

Republic of India
State of Uttarakhand, Department of Horticulture and Food Processing

PREPARATORY SURVEY
ON
UTTARAKHAND INTEGRATED
HORTICULTURE DEVELOPMENT PROJECT
(UKIHDP)

FINAL REPORT
VOLUME-I
MAIN REPORT

MARCH 2022

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
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**The Preparatory Survey
on
Uttarakhand Integrated Horticulture Development Project (UKIHDP)
in
India**

Final Report

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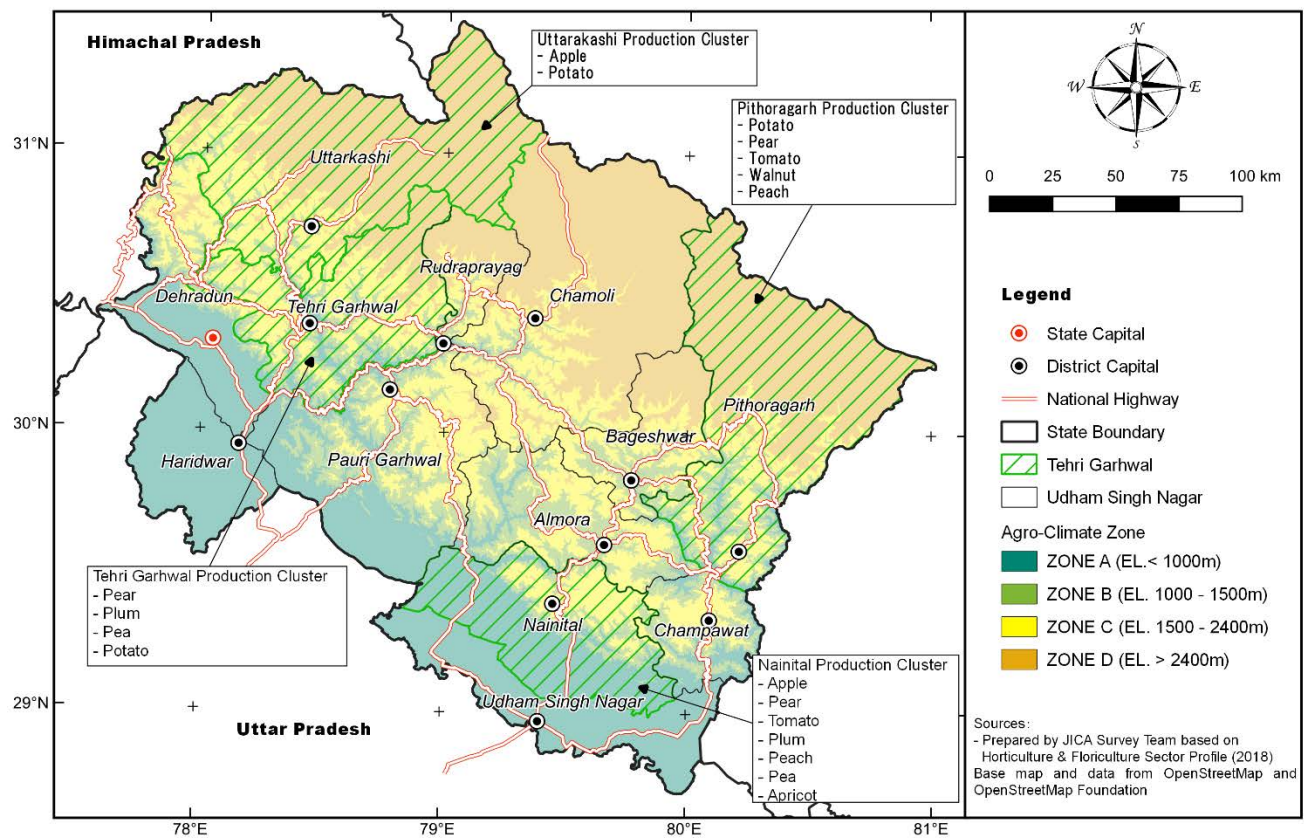
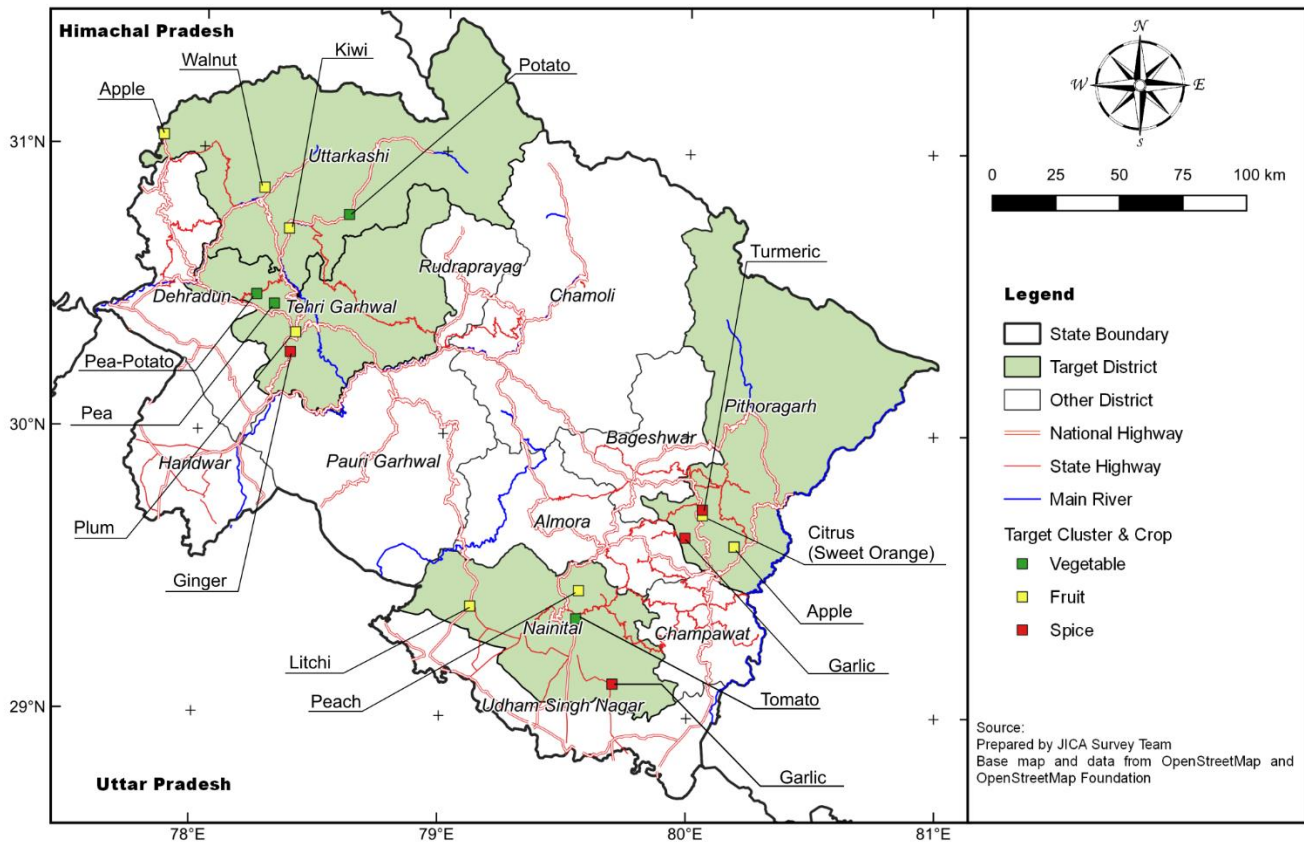
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Project Location Map and Agro-Climatic Zone

