31.8240350	76.7094420	Functional	LIS Bari Marhi Dhwal	Citrus
120	Lot 07	Mandi	Dharampur	Bahn	5.63	31.8573170	76.6735060	Functional	LIS Kothua Dhalara	Citrus
121	Lot 07	Mandi	Dharampur	Balhara 1 & 2	3.91	31.8212370	76.7470220	Functional	LIS Bari Marhi Dhwal	Citrus
122	Lot 07	Mandi	Dharampur	Bandal/Khwada	10.71	31.7417020	76.6786710	New	LIS Tihra	Guava
123	Lot 07	Mandi	Dharampur	Banerti-2	10.44	31.8097790	76.7888220	Functional	LIS Baroti Mandap Jordan	Plum
124	Lot 07	Mandi	Dharampur	Banwaar Kalaan	13.16	31.8060280	76.7458640	Functional	LIS Bari Marhi Dhwal	Citrus
125	Lot 07	Mandi	Dharampur	Barota	4.37	31.7638570	76.7643900	Non Functional	LIS Brang	Guava
126	Lot 07	Mandi	Dharampur	Bharatpur (Bharouri)	7.49	31.8166300	76.7581330	Functional	LIS Bari Marhi Dhwal	Citrus

Himachal Pradesh Sub-tropical Horticulture, Irrigation & Value Addition (HPSHIVA) - Detailed Project Report

S	Package / Lot	District	Block	Cluster Name	Area (ha)	Coordinates Latitude	Coordinates Longitude	Irrigation Scheme Type	Irrigation Scheme Name	Cluster Crop
127	Lot 07	Mandi	Dharampur	Chah (Cheh)	8.67	31.7676400	76.7828420	Functional	LIS Baroti Mandap Jordan	Guava
128	Lot 07	Mandi	Dharampur	Chakyana	3.72	31.8205600	76.7659900	Functional	LIS Bari Marhi Dhwali	Citrus
129	Lot 07	Mandi	Dharampur	Chandpur	11.98	31.7427630	76.6846590	New	LIS Tihra	Citrus
130	Lot 07	Mandi	Dharampur	Chhapanu	8.38	31.8116730	76.7608600	Functional	LIS Bari Marhi Dhwali	Citrus
131	Lot 07	Mandi	Dharampur	Chhater	10.86	31.7438330	76.7847480	New	LIS Tihra	Guava
132	Lot 07	Mandi	Dharampur	Cholgrah (Khajurti)	5.76	31.8188870	76.6378880	New	LIS Tihra	Citrus
133	Lot 07	Mandi	Dharampur	Chunighat	14.14	31.8017370	76.7044530	Functional	LIS Bari Marhi Dhwali	Citrus
134	Lot 07	Mandi	Dharampur	Churu ra Balh	20.88	31.7850590	76.7327610	Functional	LIS Churu Balh	Citrus
135	Lot 07	Mandi	Dharampur	Darwaar	9.27	31.7562240	76.6922040	New	LIS Tihra	Guava
136	Lot 07	Mandi	Dharampur	Dedhal (Dyol)	5.59	31.8510460	76.7389770	New	LIS Tihra	Citrus
137	Lot 07	Mandi	Dharampur	Dhalara-1	9.35	31.8490050	76.6809510	Functional	LIS Kothua Dhalara	Citrus
138	Lot 07	Mandi	Dharampur	Dhalara-2	8.70	31.8424830	76.6811120	Functional	LIS Kothua Dhalara	Citrus
139	Lot 07	Mandi	Dharampur	Dhardi-1	2.67	31.8190430	76.7200620	Functional	LIS Bari Marhi Dhwali	Citrus
140	Lot 07	Mandi	Dharampur	Dhardi-2	3.55	31.8197010	76.7243900	Functional	LIS Bari Marhi Dhwali	Citrus
141	Lot 07	Mandi	Dharampur	Didnu	5.20	31.7830990	76.7606470	Functional	LIS Baroti Mandap Jordan	Citrus
142	Lot 07	Mandi	Dharampur	Digho-Baglana (Karyal)	7.28	31.7167900	76.6894410	New	LIS Tihra	Guava
143	Lot 07	Mandi	Dharampur	Drumman	30.76	31.7686590	76.8110470	Functional	LIS Baroti Mandap Jordan	Citrus
144	Lot 07	Mandi	Dharampur	Galloo (Chanouta)	6.19	31.7621880	76.7732420	Functional	LIS Baroti Mandap Jordan	Citrus
145	Lot 07	Mandi	Dharampur	Ghanswai	8.30	31.8146460	76.7127160	Functional	LIS Bari Marhi Dhwali	Guava
146	Lot 07	Mandi	Dharampur	Gorat	12.25	31.8545550	76.7050820	Functional	LIS Bari Marhi Dhwali	Citrus
147	Lot 07	Mandi	Dharampur	Guin	27.80	31.7766450	76.8082530	Functional	LIS Baroti Mandap Jordan	Citrus
148	Lot 07	Mandi	Dharampur	Harnayal	12.55	31.8098850	76.7275340	Functional	LIS Bari Marhi Dhwali	Guava
149	Lot 07	Mandi	Dharampur	Hiun	3.96	31.7671810	76.7970430	Functional	LIS Baroti Mandap Jordan	Citrus
150	Lot 07	Mandi	Dharampur	Kanohi	1.32	31.8345410	76.6474760	Functional	LIS Sandhole	Guava
151	Lot 07	Mandi	Dharampur	Kharoh (Kalerka)	17.11	31.7124720	76.7173280	Functional	LIS Basantpur	Citrus

Himachal Pradesh Sub-tropical Horticulture, Irrigation & Value Addition (HPSHIVA) - Detailed Project Report

S	Package / Lot	District	Block	Cluster Name	Area (ha)	Coordinates Latitude	Coordinates Longitude	Irrigation Scheme Type	Irrigation Scheme Name	Cluster Crop
152	Lot 07	Mandi	Dharampur	Kumahrda	13.84	31.7828430	76.8105300	Functional	LIS Baroti Mandap Jordan	Plum
153	Lot 07	Mandi	Dharampur	Kumahrda 2	10.22	31.7938920	76.8112860	Functional	LIS Baroti Mandap Jordan	Plum
154	Lot 07	Mandi	Dharampur	Lahsni	1.35	31.8329940	76.6701020	Functional	LIS Sandhole	Guava
155	Lot 07	Mandi	Dharampur	Lalana	4.27	31.8112110	76.7000320	Functional	LIS Bari Marhi Dhwal	Citrus
156	Lot 07	Mandi	Dharampur	Lower (Nichali) Bairi	9.13	31.8826390	76.6780010	Functional	LIS Bairi	Citrus
157	Lot 07	Mandi	Dharampur	Upper Bairi	23.98	31.8779240	76.6832790	Functional	LIS Bairi	Citrus
158	Lot 07	Mandi	Dharampur	Lower Balh	6.24	31.8598720	76.6888400	Functional	LIS Kothua Dhalara	Citrus
159	Lot 07	Mandi	Dharampur	Lower Chatrun	11.26	31.8572470	76.6688860	Functional	LIS Kothua Dhalara	Guava
160	Lot 07	Mandi	Dharampur	Mannu Dhar(Joh)	13.68	31.8063100	76.7168110	Functional	LIS Bari Marhi Dhwal	Citrus
161	Lot 07	Mandi	Dharampur	Manyoh- Lambri	20.14	31.7608300	76.6391320	New	LIS Tihra	Guava
162	Lot 07	Mandi	Dharampur	Pakhdol	4.39	31.8657850	76.6986250	Functional	LIS Bari Marhi Dhwal	Citrus
163	Lot 07	Mandi	Dharampur	Parly pryal	1.70	31.8306630	76.7125230	Functional	LIS Bari Marhi Dhwal	Citrus
164	Lot 07	Mandi	Dharampur	Patti (Kot)	6.90	31.7448300	76.6614560	New	LIS Tihra	Guava
165	Lot 07	Mandi	Dharampur	Pehad	10.04	31.8083510	76.8076910	Functional	LIS Baroti Mandap Jordan	Plum
166	Lot 07	Mandi	Dharampur	Richhali	12.81	31.8030120	76.7278160	Functional	LIS Bari Marhi Dhwal	Citrus
167	Lot 07	Mandi	Dharampur	Richhali - Dhwal	5.75	31.8076510	76.7276140	Functional	LIS Bari Marhi Dhwal	Guava
168	Lot 07	Mandi	Dharampur	Sakrai Dhar	5.36	31.8125820	76.7203980	Functional	LIS Bari Marhi Dhwal	Citrus
169	Lot 07	Mandi	Dharampur	Satrehar	12.52	31.8165880	76.7506480	Functional	LIS Bari Marhi Dhwal	Citrus
170	Lot 07	Mandi	Dharampur	Seoh (Balh) Nichla Ropa	18.74	31.8776340	76.7145740	Functional	LIS Seoh	Citrus
171	Lot 07	Mandi	Dharampur	Seoh-2	27.49	31.8696840	76.7153400	Functional	LIS Seoh	Citrus
172	Lot 07	Mandi	Dharampur	Sherpur I	1.24	31.8030270	76.6913490	Functional	LIS Bari Marhi Dhwal	Guava
173	Lot 07	Mandi	Dharampur	Single Kuhat	3.70	31.8490200	76.6539130	Functional	LIS Sandhole	Citrus
174	Lot 07	Mandi	Dharampur	Siram(Sarskan)	7.05	31.7934640	76.7767400	Functional	LIS Baroti Mandap Jordan	Citrus
175	Lot 07	Mandi	Dharampur	Skohta	1.82	31.7489200	76.6415150	New	LIS Tihra	Citrus
176	Lot 07	Mandi	Dharampur	Tarohla	8.00	31.8064990	76.7347860	Functional	LIS Bari Marhi Dhwal	Guava
177	Lot 07	Mandi	Dharampur	Taroon	9.26	31.8380130	76.7174300	Functional	LIS Bari Marhi Dhwal	Citrus

Himachal Pradesh Sub-tropical Horticulture, Irrigation & Value Addition (HPSHIVA) - Detailed Project Report

S	Package / Lot	District	Block	Cluster Name	Area (ha)	Coordinates Latitude	Coordinates Longitude	Irrigation Scheme Type	Irrigation Scheme Name	Cluster Crop
178	Lot 07	Mandi	Dharampur	Thanna (Ropari)	8.18	31.7255340	76.6979050	New	LIS Tihra	Citrus
179	Lot 07	Mandi	Dharampur	Tikkar Chanyar	14.51	31.7659920	76.6690850	New	LIS Tihra	Plum
180	Lot 07	Mandi	Dharampur	Tourjajar	9.74	31.7592130	76.7937560	Functional	LIS Baroti Mandap Jordan	Citrus
181	Lot 07	Mandi	Dharampur	Trembala	6.06	31.7737620	76.7315980	Functional	LIS Baroti Mandap Jordan	Citrus
182	Lot 07	Mandi	Gopalpur	Bag-chuhku	12.86	31.6194680	76.7194990	New	LIS TW4	Citrus
183	Lot 07	Mandi	Gopalpur	Bahi	8.71	31.6052590	76.7392990	Functional	LIS Bahi	Guava
184	Lot 07	Mandi	Gopalpur	Barchwar	10.82	31.6774560	76.7278830	Functional	LIS Basantpur	Guava
185	Lot 07	Mandi	Gopalpur	Batial-1	19.70	31.5809700	76.7334120	New	LIS TW3	Plum
186	Lot 07	Mandi	Gopalpur	Batal- 2	9.13	31.5759190	76.7321670	New	LIS TW3	Citrus
187	Lot 07	Mandi	Gopalpur	Bhadarwar Khobla	9.02	31.6879300	76.7886390	Functional	LIS Bhadrwar	Guava
188	Lot 07	Mandi	Gopalpur	Bhambhla-I	14.15	31.5900390	76.7360520	New	LIS Bhamla	Citrus
189	Lot 07	Mandi	Gopalpur	Dhar	10.16	31.6703990	76.7140010	Functional	LIS Basantpur	Guava
190	Lot 07	Mandi	Gopalpur	Ghadhyani	7.24	31.6769950	76.7215110	Functional	LIS Basantpur	Guava
191	Lot 07	Mandi	Gopalpur	Mataur Tanda 2	13.05	31.5662110	76.7301350	New	LIS Seer Khad	Pomegranate
192	Lot 07	Mandi	Gopalpur	Rasher	10.95	31.6816610	76.7867160	New	LIS Rasher Son Khad	Citrus
193	Lot 07	Mandi	Gopalpur	Sulpur	7.50	31.5940270	76.7274010	Functional	LIS Sulpur	Pomegranate
194	Lot 07	Mandi	Gopalpur	Thouna/Dhalait	8.18	31.7158170	76.8181130	New	LIS Thouna	Guava
195	Lot 08	Mandi	Drang / Sadar	Baragaon	14.32	31.7911150	76.9174170	Functional	LIS Baragaon	Guava
196	Lot 08	Mandi	Drang / Sadar	Binol	7.21	31.7017220	77.0410610	Functional	LIS Binol	Citrus
197	Lot 08	Mandi	Drang / Sadar	Dhaniyara	17.85	31.7543960	76.8654030	Functional	LIS Dhaniyara	Litchi
198	Lot 08	Mandi	Gohar/Balh	Bagga Chalog	8.63	31.6064460	77.0653430	Functional	LIS Bagga Chalog	Plum
199	Lot 08	Mandi	Gohar/Balh	Brikhmani	16.76	31.5470030	76.9691940	Functional	LIS Darvehad birkhamani	Plum
200	Lot 08	Mandi	Gohar/Balh	Darvehad	12.33	31.5487780	76.9546660	Functional	LIS Darvehad birkhamani	Plum
201	Lot 08	Mandi	Gohar/Balh	Dharwahan-II (Sehal)	17.39	31.6309600	76.8984490	Functional	LIS Dharwan	Guava
202	Lot 08	Mandi	Gohar/Balh	Latogali	26.97	31.6520770	77.0924860	Functional	LIS Latogli	Persimmon
203	Lot 08	Mandi	Gohar/Balh	Manjhagan Chudara	28.56	31.6409960	77.0709460	Functional	LIS Manjhagan Chudara	Plum
204	Lot 08	Mandi	Gohar/Balh	Manjhog Dhaniut	9.66	31.5055900	76.9784120	Functional	LIS Manjhog Dhaniut	Plum

Himachal Pradesh Sub-tropical Horticulture, Irrigation & Value Addition (HPSHIVA) - Detailed Project Report

S	Package / Lot	District	Block	Cluster Name	Area (ha)	Coordinates Latitude	Coordinates Longitude	Irrigation Scheme Type	Irrigation Scheme Name	Cluster Crop
205	Lot 08	Mandi	Gohar/Balh	Sawla	17.46	31.6653720	77.0548070	Functional	LIS Sawla	Persimmon
206	Lot 08	Mandi	Sundernagar	Bhantraed	11.85	31.4338970	76.8052930	Functional	LIS Bhantrred	Citrus
207	Lot 08	Mandi	Sundernagar	Khagron	10.15	31.4914590	76.9592190	New	LIS Khargaon	Plum
208	Lot 08	Mandi	Sundernagar	Kuthain	15.45	31.5197050	76.9343030	Functional	LIS Kuthain	Citrus
209	Lot 08	Mandi	Sundernagar	Palhota	17.11	31.5227660	76.9323240	Functional	LIS Pallhota	Citrus
210	Lot 09	Kangra	Bajjnath	Kudail	16.61	31.9852810	76.6765140	New	LIS Kudail	Guava
211	Lot 09	Kangra	Bajjnath	Langhu 1	6.20	32.0035300	76.6231690	New	LIS Binwa Khad	Guava
212	Lot 09	Kangra	Bajjnath	Langhu-2	7.25	32.0110320	76.6183240	New	LIS	Guava
213	Lot 09	Kangra	Bajjnath	Langhu-3	8.42	32.0110456	76.6188760	New	LIS	Guava
214	Lot 09	Kangra	Bajjnath	Malghota	6.00	32.0584480	76.6496070	New	LIS Manghota	Guava
215	Lot 09	Kangra	Bajjnath	Upper Bhet	21.67	32.0872400	76.6138300	New	LIS	Guava
216	Lot 09	Kangra	Bhawarna	Branker Mahadev	5.00	32.0769890	76.4314780	New	LIS	Guava
217	Lot 09	Kangra	Bhawarna	Chartkhola	17.71	32.1000100	76.4323800	New	LIS Tal Khad	Citrus
218	Lot 09	Kangra	Bhawarna	Ghar	8.21	32.0424920	76.5370300	New	LIS Ghar	Citrus
219	Lot 09	Kangra	Bhawarna	Ldhran	15.09	32.0909330	76.4312900	New	LIS Tal Khad	Litchi
220	Lot 09	Kangra	Bhawarna	Malahu 1	5.29	32.0105480	76.5075670	New	LIS Malahu	Citrus
221	Lot 09	Kangra	Bhawarna	Malahu 2	8.46	32.0061150	76.5177770	New	LIS Malahu	Litchi
222	Lot 09	Kangra	Bhawarna	Sidhpur Sarkari	30.09	32.0932100	76.4989300	New	LIS Sidpur	Citrus
223	Lot 09	Kangra	Bhawarna	Thandol 1	16.95	32.0111700	76.5262100	New	LIS Thandol	Guava
224	Lot 09	Kangra	Lambagaon	Jangal	9.15	31.8599900	76.4960700	Functional	LIS Malodan jangal	Citrus
225	Lot 09	Kangra	Lambagaon	Kathla	7.59	31.8795400	76.6318100	New	LIS Kathla	Citrus
226	Lot 09	Kangra	Lambagaon	Kotlu	4.52	31.9184720	76.4976200	Functional	LIS Bandhui	Citrus
227	Lot 09	Kangra	Lambagaon	Malodan	10.59	31.8681100	76.4904400	Functional	LIS Malodan jangal	Citrus
228	Lot 09	Kangra	Lambagaon	Odri	8.76	31.9028600	76.4997100	Functional	LIS Bandhui	Citrus
229	Lot 09	Kangra	Lambagaon	Thanpal/Chambi	8.34	31.8955300	76.6257800	New	LIS Chambi	Citrus
230	Lot 09	Kangra	Panchrukhi	Agozar	7.03	32.0350180	76.5784930	New	LIS Agozar	Citrus
231	Lot 09	Kangra	Panchrukhi	Banuri	7.73	32.0896200	76.5710540	New	LIS Banuri	Citrus
232	Lot 09	Kangra	Panchrukhi	Jandpur	8.54	32.0600480	76.6002990	New	LIS Jandpur	Citrus
233	Lot 09	Kangra	Panchrukhi	Ladoh 1	17.21	32.0483300	76.5631180	New	LIS Ladho	Litchi

Himachal Pradesh Sub-tropical Horticulture, Irrigation & Value Addition (HPSHIVA) - Detailed Project Report

S	Package / Lot	District	Block	Cluster Name	Area (ha)	Coordinates Latitude	Coordinates Longitude	Irrigation Scheme Type	Irrigation Scheme Name	Cluster Crop
234	Lot 09	Kangra	Panchrukhi	Ladoh 2	5.53	32.0503100	76.5585240	New	LIS Ladho 2	Litchi
235	Lot 09	Kangra	Panchrukhi	Molichak	6.15	32.0813900	76.5627000	New	LIS Molichak	Citrus
236	Lot 09	Kangra	Panchrukhi	Rajhot	17.27	32.0269970	76.5918550	New	LIS Rajhot	Citrus
237	Lot 09	Kangra	Panchrukhi	Saliana	7.33	32.0715320	76.5652310	New	LIS Saliana	Citrus
238	Lot 09	Kangra	Panchrukhi	Trehal	8.22	32.0512070	76.5977360	New	LIS Trehal	Guava
239	Lot 09	Kangra	Sullah	Chah (Chandar)	36.60	31.9700110	76.4959470	New	LIS Chander	Litchi
240	Lot 09	Kangra	Sullah	Chainchadi- Kuthera	10.19	31.9705800	76.5308600	New	LIS Kuthera	Citrus
241	Lot 09	Kangra	Sullah	Dheera	23.47	32.0120100	76.4542100	New	LIS Dheera	Citrus
242	Lot 09	Kangra	Sullah	Dheera 3	10.81	32.0120100	76.4542100	New	LIS Dheera 3	Citrus
243	Lot 09	Kangra	Sullah	Gagal Khas	23.47	32.0353880	76.4487070	New	LIS Ghagal Khas	Litchi
244	Lot 09	Kangra	Sullah	Purba	15.36	31.9540500	76.4442600	New	LIS Purba	Citrus
245	Lot 10	Kangra	Dehra	Bhatera Bassa	13.90	32.0138910	76.1754300	Functional	LIS Bhatera Bassa	Citrus
246	Lot 10	Kangra	Dehra	Bhatoli Phakasian	11.44	31.9788620	76.1347410	Functional	LIS Bhatoli Phakasian	Citrus
247	Lot 10	Kangra	Dehra	Dhanot	206.21	31.8089300	76.3123500	New	LIS Jakhota Dhanot	Citrus
248	Lot 10	Kangra	Dehra	Jakhota	227.54	31.7861300	76.3234800	New	LIS Jakhota Dhanot	Citrus
249	Lot 10	Kangra	Dehra	Lalwada	30.41	31.8243680	76.3179600	New	LIS Jakhota Dhanot	Citrus
250	Lot 10	Kangra	Pragpur	Chamba Khas	10.44	31.8197400	76.2569800	New	LIS Chamba Khas	Citrus
251	Lot 10	Kangra	Pragpur	Kuhna	11.86	31.8094100	76.2850100	New	LIS Kunah	Citrus
252	Lot 11	Una	Bangana	Balh Kholin	14.02	31.5401630	76.3665260	New	LIS Balh	Pomegranate
253	Lot 11	Una	Bangana	Baral	28.11	31.5525280	76.3778270	New	LIS	Guava
254	Lot 11	Una	Bangana	Boul - 3 (or 2)	24.55	31.5469200	76.3022800	Functional	LIS Samoor	Guava
255	Lot 11	Una	Bangana	Boul 1& 2	19.32	31.5490580	76.3005310	Functional	LIS Samoor	Guava
256	Lot 11	Una	Bangana	Chadoli	26.75	31.6338410	76.2960790	New	LIS Chapla Dam	Guava
257	Lot 11	Una	Bangana	Dobad	8.70	31.4641060	76.4165480	New	LIS Dobad	Pomegranate
258	Lot 11	Una	Bangana	Dulehri	9.11	31.5271520	76.3568850	Functional	LIS Dulheri	Pomegranate
259	Lot 11	Una	Bangana	Dumkhar	10.75	31.6129830	76.3379680	New	LIS Chapla Dam	Pomegranate
260	Lot 11	Una	Bangana	Handola	11.84	31.4259250	76.3890800	Non Functional	LIS Handola	Guava
261	Lot 11	Una	Bangana	Muchali	21.26	31.6185170	76.3499740	New	LIS Muchali	Guava
262	Lot 11	Una	Bangana	Nalwari	36.52	31.6067670	76.3465190	New	LIS Chapla Dam	Pomegranate
263	Lot 11	Una	Bangana	Sanhal	13.58	31.5425250	76.3377790	Functional	LIS Samoor	Guava
264	Lot 11	Una	Bangana	Thana Khurd	27.24	31.5253040	76.3577840	Functional	LIS Dulheri	Pomegranate

Annexure 1.4: Crop Specification and Market Trends

SWEET ORANGE

Introduction

Sweet Orange (*Citrus sinensis*) is tight skin orange and includes varieties Jaffa, Mosambi, Washington Navel, Natal, Hamlin, Pera, Westin etc. It is rich in Vitamin-C and minerals and in India is popular only next to Mango.

Citrus fruits in subtropical area of state are cultivated under varied agro-climatic situations right from Kangra to Paunta valley of Sirmaur district. Being evergreen fruit citrus should be grown in subtropical areas. They tend to produce cyclic growth flushes and hence regulating cropping in subtropical areas.

Crop Ecological Parameters⁵⁸

Sr. No.	Parameter Head	Parameter
1	Altitude	Upto 900 M amsl
2	Aspect	Northern
3	Terrain	
4	Soil type	Deep soil with no hard pan up to 2 m depth. Sandy loam to Clay Loam
5	Soil PH	5.5-7.5
6	EC	Less than 1. Sensitive to high salt concentration in the soil
7	Drainage	Well Drained
8	Frost	Can withstand occasional light frost
9	Optimum Temperature	13 -37 Degree Celsius
10	Avg. Annual Rainfall	500-775 mm

⁵⁸ Secondary Research and various state PoPs. Finalized in consultation with PMU and CS04 (University)

Crop Details⁵⁹

S.No.	Parameter Head	Parameter
A	Spacing	3X3 Mtr, 1111 Plant per Hectare
B	Planting Material Cost	INR 30 Per plant
C	Packing Cost	INR 2.5 Per kg
D	List of Micronutrients & Chemical for IPDM	1. Fenvalerate 2. Cypermethrin 3. Chloropyriphos 4. Thiamethoxam 5. Ethion 6. Oxydemeton- S- Methy 7. Bordeaux Mixture 8. Ridomil

Crop Cultivation Details

FYM: Well rotten farmyard manure should be applied along with 50% P through single super phosphate (SSP) in the basin by band placement during winter months before mid-January.

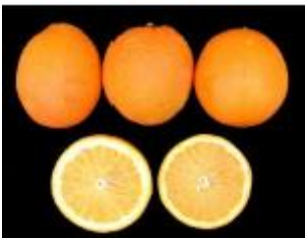
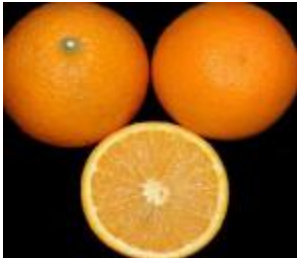
Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Production (kg/Plant)	0	0	15	25	35	35	35	35	35	35	35	35	35	35	35	35	25	25	20	15
FYM	10	10	15	20	25	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30

The inadequate fertilization is one of the reasons of citrus decline. Nutrition has become very costly input for fruit crops. Judicious use of manures and fertilizers helps to maintain productivity of citrus orchards. Right choice of fertilizers in an appropriate does in split applications at critical growth stages of the crop results into maximum advantage. The fertilizers doses recommended are on higher side.

Nutrient (g/tree)	1 st Year	2 nd Year	3 rd Year	4 th Year and Onwards
Nitrogen	60	120	200	300
Phosphorous	-	60	80	100
Potassium	-	50	100	150

⁵⁹ Finalized in consultation with PMU, CS04 (University) and CS03 Value Chain Report

Recommended Cultivars

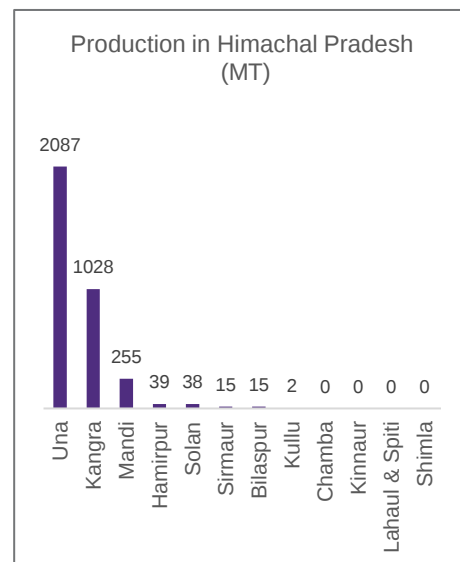
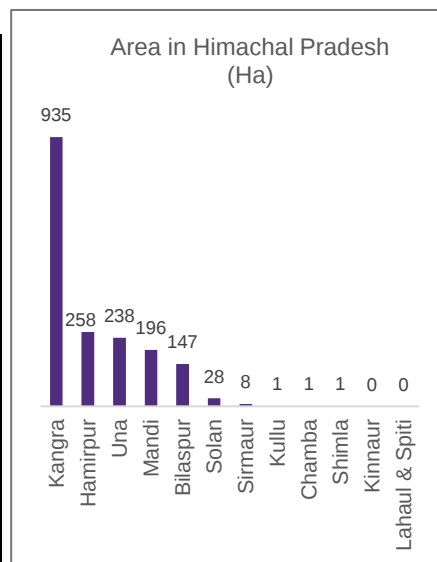
Mosambi This is a very distinctive variety with its fruits being small to medium in size and broadly sub-globose. Its colour varies from light yellow to pale orange at maturity, its surface is moderately to roughly pebbled with faint strips, narrow longitudinal grooves and ridges.	
Valencia Late Its fruits are slightly oval, medium in size and deep golden orange coloured at maturity. Fruits have abundant juice and the flavour is good but somewhat sub-acid in taste. The rind is medium thick, touch and leathery with a smooth to faintly pebbled surface.	
Blood Red It is distinguished by the development of red pigmentation in the pulp with deeply coloured cadmium-yellow glossy rind. The flesh is streaked red early in the season, but develops full red colour when ripe. Eight to ten seeded fruits ripen in December-January.	
Jaffa The colour of this fruit is orange red under favourable conditions. Its rind is medium-thick, finely pitted and moderately pebbled. The fruit medium to large sized, globose to slightly ellipsoid or obovate and seeds are comparatively few, around 8-10.	

Value Chain Analysis

In Himachal Pradesh, the area cultivated under Sweet Orange is 1813 ha and Production volume is 3482 MT with a productivity of 1.9 MT/ha.

Area and Production:

District	Productivity (MT/ha)
Una	8.8
Sirmaur	2.3
Kullu	2
Solan	1.4
Mandi	1.3
Kangra	1.1
Hamirpur	0.2
Bilaspur	0.1
Chamba	0
Kinnaur	0
Lahaul & Spiti	0
Shimla	0
Total	1.9



Seasonality:

Sweet Orange is expected to be harvested in November- December (peak season) and lean peak season will be there till January in Himachal Pradesh.