-Photographs-
Apple production in Uttarkashi (high density and conventional)

 Latitude: 31.071635 Longitude: 77.8566 Elevation: 2329.22485 m Accuracy: 4.1 m Azimuth: 321° (NW) Pitch: 19.8° (LC) Time: 14.06.2021 14:42 Note: Shree Chait Singh Bhatwari Thunakshi	 Latitude: 31.025565 Longitude: 77.536988 Elevation: 1240.05495 m Accuracy: 4.7 m Azimuth: 173° (E) Pitch: 3.8° (LC) Time: 10.06.2021 17:45 Note: Shree Chait Singh Bhatwari Thunakshi
High density apple with shade/hail net and drip irrigation (80% subsidy), current extended to 6 farmers in the district Puraula block, Uttarkashi District 2329m asl, Uttarkashi DHO photo, 19.06.2021	Conventional big apple orchard on the slope Mori block, Uttarkashi, 1240m asl, Uttarkashi DHO photo, 10.06.2021
 Latitude: 30.967101 Longitude: 78.705956 Elevation: 1564.20 m Accuracy: 4.9 m Azimuth: 87° (E) Pitch: 12.3° (LC) Time: 24.06.2021 10:26 Note: Sata Raj Singh - Chhatrapur	 Latitude: 31.097634 Longitude: 78.103648 Elevation: 1497.2199 m Accuracy: 4.4 m Azimuth: 135° (SE) Pitch: 7.7° (LC) Time: 11.06.2021 09:20 Note: Shree Ravendra Singh
High density apple (mixed with cabbage) with wire / steel stand, Mori block, Uttarkashi, 1564m asl, Uttarkashi DHO photo, 24.06.2021	Apple orchard without supporting stand, Mori block, Uttarkashi, 1497m asl, Uttarkashi DHO photo,
 REDMI NOTE 8 AI QUAD CAMERA	 REDMI NOTE 8 AI QUAD CAMERA
Harvested apples carried into the shipping centre in a plastic container and ready for sorting by Maa Jagdamba SRC. Bhatwari block, Uttarkashi District, 30.06.2021	Apple sorting machine at the SRC, This and below 2 photos are same place with left.
 REDMI NOTE 8 AI QUAD CAMERA	 REDMI NOTE 8 AI QUAD CAMERA
Packing apples in a carton box with layers of trays for shipping.	In front of apple collecting and shipping centre. Behind packed apple in a carton box for shipping on the ground

-Photographs- Crops (kiwifruits and tomato) and NGO activities

 Latitude: 31.024643 Longitude: 77.832119 Elevation: 1154.66196 m Accuracy: 5.1 m Azimuth: 236° (SW) Pitch: 13.4° (2.0°) Time: 10:06:2021 19:02 Note: Shree Rupal Singh Rana Viji Thindara Area extension Kiwi	 Latitude: 31.024726 Longitude: 77.83207 Elevation: 1158.79103 m Accuracy: 4.1 m Azimuth: 255° (NW) Pitch: 9.5° (0.5°) Time: 10:06:2021 19:02 Note: Shree Rupal Singh Rana Viji Thindara Area extension Kiwi
Kiwifruits orchard to be prepared overhead trellis at the district extension area. Mori block, Uttarkashi, 1154 m asl., Uttarkashi DHO photo, 10.06.2021	Fruiting Kiwifruits on the district extension farm. Bhatwari block, Uttarkashi, 1158 m asl, Uttarkashi DHO photo, 10.06.2021
	
Tomato (indeterminate mainly for processing) cultivation with small bamboo stand by open culture, Naugaon block, Uttarkashi District, 08.07.2021, JICA Survey Team	Tomato (determinate for fresh) cultivation in polyhouse with drip irrigation supported by ILSP project, 12.03.2021 Chamoli district, Uttarakhand, photo by ILSP
	
Harvested tomato from the rainfed tomato farm (Himsona variety, F1, indeterminate), Naugaon block, Uttarkashi District, 09.07.2021, JICA Survey Team	Harvested tomato from an open tomato farm (variety unknown), Naugaon block, Uttarkashi District, 09.07.2021, JICA Survey Team
	
Soil lab operated by HARC¹⁾ for farmer support. Other soil lab could not be confirmed in Uttarkashi. Naugaon block, Uttarkashi District, 09.07.2021, JICA Survey Team	Apple seedling hardening nursery after tissue culture propagation. Will be grafted after the hardening. by HARC. Naugaon block, Uttarkashi District, 09.07.2021, JICA Survey Team

Note 1) HARC: Himalayan Action Research Centre, NGO, <https://www.harcindia.org/>

-Photographs- Crops (Apple, Peas)

	
Harvesting apple from big apple tree – hard work Mori block, Uttarkashi District, 10.06.2021, Uttarkashi DHO photo	Apple for harvesting, fruits thinning would be not extended Bathwari block, Uttarkashi District, 30.06.2021, JICA Survey Team
	
High density apple orchard ready for harvesting. Mori block, Uttarkashi District, 30.06.2021, JICA Survey Team	Apple for harvesting and grafted apple tree Naugaon block, Uttarkashi District, 30.06.2021, JICA Survey Team
	