Sweet Orange	January				February				March				April				May				June				July				August				September				October				November				December			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV								
Himachal Pradesh																																																
Haryana																																																
Jammu and Kashmir																																																
Madhya Pradesh																																																
Maharashtra																																																
Rajasthan																																																
Punjab																																																
Karnataka																																																
Andhra Pradesh																																																



Peak Season



Lean Season

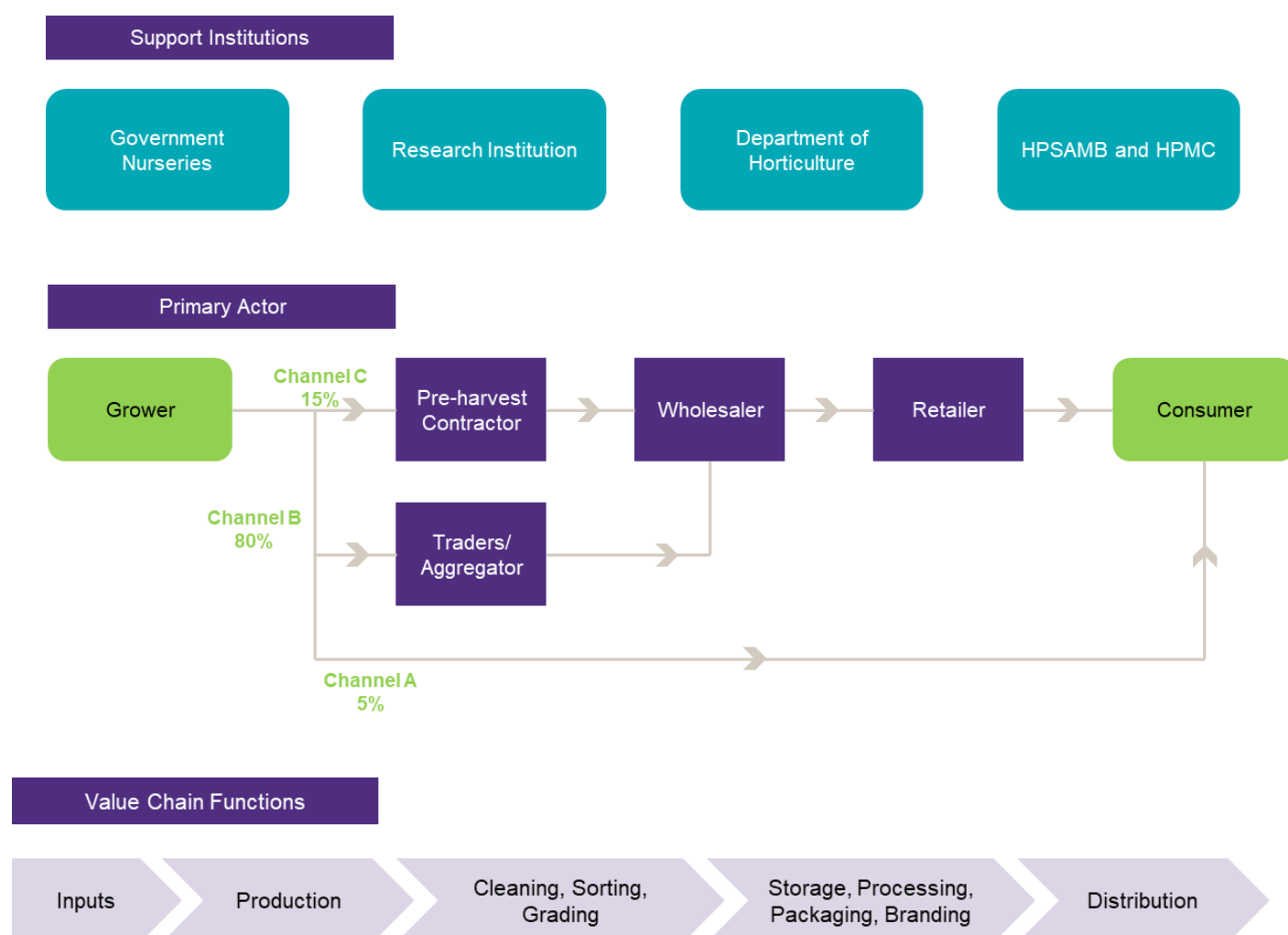
Commodity Flow Analysis

Majority of growers sell the produce to traders or aggregators who organize harvesting and transportation. Very small quantity also goes into fresh processing to retail juice vendors. Some of the farmers are also selling through pre-harvest contractors who visit

the farm either during flowering or fruiting stage, estimate the yield and negotiate a price. Subsequently, they take care of the trees and ensure harvesting and transportation. A very few farmers are also selling directly to the consumers, mostly to get immediate cash to meet family expenses. The various marketing channels and the flow of harvested produce are depicted in below diagram.

The following are the identified three main channels in the study area:

- Channel - A: Producer → Consumer
- Channel - B: Producer → Traders/Aggregators → Wholesaler → Retailer → Consumer
- Channel - C: Farmer → Pre- harvest Contractor → Wholesaler → Retailer → Consumer



Market Trends

Past five years data has shown an increasing trend in the arrival of Sweet Orange in the markets of Himachal Pradesh with a record 230.41 MT in 2019. The trend is increasing and is likely continue to grow in the future.

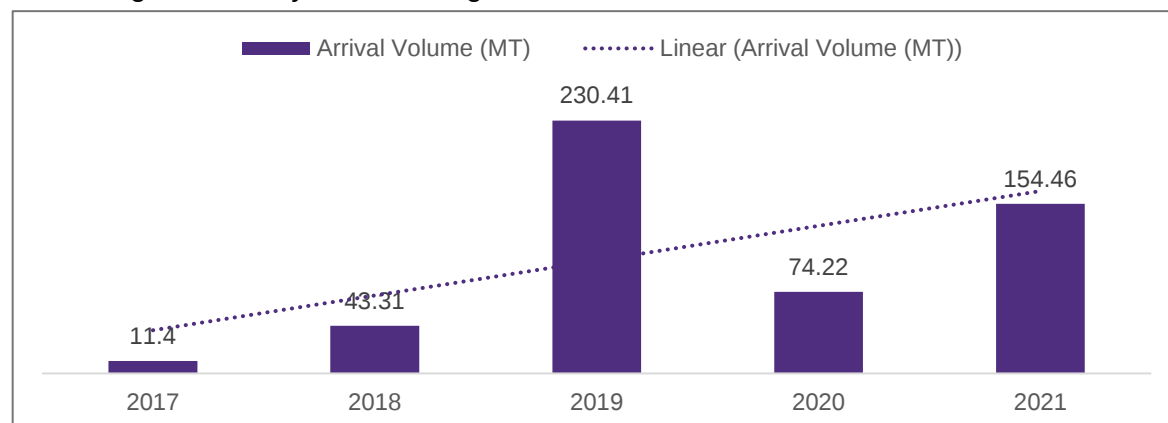


Figure 44: Trend in the arrival of Sweet Orange in the markets of Himachal Pradesh

Likewise, there is a growing trend in the mean of modal price per kilogram in the last ten years or more. In mean of the modal price was INR 17.62/ KG in 2008 and is now INR 52/KG in 2021, which grew by 195%.

Value added Products

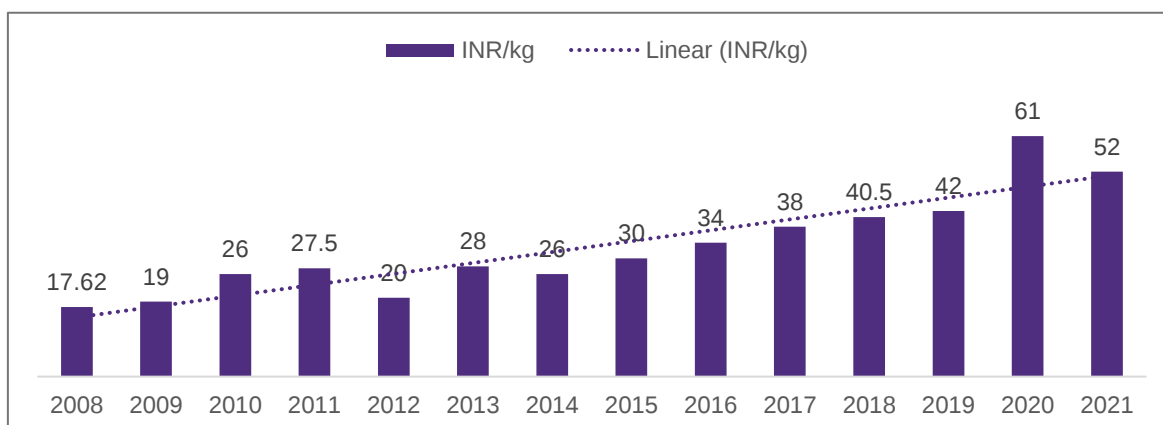


Figure 45: Mean of Modal Price Trend for Sweet Orange INR per KG

Crop	Primary Processing	Secondary Processing	Tertiary Processing
Sweet Orange	Cleaning, Sorting and Grading	Canned, Dried	Juice, Wine, Citrus Essential Oil, Citrus Pulp Pellets, Sauce

GUAVA

Introduction

Guava (*Psidium guajava*) is the fourth most important fruit of India in area and production growing well in many parts of India. It is rich in Vitamin-C and other minerals. Value addition to guava is now very common and makes excellent jelly, jam and juice. It prefers warm dry climatic conditions with mild winter. Although it is a hardy tree but is highly susceptible to frost. It can tolerate severe summer and hot winds. It can be successfully cultivated both under tropical and subtropical conditions.

Guava is a hardy tree with deep root system; however, the best productivity is achieved in loamy soils with good drainage. Heavy clay soils are not suitable for guava planting.

Crop Ecological Parameters⁶⁰

Sr. No.	Parameter Head	Parameter
1	Altitude	410 to 1200m amsl
2	Aspect	Southern
3	Terrain	
4	Soil type	Sandy Loam
5	Soil PH	5-7
6	EC	Moderately Salt Tolerant
7	Drainage	Well Drained
8	Frost	Susceptible to severe frost
9	Temperature (Min)	23-38 Degree Celsius
10	Avg. Annual Rainfall	500-1000 mm

⁶⁰ Secondary Research and various state PoPs. Finalized in consultation with PMU and CS04 (University)

Crop Details⁶¹

S.No.	Parameter Head	Parameter
A	Spacing	3X3 Mtr, 1111 Plant per Hectare
B	Planting Material Cost	INR 30 Per plant
C	Packing Cost	INR 10 per kg
D	List of Micronutrients & Chemical for IPDM	1. Zinc sulphate 2. Malathion 3. Cythian 4. Copper oxychloride 5. Chloropyriphos 6. Calcium chloride 7. Boric acid

Crop Cultivation Details

FYM: Well rotten farmyard manure should be applied along with 50% P through single super phosphate (SSP) in the basin by band placement during winter months before mid-February.

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Production (kg/Plant)	0	0	15	20	30	30	30	30	30	30	30	30	30	30	30	30	20	20	15	15
FYM	10	10	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

The amount of fertilizers to be applied in high density orchard of guava depends on the age of tree, condition of plant and type of soil. The intervals for fertigation should be weekly or biweekly. For proper growth and higher yield, following nutrient doses should be applied:

Nutrient (g/tree)	1 st Year	2 nd Year	3 rd Year	4 th Year and Onwards
Nitrogen	120	240	360	480
Phosphorous	60	120	180	240
Potassium	60	120	180	240

⁶¹ Finalized in consultation with PMU, CS04 (University) and CS03 Value Chain Report

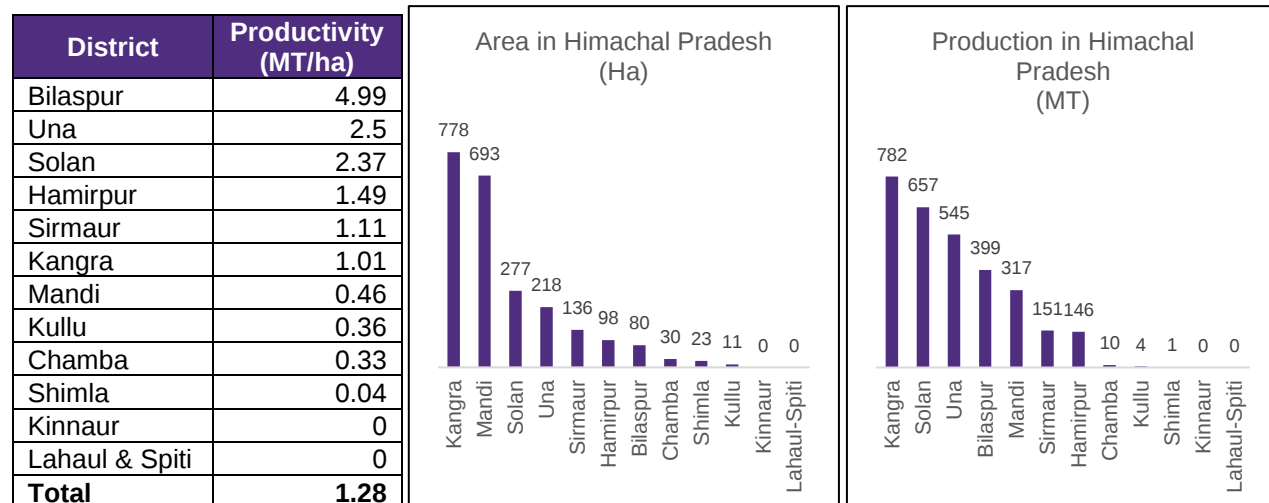
Recommended Cultivars

Shweta Fruits are round weighing 225g, white pulp with good keeping quality. Round shaped fruit, 225g in weight, pulp white with good keeping quality.	
Lalit Fruits are round in shape with pink coloured pulp. The TSS is around 11-120 Brix.	
Sardar Fruits are spherical and meaty, seeds are soft and in plenty, pulp is white and tasty contains 130 mg vitamin C/100 g pulp.	
Allahabad Safeda Fruits are big in size, round, smooth skin, white pulp, soft, firm, light yellow and on ripening develop very sweet taste, pleasing flavour and have few seeds. It is the most popular variety in India and the progenitor of many Indian varieties.	

Value Chain Analysis

The area cultivated under Guava in Himachal Pradesh is 2344 ha and Production volume is 3012 MT with a productivity of 1.28 MT/ha.

Area and Production:



Seasonality:

The peak season of Guava in Himachal Pradesh is mid-November – March. The harvesting seasons of the major neighbouring states are provided below:

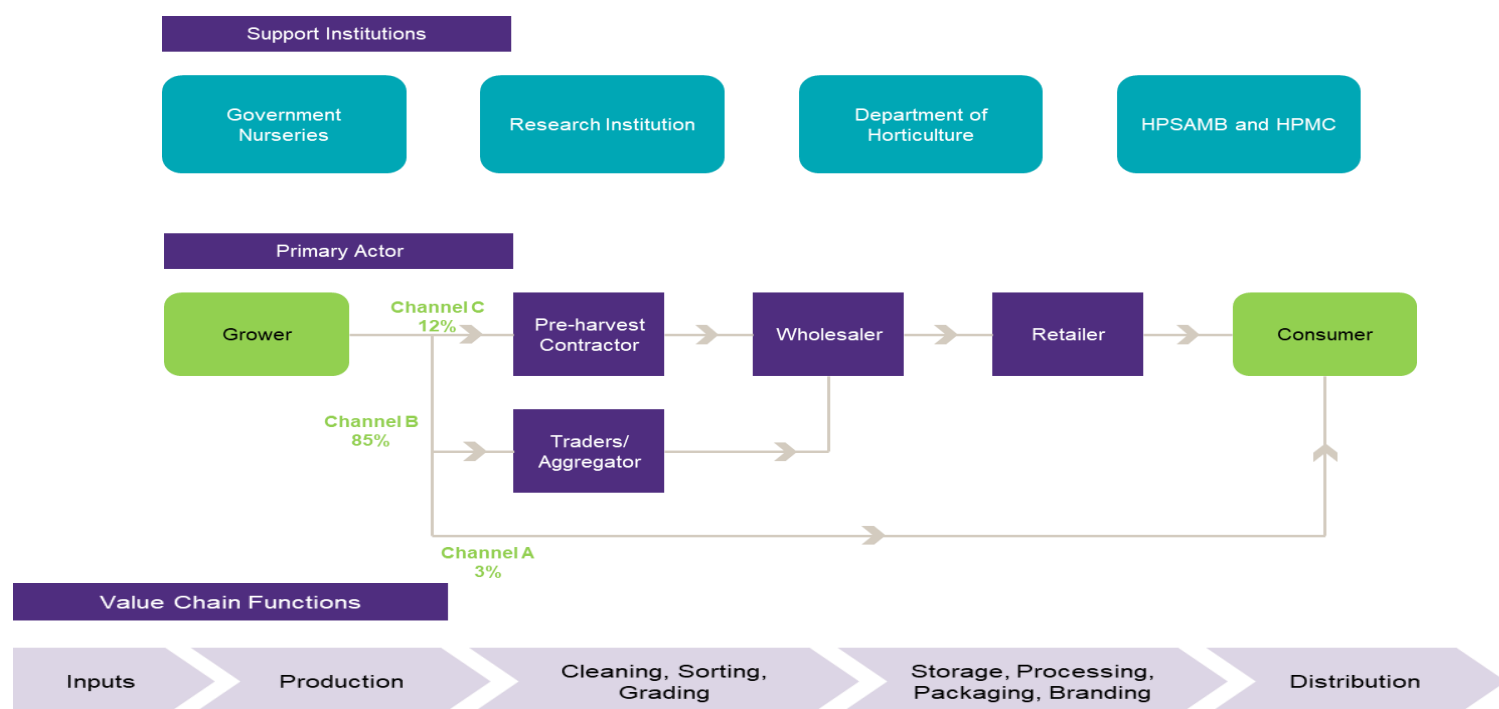
Guava	January				February				March				April				May				June				July				August				September				October				November				December			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Himachal Pradesh																																																
Haryana																																																
Jammu and Kashmir																																																
Punjab																																																
Uttar Pradesh																																																
Uttarakhand																																																



Commodity Flow Analysis

The following are the identified three main channels in the study area:

- Channel - A: Producer → Consumer
- Channel - B: Producer → Traders/Aggregators → Wholesaler → Retailer → Consumer
- Channel - C: Farmer → Pre- harvest Contractor → Wholesaler → Retailer → Consumer



Market Trends

In the past five years, we see that there has been an increase in the arrival from 2017 to 2019 and then a drastic dip to around 24.25 MT and then picking up to around 246 MT. However, the trend is decline and may likely to continue if the production inside Himachal Pradesh doesn't increase. The numbers show that there is an existing domestic demand in the state, but the deficit has to be made up by boosting internal production and importing from outside the state.

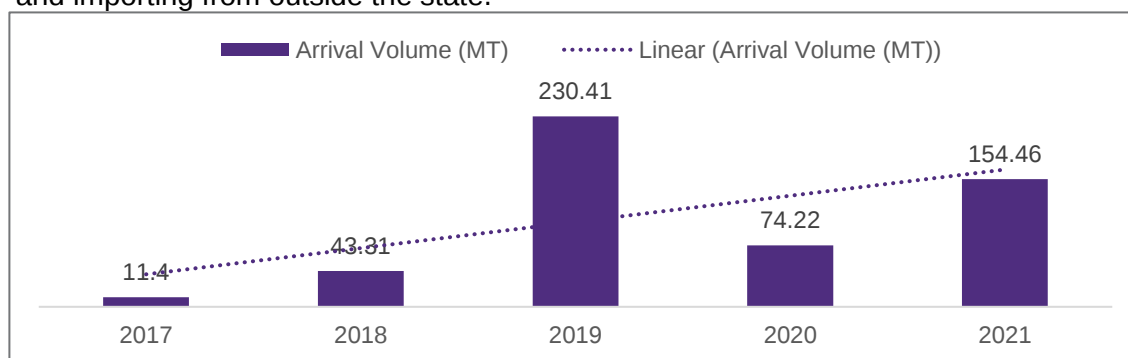


Figure 46: Trend in the arrival of Guava in the markets of Himachal Pradesh

Value added Products

Crop	Primary Processing	Secondary Processing	Tertiary Processing
Guava	Cleaning, Sorting and Grading	Guava powder	Juice, blended RTS beverages, Guava wine, jam, toffee. Cheese, ice cream topping, nectar

POMEGRANATE

Introduction

Pomegranate (*Punica granatum*) is a sub-tropical fruit. It is hardy and rainfed fruit plant which grows even under neglected conditions also. It can grow from the plains to an elevation of about 1800 m with mean annual rainfall ranging from 150 to 1000 mm. It needs hot dry summer conditions followed by cold winter for healthy growth. During fruit development and ripening stage, it requires hot and dry climate with frequent irrigation. It is fruit that can withstand drought conditions. It grows successfully even on sloppy lands. Highly humid areas and the areas having longer fog periods are not suitable for its cultivation and as such should be avoided.

Crop Ecological Parameters⁶²

Sr. No.	Parameter Head	Parameter
1	Altitude	Up to 1800 m amsl
2	Aspect	South East
3	Terrain	
4	Soil type	Alluvial or deep loamy with good drainage
5	Soil PH	6.5 to 7.0
6	EC	0.5 to 1.5
7	Drainage	Well Drained
8	Frost	Can tolerate up to -11 degree
9	Optimum Temperature	38 Degree Celsius
10	Avg. Annual Rainfall	180-550 mm

⁶² Secondary Research and various state PoPs. Finalized in consultation with PMU and CS04 (University)

Crop Details⁶³

S.No.	Parameter Head	Parameter
A	Spacing	3 X 3
B	Planting Material Cost	INR 30 per plant
C	Packing Cost	INR 20 per kg
D	List of Micronutrients & Chemical for IPDM	1. Mancozeb 2. Carbendazim 3. Thiophanate methyl 4. Baycor 5. Benomyl
E	Recommended Cultivar	Bhagwa

Crop Cultivation Details

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Production (kg/Plant)	0	0	5	20	50	50	50	50	50	50	50	50	50	50	50	50	35	35	25	15
FYM	10	10	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

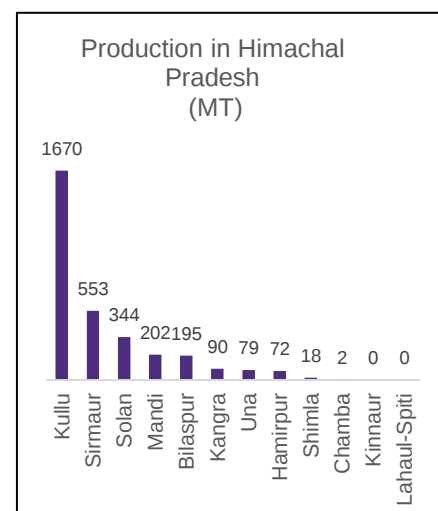
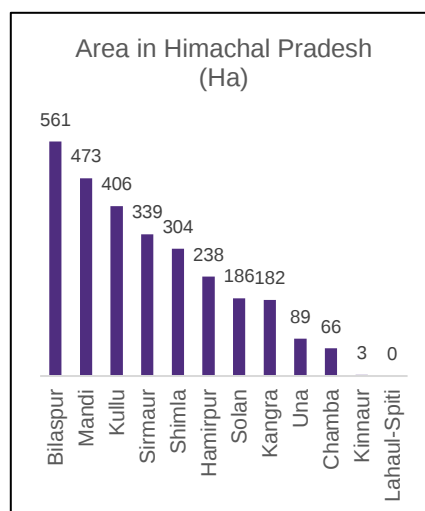
The quantity of fertilizers to be applied in HDP orchard of pomegranate mainly depends on the age of plant, condition of plant and soil type. The intervals for fertigation should be weekly or biweekly. For proper growth and higher yield, following nutrient doses should be applied:

Nutrient (g/tree)	First 18 Months (Till First Flowering)	19-24 Months (Till First Harvest)	25-36 Months (Up to three years)
Nitrogen	375	187	166
Phosphorous	63	62	146
Potassium	625	250	250

⁶³ Finalized in consultation with PMU, CS04 (University) and CS03 Value Chain Report

Area and Production:

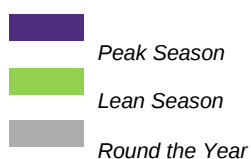
District	Productivity (MT/ha)
Kullu	4.11
Solan	1.85
Sirmaur	1.63
Una	0.89
Kangra	0.49
Mandi	0.43
Bilaspur	0.33
Hamirpur	0.3
Shimla	0.06
Chamba	0.03
Kinnaur	0
Lahaul & Spiti	0
Total	1.13



Seasonality:

Pomegranate is expected to be harvested in mid-September- mid November in Himachal Pradesh. In that period, less fruits come from major pomegranate growing regions.

Pomegranate	January				February				March				April				May				June				July				August				September				October				November				December			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
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Punjab																																																
Rajasthan																																																
Karnataka																																																
Gujarat																																																

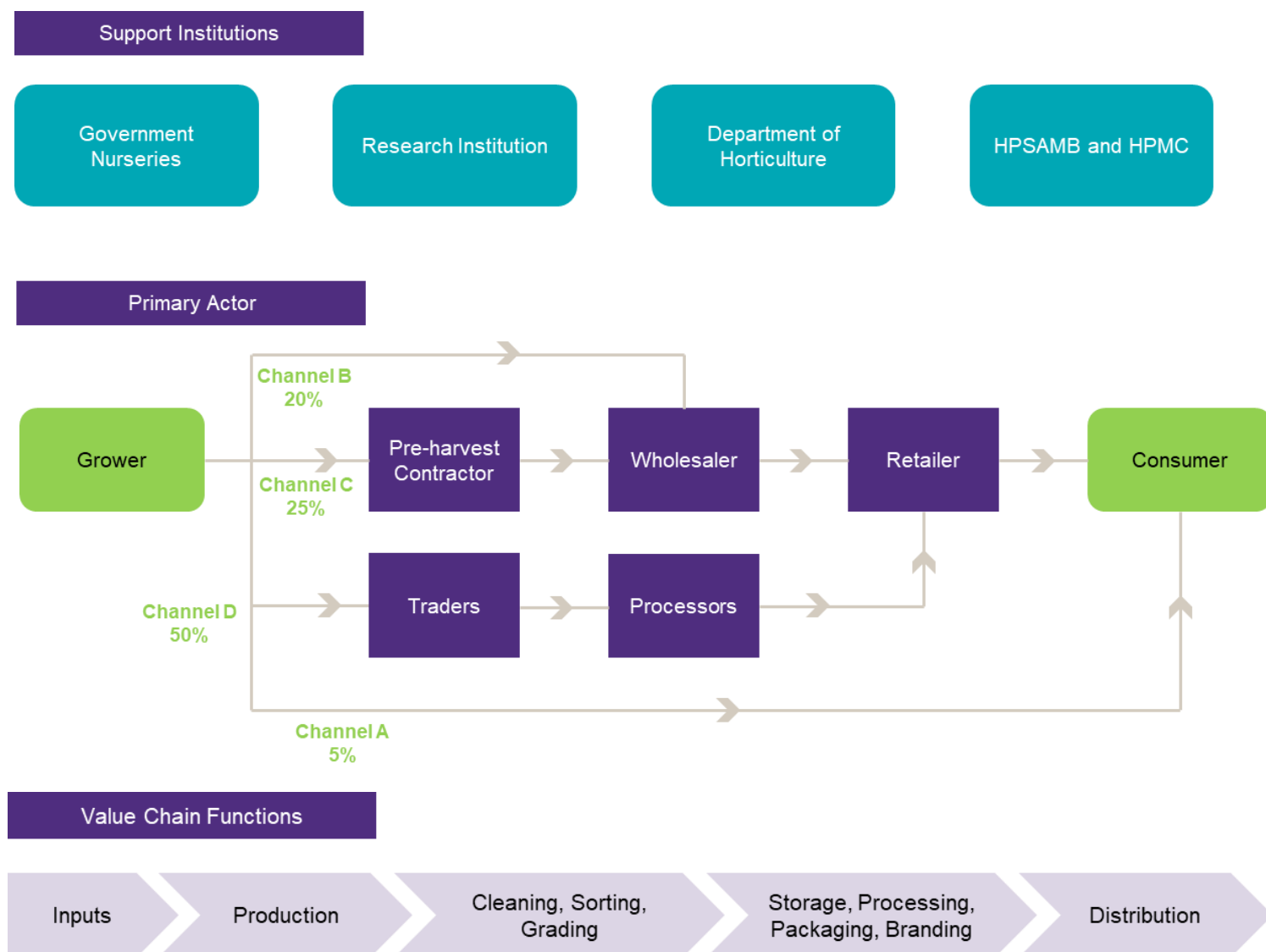


Commodity Flow Analysis

The following are the identified three main channels in the study area:

- Channel -A Producer → Consumer
- Channel -B Producer → Wholesaler → Retailer → Consumer
- Channel -C Producer → Pre-harvest contractor → Wholesaler → Retailer → Consumer

- Channel-D Producer → Traders → Processor → Retailer → Consumer



Value added Products

Crop	Primary Processing	Secondary Processing	Tertiary Processing
Pomegranate	Cleaning, Sorting and Grading	Frozen Arils, Pomegranate Powder,	Jams and Preservatives, Pomegranate Molasses, Wine, Anardana, Jellies

LITCHI

Introduction

Litchi (*Litchi chinensis*) is a delicious, juicy attractive fruit. It prefers sub-tropical climatic conditions but cannot tolerate frost in winter and dry heat in summer. It grows well under moist sub-tropical conditions at elevations ranging from 300 to 900 M with average annual rainfall of 1100 to 1200 mm. Some of the varieties of Litchi grown for their commercial value are Dehradun, Shahi, Rose Scented etc.

Crop Ecological Parameters⁶⁴

Sr. No.	Parameter Head	Parameter
1	Altitude	300 to 900 m amsl
2	Aspect	Southern
3	Terrain	
4	Soil type	Alluvial sandy loam deep soils rich in organic matter
5	Soil PH	5-7
6	EC	Sensitive to Saline soils. EC below 0.2 dS/m
7	Drainage	Well drained
8	Frost	Susceptible
9	Optimum Temperature	21- 38 Degree Celsius
10	Avg. Annual Rainfall	1100-1200 mm

Crop Details⁶⁵

S.No.	Parameter Head	Parameter
A	Spacing	4 X 4
B	Planting Material Cost	INR 30 per plant
C	Packing Cost	INR 5 per kg
D	List of Micronutrients & Chemical for IPDM	1. Thiophanate methyl 2. Copper oxychloride

⁶⁴ Secondary Research and various state PoPs. Finalized in consultation with PMU and CS04 (University)

⁶⁵ Finalized in consultation with PMU, CS04 (University) and CS03 Value Chain Report

		3. Mancozeb 4. Azoxystrobin 5. Hexaconazole 6. Carbendazim
E	Recommended Cultivar	Dehradun

Crop Cultivation Details

FYM: Well rotten farmyard manure should be applied along with 50% P through single super phosphate (SSP) in the basin by band placement during winter months before mid-February.

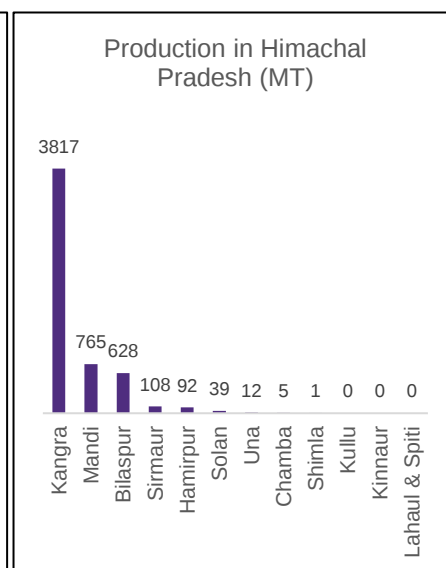
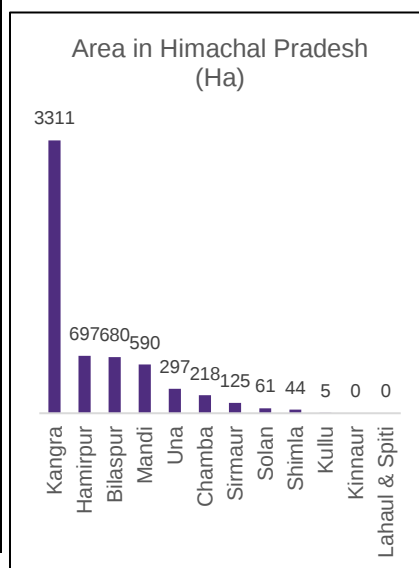
Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Production (kg/Plant)	0	0	0	0	5	15	25	35	45	65	70	70	70	70	70	70	70	70	70	70
FYM	10	10	15	20	25	30	35	35	35	35	35	35	35	35	35	35	35	35	35	35

The rate of fertilizer application in high density orchard of litchi depends on the age of tree, condition of plant and type of soil. The intervals for fertigation should be weekly or biweekly. For proper growth and higher yield, following nutrient doses should be applied:

Nutrient (g/tree)	1 st Year	2 nd Year	3 rd Year	4 th Year	5 th Year	6 th Year Onwards
Nitrogen	45	90	135	170	215	260
Phosphorous	20	40	60	80	100	120
Potassium	45	90	135	170	215	260

Area and Production:

District	Productivity (MT/ha)
Mandi	1.3
Kangra	1.2
Sirmaur	0.9
Bilaspur	0.9
Solan	0.6
Hamirpur	0.1
Kullu	0
Una	0
Shimla	0
Chamba	0
Kinnaur	0
Lahaul & Spiti	0
Total	0.9