Pea cultivation with hung string, in poly house, supported by ILSP. Chamoli District, 01.04.2021, ILSP photo	Pea cultivation on the rainfed farm without support pole or strings. Chamoli District, 01.04.2021, ILSP photo
	
Pea grading training. Grading and shipping by grade is not started yet. Chamoli District, 08.05.2021, ILSP photo	Left: reservoir for irrigation water, centre: soil for germination bed, back of centre: poly tunnel for nursery, etc Chamoli District, 29.05.2021, ILSP photo

-Photographs- Cultivations techniques and some natural conditions

	
Tomato seedling nursery in small polyhouse without grafting (scion root) by leading farmer, supported by ILSP Chamoli district, 26.05.2021, Photo by ILSP	Animal repellent fence e.g. wild pig, deer, etc., by leading farmer, supported by ILSP Chamoli District, 26.05.2021, photo by ILSP
	
Poly mulching was set for next cultivation for tomato etc., after harvesting mainly wheat on the terrace farm. Chamoli District, 12.06.2021, photo by ILSP	Poly mulching was set for next cultivation but difficult to maintaining even condition of the ridges on the steep slopes, Chamoli District, 12.06.2021, ILSP
	
Apple seedlings (grafted) for transplanting and planted one supported by ILSP. Chamoli District, 17.02.2020, ILSP photo	Development of one of apple farms in Chamoli for digging hole for transplanting the supplied apple seedling by ILSP. Chamoli District, 17.02.2020, ILSP
	
Apple farm in May without fruiting and background landscape of trail and terrace farm on the steep slope Chamoli District, 27.05.2021, ILSP photo	Apple farm after transplanting in July and animal repellent fence, Chamoli District, 14.07.2020, ILSP photo

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**Final Report
Volume-I Main Report**

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Abbreviations

ACZ	Agro-Climatic Zones
AD	Agriculture Department
AE	Advance Estimates
AE	Assistant Engineer
AEZs	Agro-ecological zones
APC	Agricultural Production Commissioner
APEDA	Agricultural and Processed Food Products Export Development Authority
APMC	Agricultural Produce Market Committee
ATMA	Agricultural Technology Management Agency
AWC	Anganwadi Centres
AYUSH	Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy
bgl	Below Ground Level
BIRD	Bankers' Institute of Rural Development
BIS	Bureau of Indian Standards
BMI	Body Mass Index
CAs	Commission Agents
CA storage	Controlled Atmospheric storage
CAGR	Compound Annual Growth Rate
CBBOs	Cluster Based Business Organisations
CDB	Coconut Development Board
CE	Chief Engineer
CGWB	Central Ground Water Board
CHCs	custom hiring centres
CHU	Custom Hiring Units
CIH	Central Institute for Horticulture
Cl	Chloride
CM	Chief Minister
CNNS	Comprehensive National Nutrition Survey
CoE	Centre of Excellence
COVID-19	Corona Virus Diseases – 2019
CPPGG	Centre for Public Policy and Good Governance
DAC	Department of Agriculture and Cooperation
DASP	Diversified Agriculture Support Project
DF/R	Draft Final Report
DFU	Disease Forecasting Units
DGBR	Director General Border Roads
DHFP	Department of Horticulture and Food Processing
DI	Department of Industries
DIU	District Implementation Unit
DMs	District Magistrates
DPIIT	Department for Promotion of Industry and Internal Trade
DPR	Detailed Project Report
DSDE	Department of Skill Development and Employment
DWECD	Department of Women Empowerment & Child Development
ECA	Essential Commodities Act
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EIRR	Equity Internal Rate of Return
EL	Elevation
eNAM	National Agriculture Market
eVIN	Vaccine Intelligence Network