**Seasonality:**

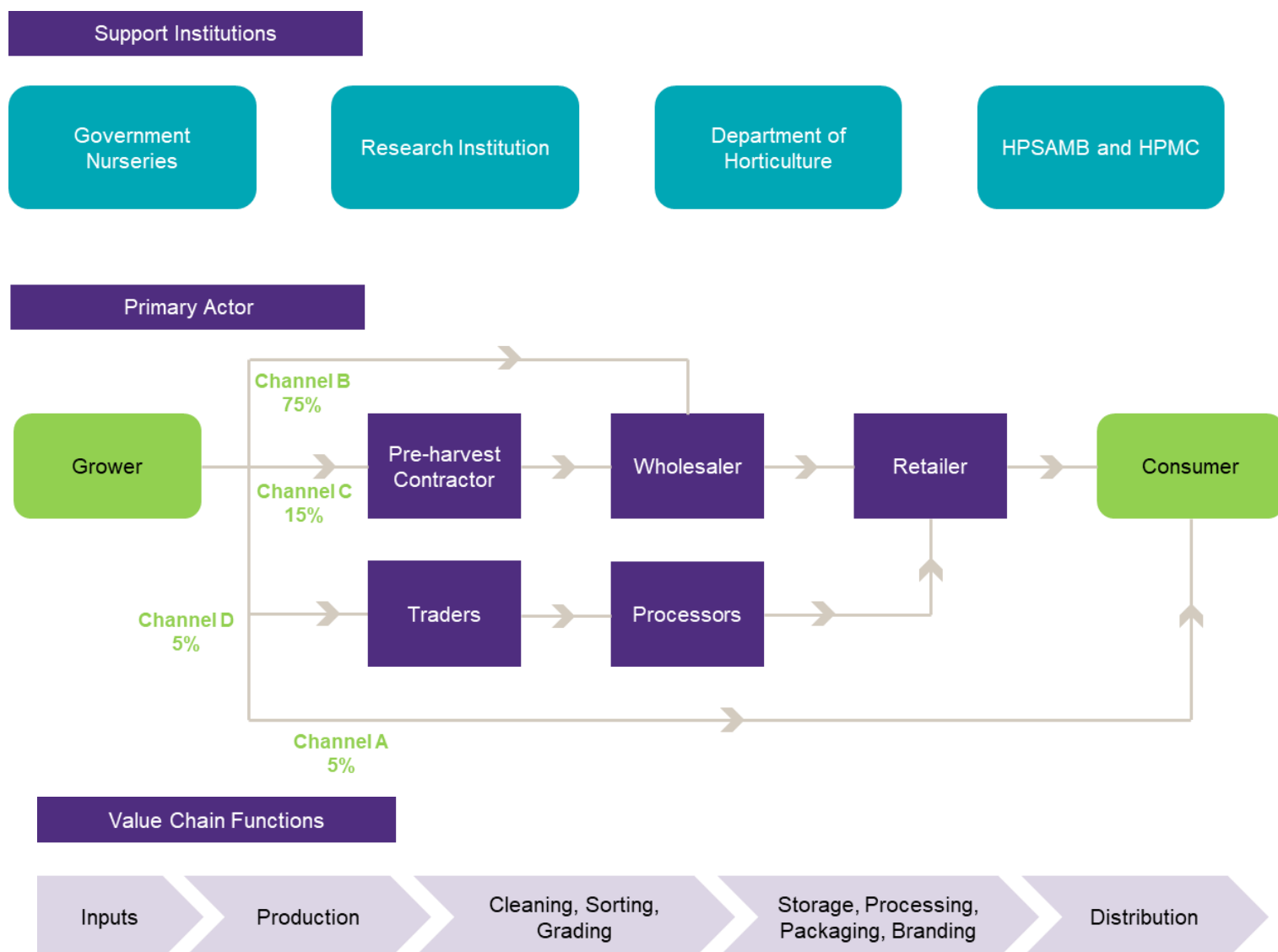
Litchi is expected to be harvested in May-July in Himachal Pradesh as shown below:

Litchi	January				February				March				April				May				June				July				August				September				October				November				December			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Himachal Pradesh																																																
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Punjab																																																
Bihar																																																
Jharkhand																																																

**Commodity Flow Analysis**

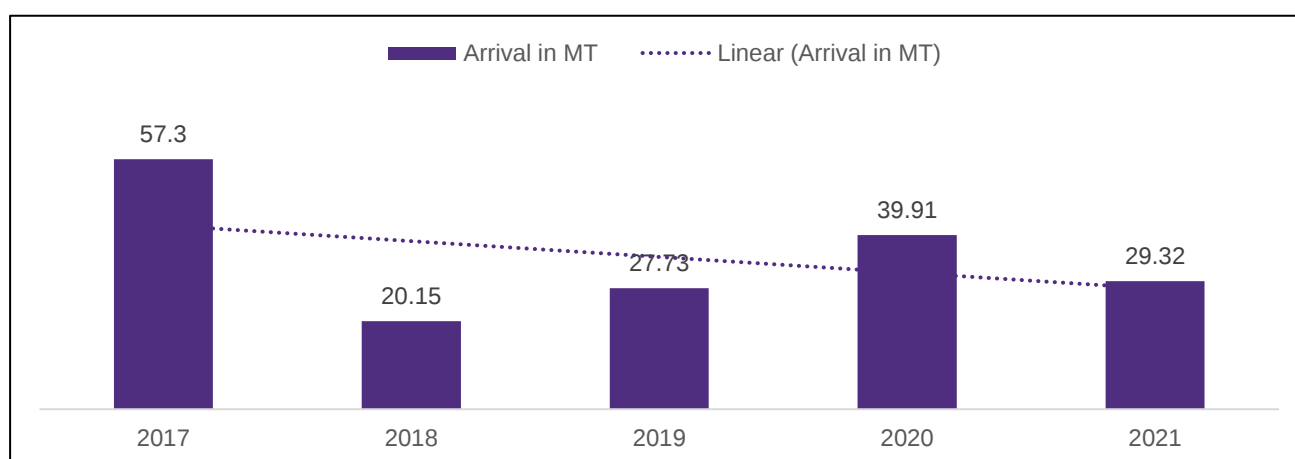
The following are the identified three main channels in the study area:

- Channel -A Producer → Consumer
- Channel -B Producer → Wholesaler → Retailer → Consumer
- Channel -C Producer → Pre-harvest contractor → Wholesaler → Retailer → Consumer
- Channel-D Producer → Traders → Processor → Consumer



Market Trends

The arrival trend of Litchi in Himachal Pradesh market in the past five years seem to be showing a declining trend. In 2017 the arrival was a volume of 57.3 MT, which in 2021 is 29.32 MT, a reduction of almost 44% in the past five years. This declining trend can be arrested by procuring



Litchi from other Litchi producing states of India or my increasing production in Himachal Pradesh.

The analysis of the mean of the modal price in Himachal Pradesh from 2008 to 2021 shows that the price of Litchi to be increasing every year. There is growth in price and this trend is positive and likely to grow in the future. In the last ten years the price rose by around 30% from INR48.51/KG in 2012 to INR63.31 in 2021.

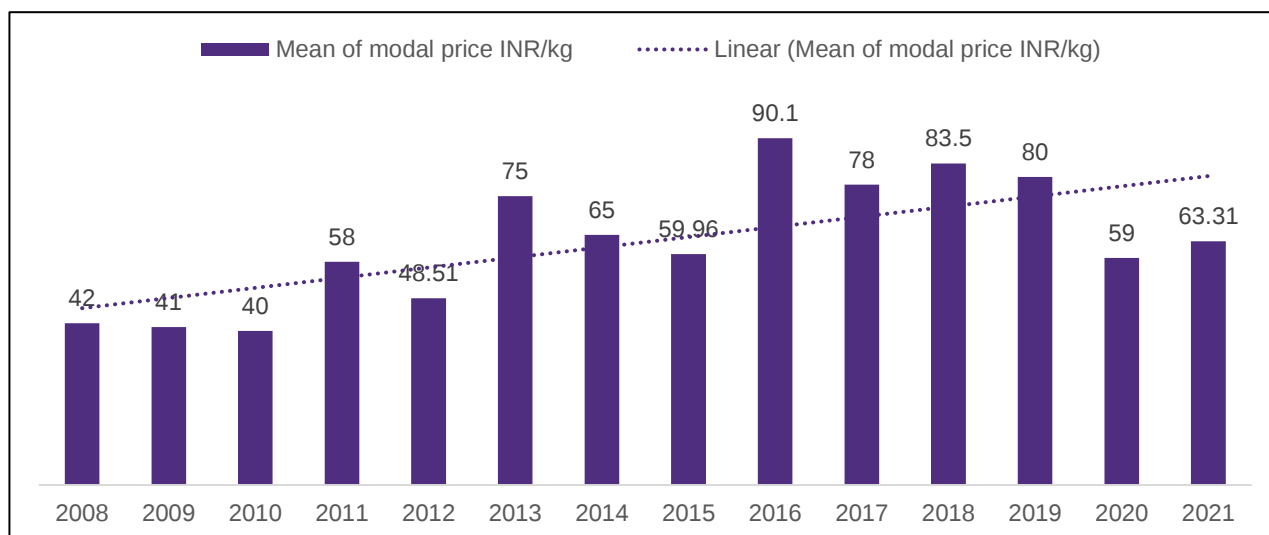


Figure 48: Mean of Modal Price Trend for Litchi INR per KG

Value added Products

Crop	Primary Processing	Secondary Processing	Tertiary Processing
Litchi	Cleaning, Sorting and Grading	Dried or Dehydrated products (nuts)	Canned litchi, Squash, cordial, Syrup, RTS (ready to serve), Jam, Jellies, Juice

PERSIMMON

Introduction

The Japanese persimmon (*Diospyros kaki* L) is a deciduous and distinctly a subtropical fruit tree. It can be grown successfully from sub-tropics to wet temperate zone. At present grown in limited scale in sub-tropics of Kangra, Mandi, Chamba, Kangra, Hamirpur, Una, Bilaspur districts of Himachal Pradesh.

The tree is winter hardy. Fruits are sweet edible but are consumed only when fully ripe otherwise cause puckering of mouth. Persimmons is used in cookies, puddings and breads. Its fruits are rich in Vitamin “C”, dietary fibers, anti-oxidants and minerals besides being low calorie fruit. It can easily tolerate drought condition. It grows well at altitude ranging from 900 to 2000 M with average annual rainfall of 1500-2500 mm.

It has two types of varieties:

1. Astringent like Hyachi, Eureka etc. (Fruit can be consumed when fully ripe).
2. Non-astringent like Jiro (Semi-dwarf), Fuyu (Semi-dwarf), Gasho etc. These varieties require warm conditions for fruit maturation. The orientation of planting should be North–South direction.

Crop Ecological Parameters⁶⁶

Sr. No.	Parameter Head	Parameter
1	Altitude	900-2000 M amsl
2	Aspect	North-South
3	Terrain	
4	Soil type	Well drained sandy loam with rich OM
5	Soil PH	6.5-7.5
6	EC	
7	Drainage	Well drained
8	Frost	Susceptible (-4 Degree)
9	Optimum Temperature	
10	Avg. Annual Rainfall	1500-2500 mm

⁶⁶ Secondary Research and various state PoPs. Finalized in consultation with PMU and CS04 (University)

Crop Details⁶⁷

S.No.	Parameter Head	Parameter
A	Spacing	4 X 4
B	Planting Material Cost	INR 30 per plant
C	Packing Cost	INR 20 per kg
D	of Micronutrients & Chemical for IPDM	1. Trichoderma viride 2. Thiophanate methyl 3. Difenconazole 4. Azoxystrobin 5. Methyl Demeton 25EC
E	Recommended Cultivar	Fuyu

Crop Cultivation Details

FYM: Well rotten farmyard manure should be applied along with 50% P through single super phosphate (SSP) in the basin by band placement during winter months before mid-February.

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Production (kg/Plant)	0	0	0	5	10	20	30	40	50	60	70	80	80	80	80	80	80	80	80	80
FYM	10	10	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

The amount of fertilizers to be applied in high density orchard of persimmon depends on the age of tree, condition of plant and type of soil. The intervals for fertigation should be weekly or biweekly. For proper growth and higher yield, following nutrient doses should be applied:

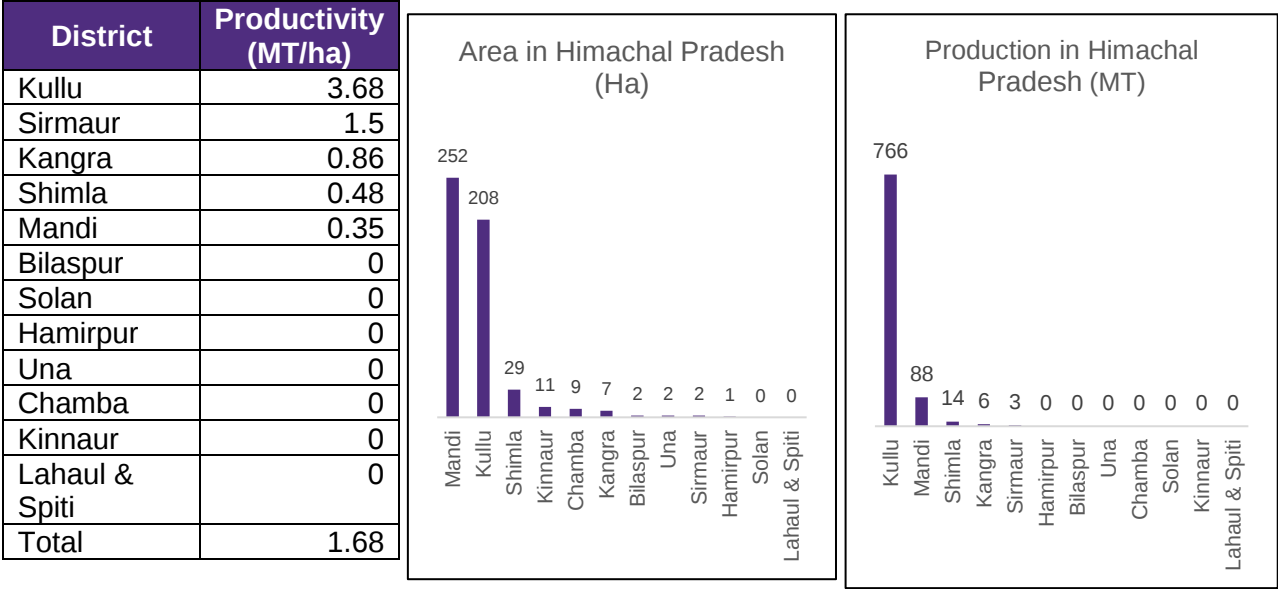
Nutrient (g/tree)	1 st Year	2 nd Year	3 rd Year	4 th Year and Onwards
Nitrogen	120	240	360	480
Phosphorous	60	120	180	240
Potassium	60	120	180	240

⁶⁷ Finalized in consultation with PMU, CS04 (University) and CS03 Value Chain Report

Value Chain Analysis

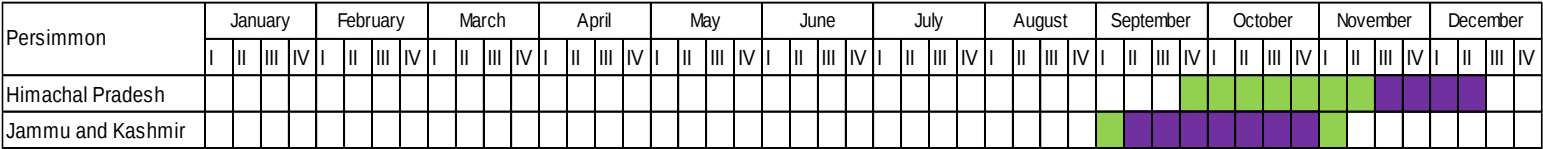
Area and Production:

Evident from figure below, Kullu, Mandi and Shimla are the major persimmon producing districts in Himachal Pradesh. Further, Mandi has the highest area under persimmon cultivation followed by Kullu and Shimla. However, Mandi lags behind Kullu in terms of production even after having more area under cultivation due to poor productivity per hectare.



Seasonality:

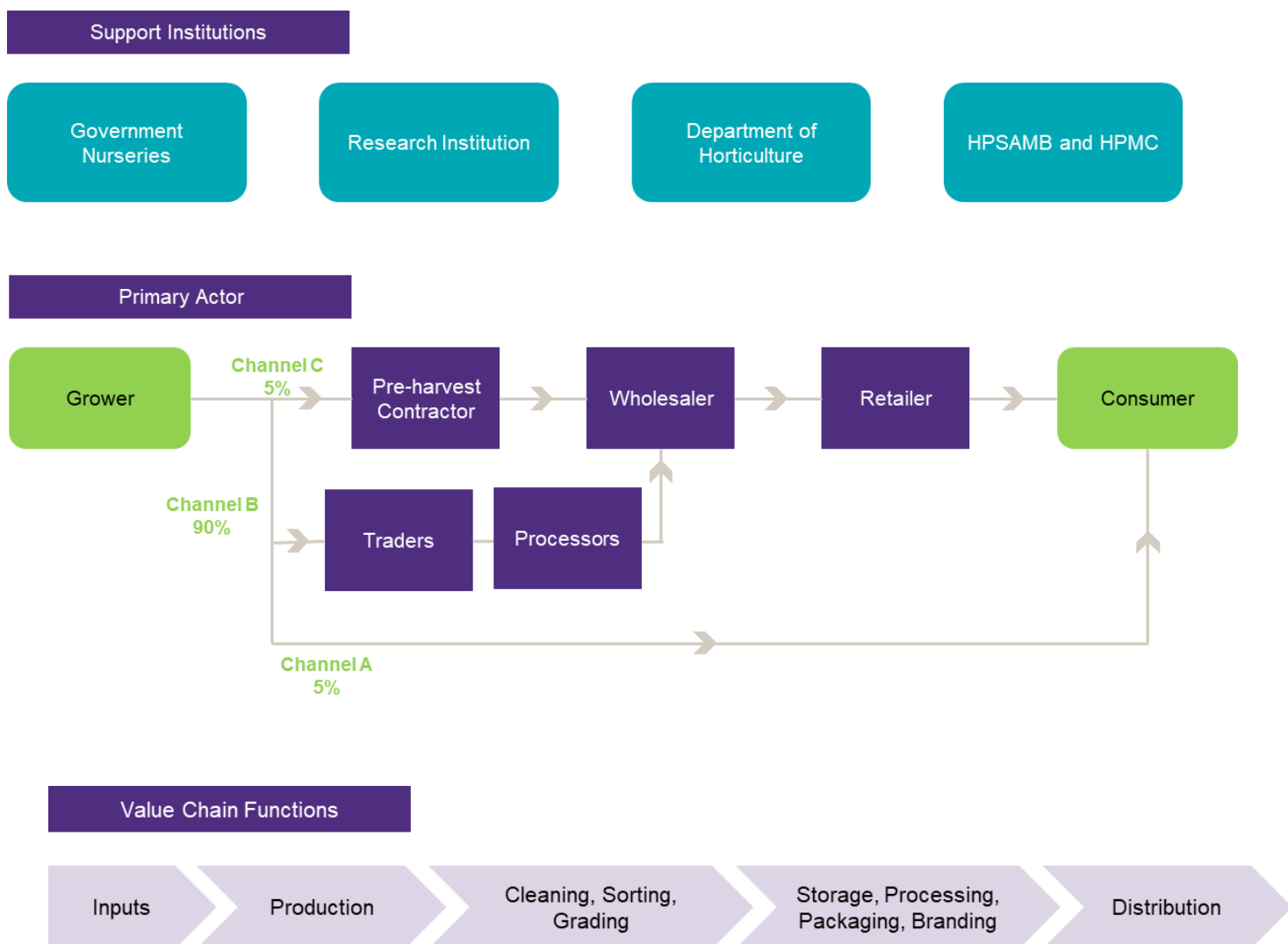
Persimmon is harvested in last week in September – mid December period in Himachal Pradesh.



Commodity Flow Analysis

The following are the identified three main channels in the study area:

- Channel - A: Producer → Consumer
- Channel - B: Producer → Traders → Wholesaler → Retailer → Consumer
- Channel - C: Farmer → Pre- harvest Contractor → Wholesaler → Retailer → Consumer



Value added Products

Crop	Primary Processing	Secondary Processing	Tertiary Processing
Persimmon	Cleaning, Sorting and Grading	Canned, Dried	Juice, Wine

PLUM

Introduction

Two groups of Plum are grown in India namely *Prunus domestica* (European plum) and *Prunus salicina* (Japanese plum.). It is a deciduous fruit and grows well under Temperate climatic conditions. High chilling requirement varieties are most suitable for hilly areas of J&K, HP, Uttarakhand and UP having elevations ranging from 3000 to 4000 M. Low chilling varieties are specific for plains of Punjab, Haryana and Rajasthan at elevation of 1000 to 1600 M. Fruit is rich in vitamins, minerals, organic acids, anti-oxidants, carbohydrates and fats. It is a hardy plant and resists frost. Good quality wine and brandy are also prepared from plum.

In Himachal Pradesh an area of about 9000 Ha is under plum cultivation and 85-90% area of plum is under variety Santa Rosa variety.

Crop Ecological Parameters⁶⁸

Sr. No.	Parameter Head	Parameter
1	Altitude	1000-4000 m amsl
2	Aspect	
3	Terrain	
4	Soil type	Sandy loam
5	Soil PH	6.5
6	EC	
7	Drainage	Well drained
8	Frost	
9	Optimum Temperature	0 - 45 Degree Celsius
10	Avg. Annual Rainfall	1000-1250 mm

⁶⁸ Secondary Research and various state PoPs. Finalized in consultation with PMU and CS04 (University)

Crop Details⁶⁹

S.No.	Parameter Head	Parameter
A	Spacing	4 X 4
B	Planting Material Cost	INR 30 per plant
C	Packing Cost	INR 10 per kg
D	List of Micronutrients & Chemical for IPDM	1. Zinc Sulphate 2. Paradichlorobenzene 3. Sulphur 4. Monocrotophos 5. Cyantraniliprole 6. Chlorantraniliprole 7. Imidachlopid 8. Dimethoate 9. Deltamethrin 10. Cypermethrin
E	Recommended Cultivars	Frontier, Santa Rosa, Beauty, Red Beaut, Aloocha Purple, Black Amber, Kala Amritsari, Satluj Purple

Crop Cultivation Details

FYM: Well rotten farmyard manure should be applied along with 50% P through single super phosphate (SSP) in the basin by band placement during winter months before mid-February.

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Production (kg/Plant)	0	0	0	5	10	20	30	40	50	60	70	75	75	75	75	75	75	75	75	75
FYM	10	10	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

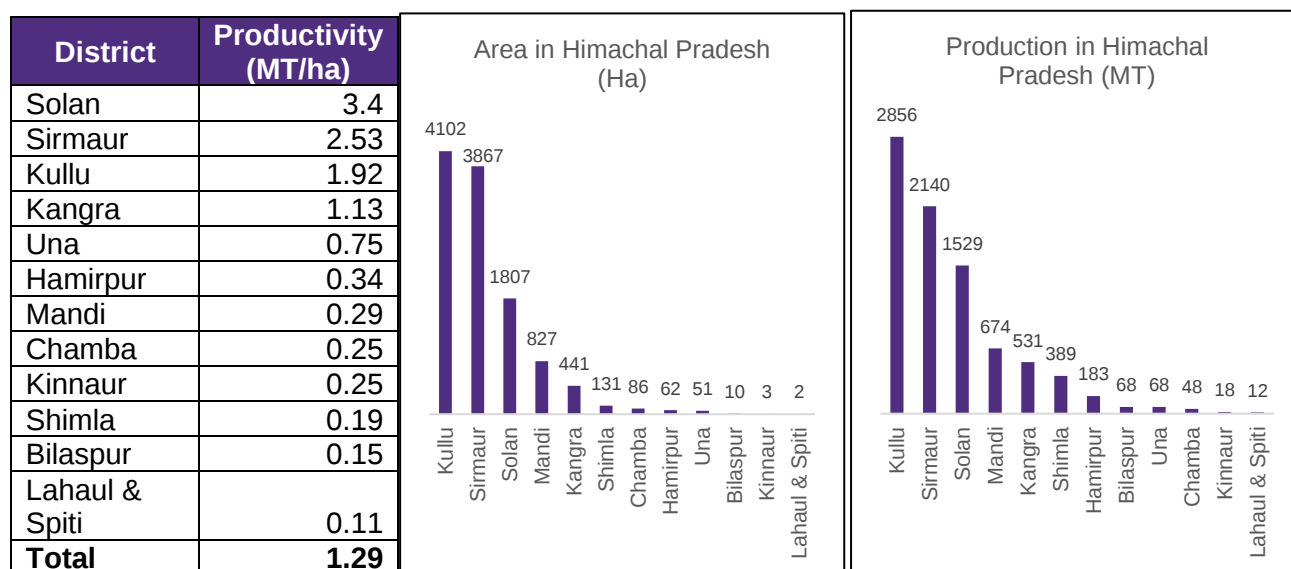
The amount of fertilizers to be applied in high density orchard of plum depends on the age of tree, condition of plant and type of soil. The intervals for fertigation should be weekly or biweekly. For proper growth and higher yield, following nutrient doses should be applied:

⁶⁹ Finalized in consultation with PMU, CS04 (University) and CS03 Value Chain Report

Nutrient (g/tree)	1 st Year	2 nd Year	3 rd Year	4 th Year and Onwards
Nitrogen	50	100	150	200
Phosphorous	25	50	75	100
Potassium	40	80	10	190

Area and Production:

The state has recorded production of 11,389 MT on an area of 8,816 ha with an average productivity of 1.29 MT/ha during FY 2018-19. Mandi, Kullu and Sirmaur accounts for nearly 74% area under production whereas Kullu, Sirmaur and Solan accounts for nearly 86% production of the state. Though, Mandi district has highest area (32%) under plum cultivation; it only contributes 7% production of the state due to low productivity (0.29 MT/ha). The state has recorded highest productivity of 3.40 MT/ha (Solan) and lowest productivity of 0.11 MT/ha (Lahaul & Spiti). However, with improved package of practices it is expected to achieve the maximum productivity across state.



Seasonality:

Plum is expected to be harvested in mid-July – mid October in Himachal Pradesh.

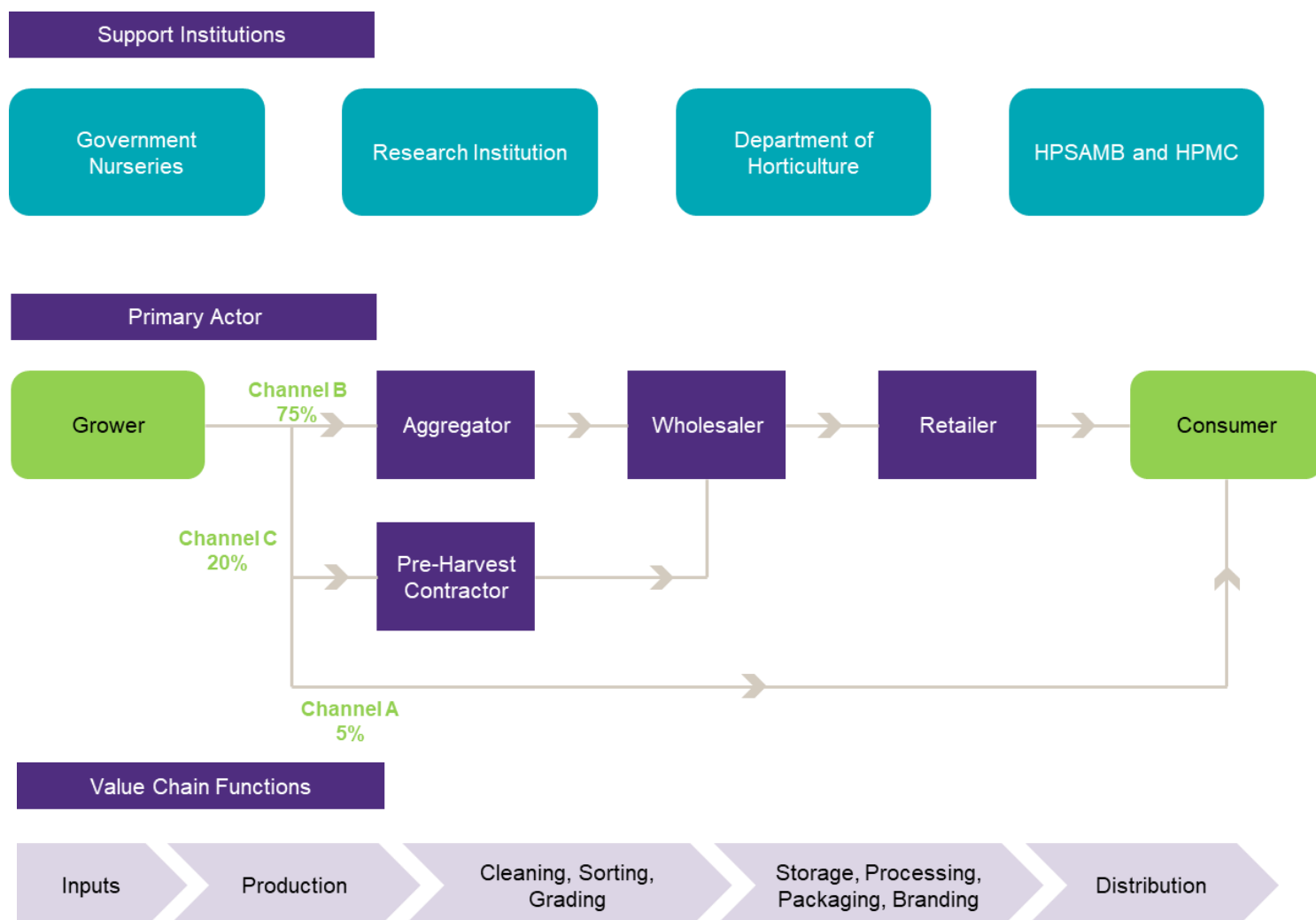
Plum	January				February				March				April				May				June				July				August				September				October				November				December			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV								
Himachal Pradesh																																																
Uttarakhand																																																
Jammu and Kashmir																																																
Punjab																																																



Commodity Flow Analysis

The following are the identified three main channels in the study area:

- Channel - A: Producer → Consumer
- Channel - B: Producer → Traders/Aggregators → Wholesaler → Retailer → Consumer
- Channel - C: Farmer → Pre- harvest Contractor → Wholesaler → Retailer → Consumer



Market Trends

The last four years data shows that there is growth of 254% in the volume of arrival since 2018 till 2021. In 2018 the arrival was 212.47 MT which rose to 752.18Mt. The trend is positive and arrival volume is likely to continue growing in the future.

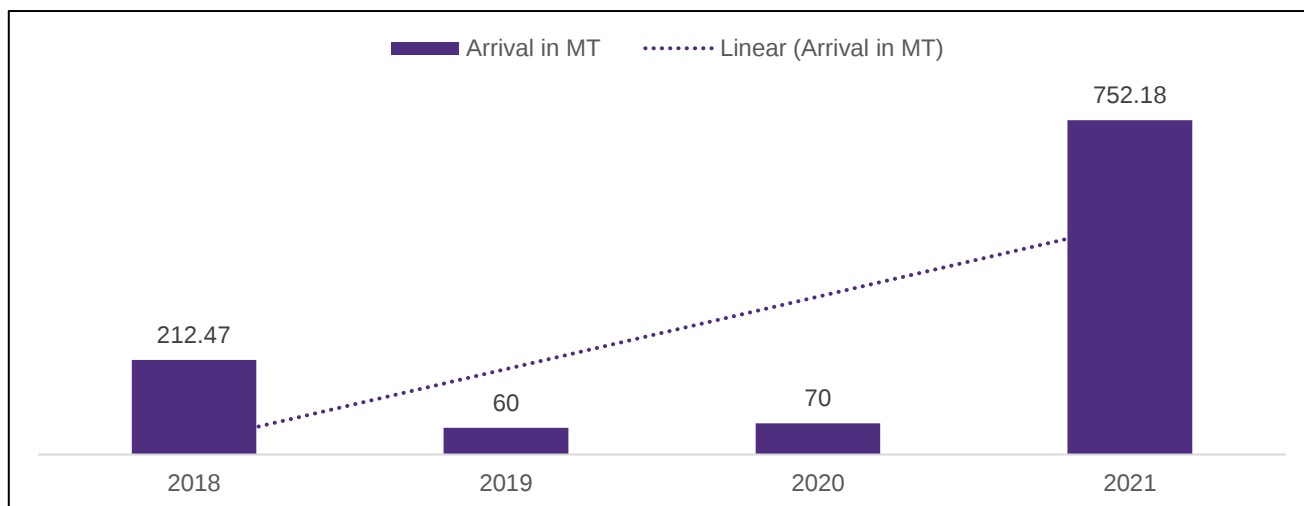


Figure 49: Trend in the arrival of Plum in the markets of Himachal Pradesh

Value added Products

Crop	Primary Processing	Secondary Processing	Tertiary Processing
Plum	Cleaning, Sorting and Grading	Dried, Flavored - Salted Plum	Juice, Wine, Plum Jerkum, Puree

MANGO

Introduction

Mango (*Mangifera indica*) is the king of fruits in India. It grows well under sub-tropical climatic conditions with rainless, dry period for development of blossom, rainfall during growth and development of fruit and warm dry summer temperature during fruit ripening. Rain, fog and cloudy season during bloom period cause heavy damage to crop.

In Himachal, > 90% of the total area under mango is covered by early and mid-season varieties. Their harvesting period coincides with the mango produced by the adjoining states. Farmers fetch poor prices in the market. Hence, the late improved cultivars of mango which mature during August onwards to 1st fortnight of September have huge potential for improving the socio-economic status of the farmers due to non-availability of the mango in the market. Hence the new plantation should be done with late season improved cultivars like Mallika, Arunika, Arunima, Pusa Shrestha, Ambika.

Chausa and Ramkela (pickle type) should be planted at 5×5 m spacing of medium high-density planting.

Crop Ecological Parameters⁷⁰

Sr. No.	Parameter Head	Parameter
1	Altitude	Up to 1000m amsl
2	Aspect	
3	Terrain	Slopping
4	Soil type	Well drained deep loamy soil
5	Soil PH	5.5-7.5
6	EC	Below 1 dS/m
7	Drainage	Well Drained
8	Frost	Can tolerate up to -1.1 degree
9	Optimum Temperature	23 - 26 Degree Celsius (Optimum Range)
10	Avg. Annual Rainfall	750-3750 mm

⁷⁰ Secondary Research and various state PoPs. Finalized in consultation with PMU and CS04 (University)

Crop Details⁷¹

S.No.	Parameter Head	Parameter
A	Spacing	3 X 3
B	Planting Material Cost	INR 30 per plant
C	Packing Cost	INR 5 per kg
D	List of Micronutrients & Chemical for IPDM	1. Phosalone 2. Fenthion 3. Cryptolaemus montrouzieri 4. Paclobutrazol 5. Carbendazim 6. Copper Oxychloride 7. Potassium Metabisulphite 8. Bordeaux mixture

Crop Cultivation Details

FYM: Well rotten farmyard manure should be applied along with 50% P through single super phosphate (SSP) in the basin by band placement during winter months before mid-January.

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Production (kg/Plant)	0	0	3	5	10	15	20	25	30	35	40	45	50	50	50	50	50	50	35	25
FYM	10	10	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

The amount of fertilizers to be applied in high density orchard of mango depends on the age of tree, condition of plant and type of soil. The intervals for fertigation should be weekly or biweekly. For proper growth and higher yield, following nutrient doses should be applied:

Nutrient (g/tree)	1 st Year	2 nd Year	3 rd Year	4 th Year and Onwards
Nitrogen	50	100	150	200
Phosphorous	25	50	75	100
Potassium	50	100	100	200

⁷¹ Finalized in consultation with PMU, CS04 (University) and CS03 Value Chain Report

Recommended Cultivars

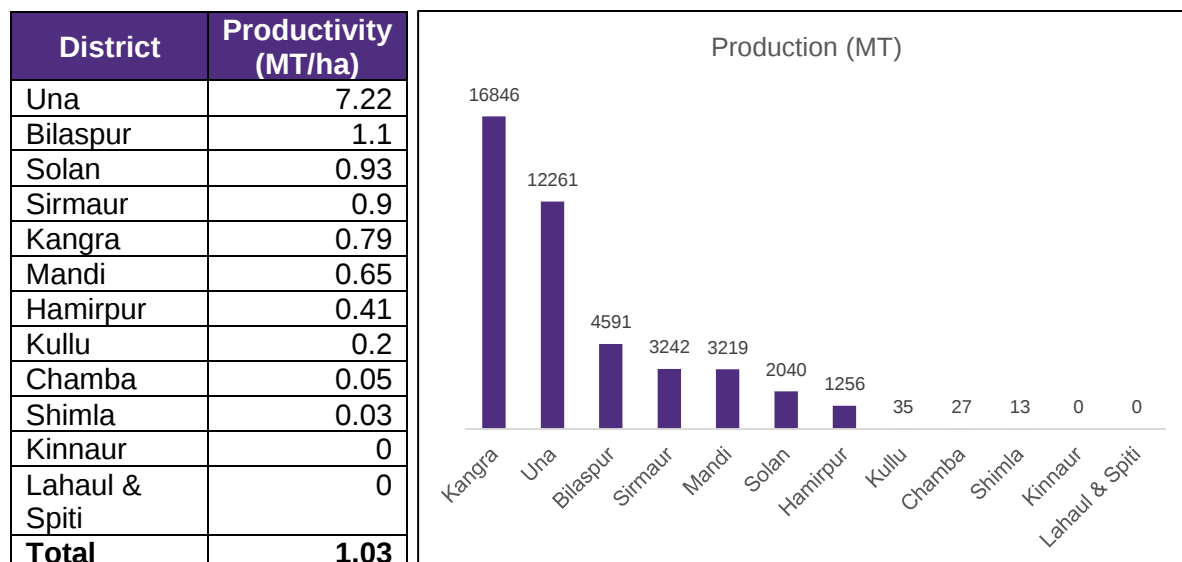
Mallika Strong regular bearing tendency. Average fruit weight 350-400g with deep yellow pulp, high TSS, good flavour, uniform fruits and moderate keeping quality.	
Arunima Medium sized fruit with attractive skin colour. Pulp deep yellow, TSS is around 200 Brix.	
Pusa Pratibha Variety is regular bearer with uniformly attractive fruit size. Peel colour bright red, pulp orange. Semi-vigorous, good sugar: acid blend.	
Pusa Shreshth Semi vigorous, regular bearing with elongated and uniform sized fruits (228g). Peel attractive red; pulp orange, fibreless, firm at ripening contains beta carotene and aerobic acid in good amounts with moderate blend or sugar: acid.	
Ambika Medium Sized fruits bright yellow with dark red blush, some fibre in flesh but firm. Late maturing with 210B TSS.	
Arunika Regular bearer and dwarf variety. Attractive fruits having red blush, firm flesh, high TSS (240B) high carotenoids.	
Chausa Late maturing variety, which matures during end of July to mid of August. Fruits are large weighing about 350 to 400 g. Fruits are bright yellow in colour. Pulp soft and sweet. It is a biennial bearer.	

Pusa Lalima

Regular bearing, semi vigorous variety. Fruit peel bright red on yellowish green background; pulp orange in colour with good blend of sugar: acid.

**Area and Production:**

Evident from the figure below, that Kangra, Una and Bilaspur are the top 3 mango producing district in Himachal Pradesh. Further, Kangra has the highest area under mango cultivation followed by Mandi and Bilaspur. However, it should be noted that even after having the second largest area under mango cultivation in the state, Mandi lags in production due to low productivity of 0.65 MT / Ha, on the other hand Una benefits from highest productivity and has 2nd largest mango production even after being 7th in terms of area under cultivation.

**Seasonality:**

Mallika is harvested from July 3rd week – August 2nd week, and Pusa Arunima is harvested from 3rd week of August till 2nd week of September.

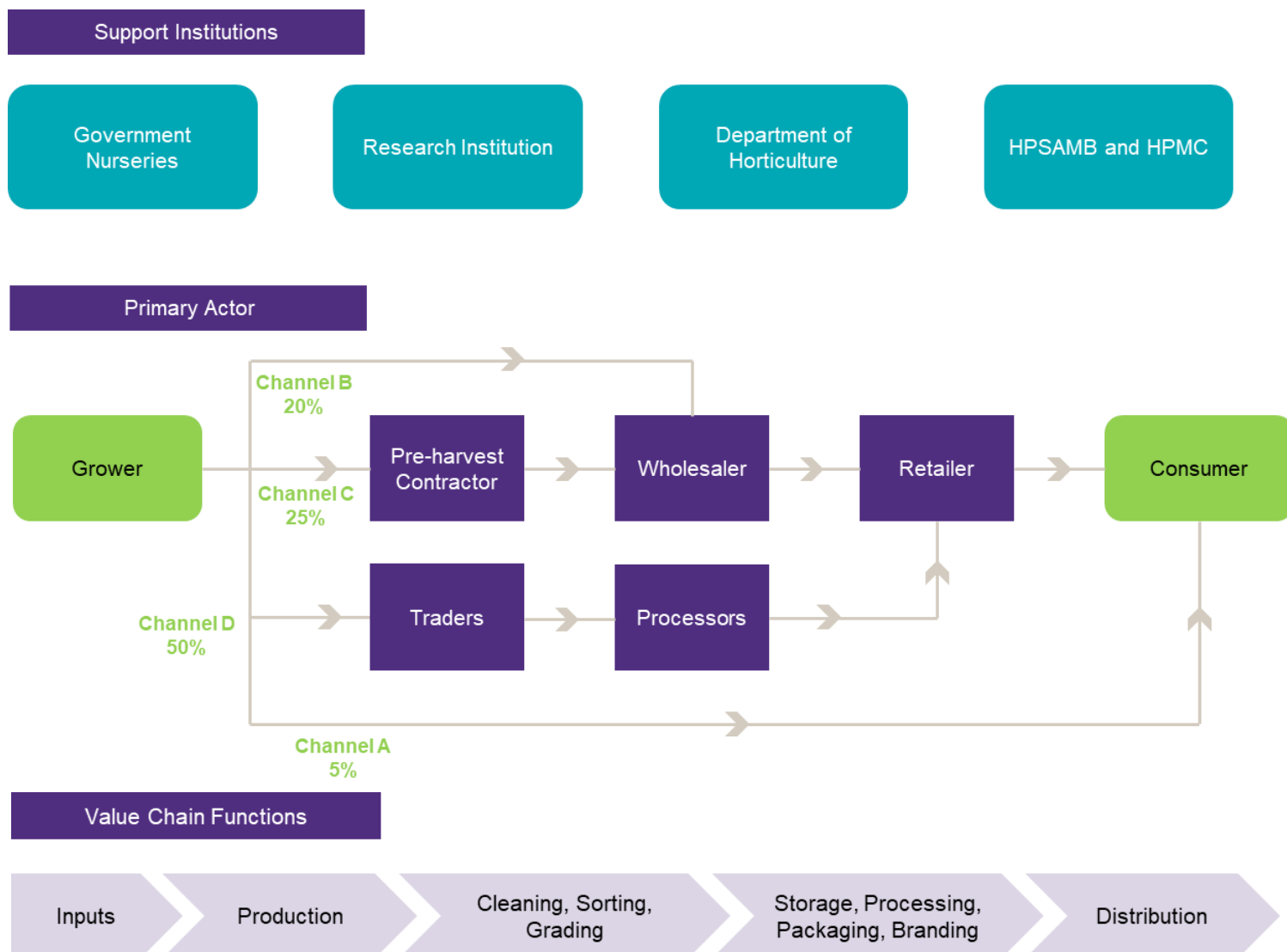
Mango	January				February				March				April				May				June				July				August				September				October				November				December			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Himachal Pradesh																																																
Uttar Pradesh																																																
Maharashtra																																																
Karnataka																																																
Andhra Pradesh																																																



Commodity Flow Analysis

The following are the identified three main channels in the study area:

- Channel -A Producer → Consumer
- Channel -B Producer → Wholesaler → Retailer → Consumer
- Channel -C Producer → Pre-harvest contractor → Wholesaler/processor → Retailer → Consumer
- Channel -D Producer → Traders → Processing unit → Retailer → Consumer



Market Trends

The Mango arrival trend in the last 6 years seems to be in an increasing trend and is likely to continue in the future. In 2017 a very low volume arrived to the markets in Himachal Pradesh compared to the previous year. However, the volume picked up the subsequent year. In 2021 it witnessed an arrival volume of 2024.2 MT.

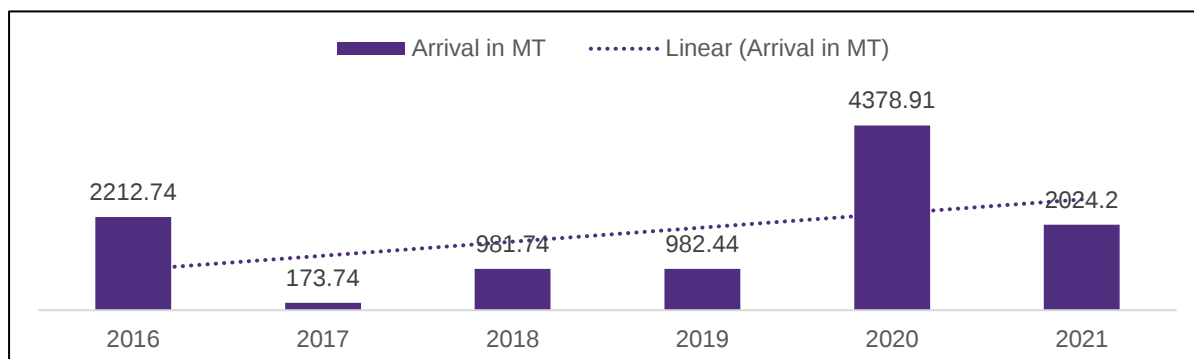


Figure 50: Trend in the arrival of Mango in the markets of Himachal Pradesh

The mean of the modal price trend since the past five years, or the past ten years seems to be increasing every year and this trend will perhaps continue to grow.

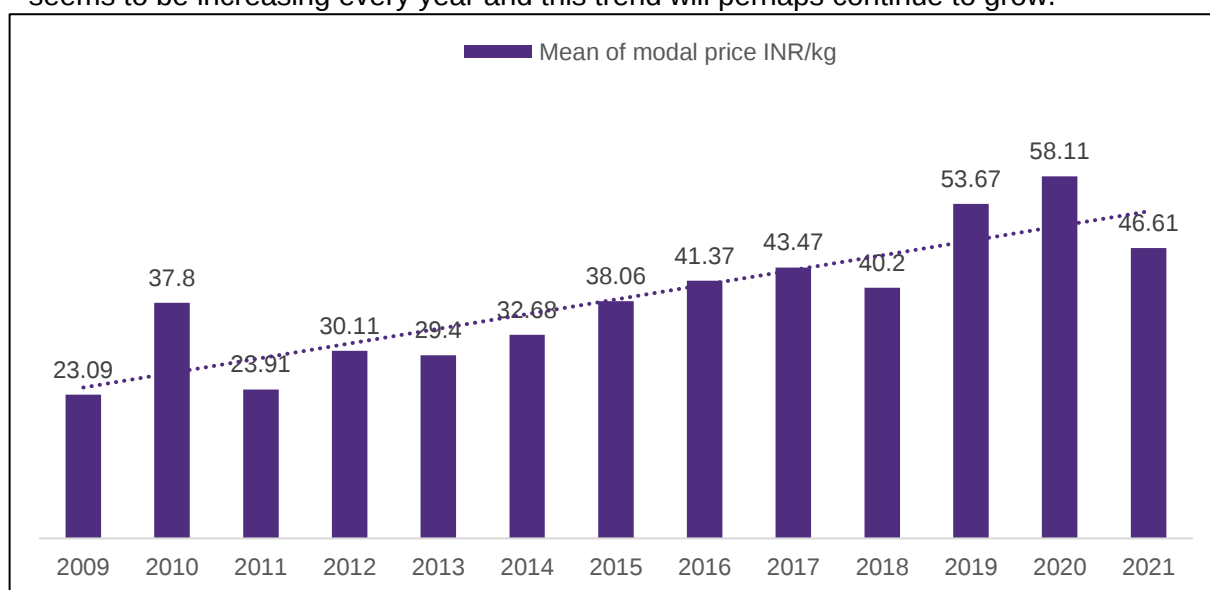


Figure 51: Mean of Modal Price Trend for Mango INR per KG

Value added Products

Crop	Primary Processing	Secondary Processing	Tertiary Processing
Mango	Cleaning, Sorting and Grading	Slices, Dried, Flakes Canned, Powder	Mango Squash, Jam, Pickle Leather, Juice,

PECAN NUT

Introduction

Pecan nut (*Carya illinoensis*) a temperate nut fruit is native of Southern US and Northern Mexico. It is a deciduous plant and sheds its leaves during dormancy. It grows well under sub-temperate climatic conditions. Currently its cultivation in India is confined few micro-agroclimatic zones of J&K (Poonch) and some isolated areas of HP. Its plantation is sporadic.

Due to its high value and higher demand in confectionaries and other processing industries, its cultivation is popular in US and Mexico. It has shown adaptation in sub-tropical climatic conditions. It likes dry conditions and short cold winters and long hot summers besides a suitable growth season of about 300 days in a year.

There are more than 500 varieties of Pecan nut throughout world but almost all are from seedling origin. Some of the popular varieties named out of the wild seedlings are Cape Fear, Desirable, Stuart, Natives and Mahan.

Crop Ecological Parameters⁷²

Sr. No.	Parameter Head	Parameter
1	Altitude	1000-2000 M amsl
2	Aspect	
3	Terrain	
4	Soil type	Deep sandy loam soils
5	Soil PH	6.2-6.5
6	EC	
7	Drainage	
8	Frost	Resistant
9	Optimum Temperature	27 Degree Celsius
10	Avg. Annual Rainfall	800-1500 mm

⁷² Secondary Research and various state PoPs. Finalized in consultation with PMU and CS04 (University)

Crop Details⁷³

S.No.	Parameter Head	Parameter
A	Spacing	6 X 6
B	Planting Material Cost	INR 30 per plant
C	Packing Cost	INR 10 per kg
D	List of Micronutrients & Chemical for IPDM	1. Copper-oxychloride 2. Chlorpyriphos
E	Cultivars	Mahan, Nellis, Burkett, western schley, Wichta, Mazester

Crop Cultivation Details

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Production (kg/Plant)	0	0	0	0	5	10	15	20	25	25	25	25	25	25	25	25	25	25	25	25
FYM	20	30	40	50	60	70	50	90	100	100	100	100	100	100	100	100	100	100	100	100

Well rotten farmyard manure should be applied along with 50% P through single super phosphate (SSP) in the basin by band placement during winter months before mid-February.

Nutrient (g/tree)	1 st Year	2 nd Year	3 rd Year	4 th Year	5 th Year	6 th Year	7 th Year	8 th Year	9 th Year	10 th Year
Nitrogen	75	150	225	300	375	450	525	600	675	750
Phosphorous	35	70	105	140	175	210	245	280	300	300
Potassium	75	150	225	300	375	450	525	600	675	750

Value Chain Analysis

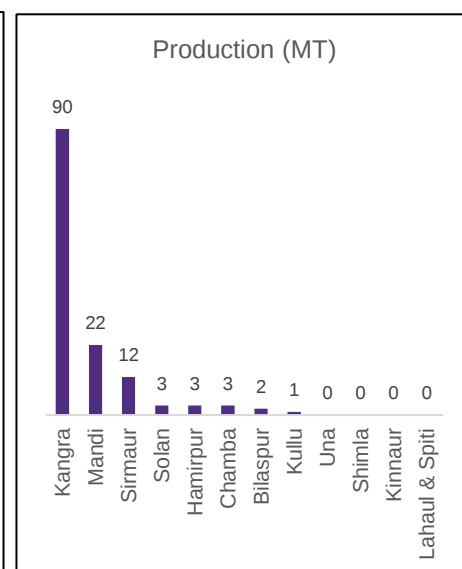
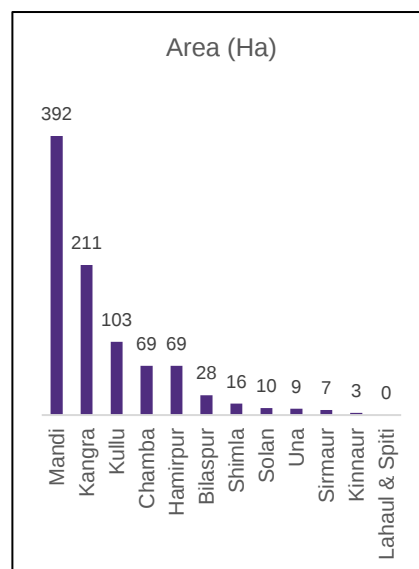
Currently, the cultivation of pecan nut tree is limited in India and imports Pecan nut predominantly from USA. The market overview is not provided because of lack of data.

⁷³ Finalized in consultation with PMU, CS04 (University) and CS03 Value Chain Report

Area and Production:

The state has recorded production of 136 MT on an area of 926 ha with an average productivity of 0.15 MT/ha during FY 2018-19.

District	Productivity (MT/ha)
Sirmaur	1.71
Kangra	0.43
Solan	0.3
Bilaspur	0.07
Mandi	0.06
Hamirpur	0.04
Chamba	0.04
Kullu	0.01
Shimla	0
Una	0
Kinnaur	0
Lahaul & Spiti	0
Total	0.15



Seasonality:

Pecan is expected to be harvested in last week of September - November in Himachal Pradesh.

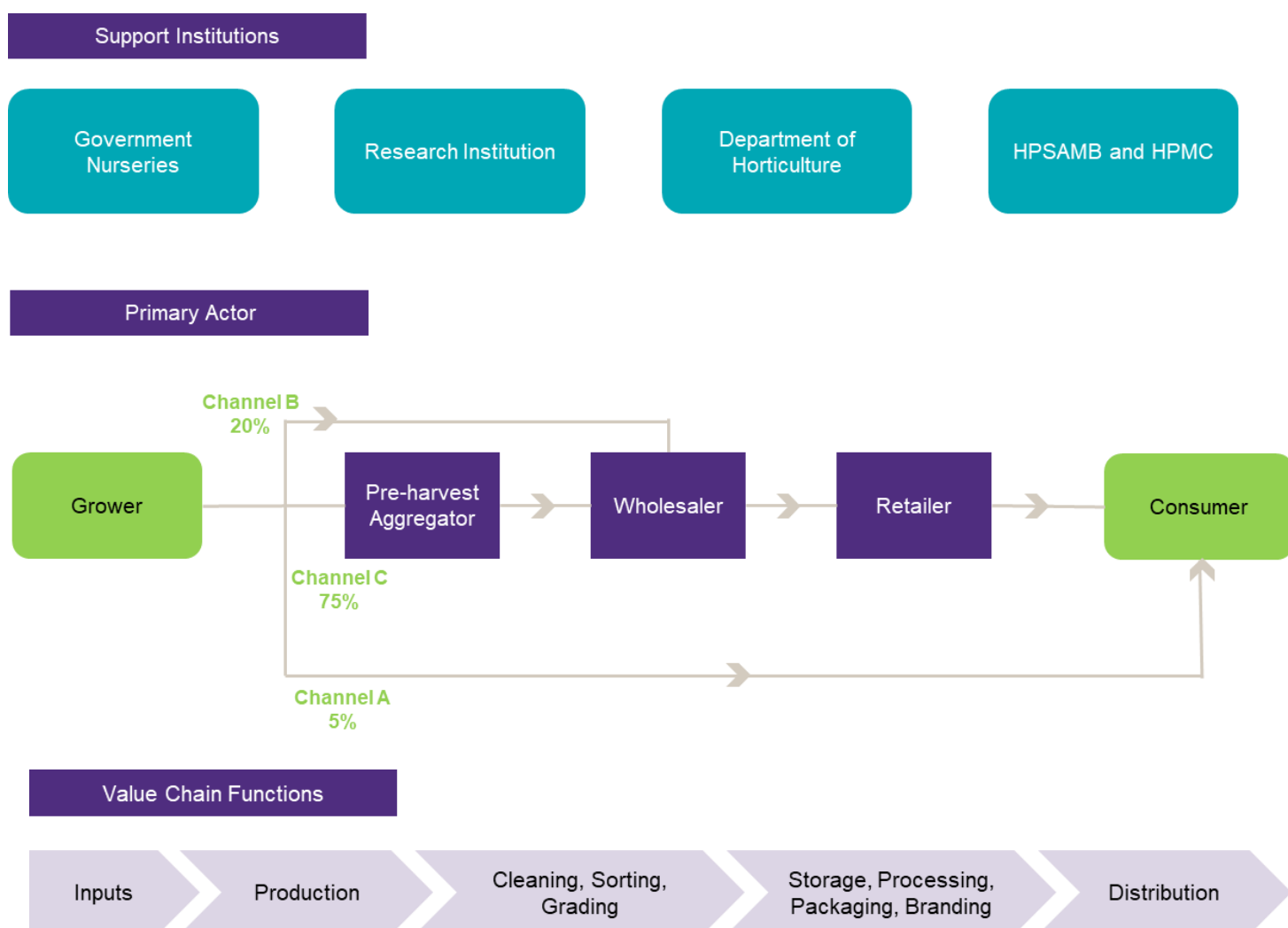
Pecan Nut	January				February				March				April				May				June				July				August				September				October				November				December			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV								
Himachal Pradesh																																																



Commodity Flow Analysis

The following are the identified three main channels in the study area:

- Channel -A Producer → Consumer
- Channel -B Producer → Wholesaler → Retailer → Consumer
- Channel -C Producer → Pre-harvest contractor → Wholesaler → Retailer → Consumer



Value added Products

Crop	Primary Processing	Secondary Processing	Tertiary Processing
Pecan Nut	Cleaning, Sorting and Grading	Cracking, Shelling, Blowing	-

9.2. Volume 2 of 5: Horticulture and Value Chain

Annexure 2.1	Package of Practices
Annexure 2.2	Value Chain Assessment Report
Annexure 2.3	Nursery Development Action Plan Report
Annexure 2.4	Note on Intercropping
Annexure 2.5	Note on Beekeeping
Annexure 2.6	Note on Digital Agri-tech Solutions
Annexure 2.7	Cluster Selection and Ranking Criteria

The annexure can be accessed by clicking the link: [Annexure Volume 2 of 5](#)

9.3. Volume 3 of 5: Irrigation

Annexure 3.1	Irrigation Scheme Feasibility Analysis
Annexure 3.2	Detailed Designed Report - Functional Scheme
Annexure 3.3	Detailed Designed Report - Non - Functional Scheme
Annexure 3.4	Detailed Designed Report - New Scheme
Annexure 3.5	Topography Maps

The annexure can be accessed by clicking the link: [Annexure Volume 3 of 5](#)

9.4. Volume 4 of 5: Safeguards

Annexure 4.1	HPSHIVA Summary Poverty Reduction and Social Strategy (SPRSS)
Annexure 4.2	HPSHIVA Gender Equality and Social Inclusion (GESI)
Annexure 4.3	HPSHIVA Climate Risk and Vulnerability Assessment (CRVA)
Annexure 4.4	Initial Environmental Examination (IEE)
Annexure 4.5	Stakeholder Communication and Engagement Plan (SCEP)
Annexure 4.6	Poverty and Social Analysis (PSA)
Annexure 4.7	Social Due Diligence Report (SDDR)
Annexure 4.8	Environmental Assessment and Review Framework (EARF)

The annexure can be accessed by clicking the link: [Annexure Volume 4 of 5](#)

9.5. Volume 5 of 5: Miscellaneous

Annexure 5.1	Centre & State Government Horticulture Schemes
Annexure 5.2	HPSHIVA Project Readiness Financing (PRF)
Annexure 5.3	HPSHIVA Sector Assessment Report
Annexure 5.4	HPSHIVA Baseline Survey Report
Annexure 5.5	Water User Association (WUA)
Annexure 5.6	Community Horticulture Produce Marketing Association (CHPMA)
Annexure 5.7	HPSHIVA Project Component Business Plans
Annexure 5.8	Project Economic and Financial Analysis

The annexure can be accessed by clicking the link: [Annexure Volume 5 of 5](#)

Picture Gallery

ADB Missions



HPSHIVA PRF Finalization Meetings



Meetings with ADB Mission



Executive Council Meeting



Executive Council Meeting



Executive Council Meeting

Field Preparation work in HPSHIVA Clusters



Plantation Drive under HPSHIVA Project



Demonstration on Training/Pruning Practices



Plantation Drive under HPSHIVA Project



Women Participation in HPSHIVA Project Activities



Training and Capacity Building of HPSHIVA Project Team



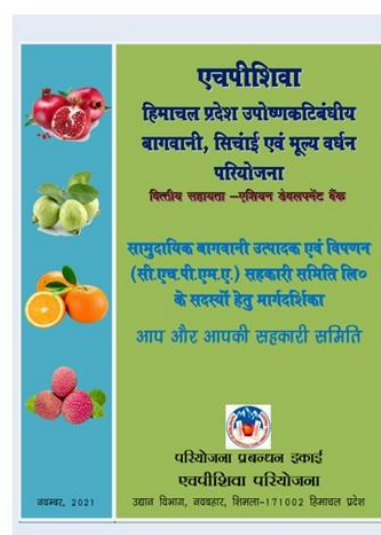
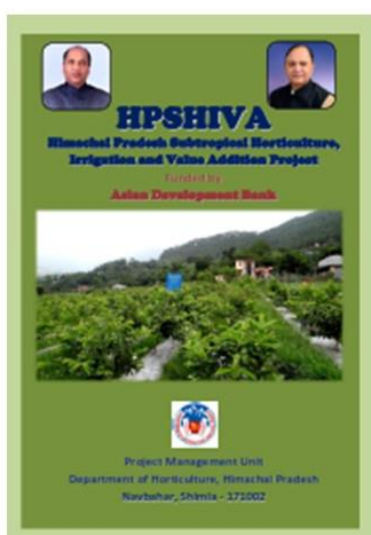
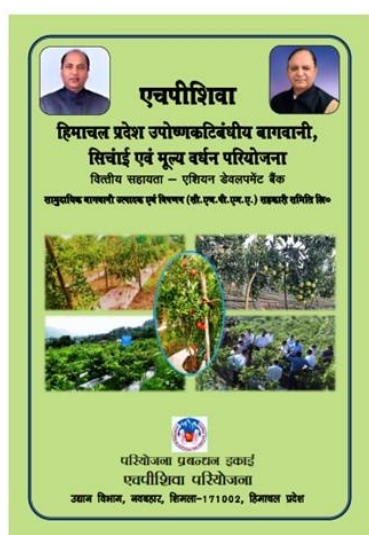
Community Mobilization and CHPMA Formation



Stakeholder Consultation Workshop at Ghumarwin, Bilaspur on 27.11.2021



Preparation of Information, Education & Communication (IEC) Material





For more details contact:

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