ESMS	Environmental Safety Management System
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
F/F	Fact Finding
FIs	Financial Institutions
FIG	Farmers Interest Group
FMB	Field Measurement Book
FPC	Farmers Producing Company
FPO	Farmers Producing Organization
F/R	Final Report
FY	Financial Year
GAP	Good Agricultural Practice
GADM	Global Administrative Areas
GC	Growth Centre
GDP	Gross Domestic Product
GFVC	Global Food Value Chain
GGI	Gender Gap Index
GI	Geographical Identify
GIS	Geological Information System
GOI	Government of India
GOU	Government of Uttarakhand
GPs	Gram Panchayats
GSDP	Gross State Domestic Product
Ha.	Hectare
HDR	Human Development Report
HHs	Households
HMNEH	Horticulture Mission for North East and Himalayan States
HMP	Himmothan Pariyojana
HMT	Horticulture Mobile Team
HPCDP	Himachal Pradesh Crop Diversification Project
IAU	Industries Association of Uttarakhand
ICAP	Integrated Cold Chain Availability Platform
ICAR	Indian Council of Agricultural Research
ICDP	Integrated Cooperative Development Project
ICDS	Integrated Child Development Scheme
ICT	Information and Communication Technology
IEMs	Industrial Entrepreneurs Memorandums
IFAD-ILSP	International Fund for Agriculture Development - Integrated Livelihood Support Project
IFAD	International Fund for Agriculture Development
IFFDC	Indian Farm Forestry Development Co- operative Ltd.
IFPRI	International Food Policy Research Institute
IC/R	Inception Report
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICMR	Indian Council of Medical Research
IDR	Irrigation Done Right
ILSP	Integrated Livelihood Support Project
IMD	Indian Meteorology Department
IMR	Infant Mortality Rate
INM	Integrated Nutrition Management
INR	The Indian Rupee
IPM	Integrated Pest Management
ISI Mark	Indian Standards Institution Mark

ISO	International Organization for Standardization
IT/R	Interim Report
IT	Information Technology
ITIs	Industrial Training Institutes
IQF	Individually Quick Frozen
JICA	Japan International Cooperation Agency
LDPE	Low Density Polyethylene
LINAC	Lxmanrao Inamdar National Academy for Cooperative Research & Development
JLGs	Joint Liability Groups
Kg	Kilogram
KVIB	Khadi and Village Industries Board
LPG	Liquefied Petroleum Gas
lpm	Liters Per Minute
LSD	Land Survey Directorate
Mas	Market Aggregators
MAAF	Ministry of Agriculture, Forestry, and Fisheries, Japan
MBT	Main Boundary Thrust
MC&I	Ministry of Commerce and Industry
MCT	Main Central Thrust
MDM	Mid-Day-Meal
MIDH	Mission for Integrated Development of Horticulture
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act 2005
MI	Micro Irrigation
MMNPY	Mukhya Mantri Nutan Polyhouse Yojna
MSE-CDP	Micro & Small Enterprises – Cluster Development Programme
MSME	Ministry of Micro, Small & Medium Enterprises
MSMED	Micro, Small & Medium Enterprises Department
MSP	Minimum Support Price
MT	Metric Ton
NABARD	National Bank for Agricultural and Rural Development
eNAM	National Agriculture Market
NARS	National Agriculture Research System
NCDC	National Cooperative Development Corporation
NCES	National Centre for Education Statistics
NCT	National Capital Territory
NDC	Nationally Determined Contributions
NFHS	National Family Health Survey
NGO	Non-Governmental Organization
NH	National Highways
NHB	National Horticulture Board
NHM	National Horticulture Mission
NIC	National Informatics Centre
NITI Aayog	National Institute for Transforming India
NREGS	National Rural Employment Generation Scheme
NRLM	National Rural Livelihood Mission
NSSO	National Sample Survey Organization
NCT Delhi	National Central Territory of Delhi
NW	North West
NWDPPRA	National Watershed Development Project for Rainfed Areas
ODA	Official Development Assistance
O&M	Operation and Management
PACS	Primary Agriculture Cooperative Societies
PDS	Public Distribution System

PE	Provisional Estimates
PG/PVGs	Producer Group/ Protecting Vulnerable Group
PG/VPGs	Producer Group/ Vulnerable Producers Group
PHM	Post Harvest Management and Marketing and Food Processing
PMC	Project Management Consultant
PM-CARES Fund	Prime Minister Citizen Assistance and Relief in Emergency Situations Fund
PM FME Scheme	Pradhan Mantri Formalisation of Micro Food Processing Enterprises
PM-KISAN scheme	Pradhan Mantri -KISAN scheme
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PMU	Project Management Unit
POSHAN	Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition
PPO	Plant Protection Officer
PPR	Preliminary Project Report
PRA	Participatory Resource Appraisal
PRI	Panchayati Raj Institutions
PSI	People's Science Institute
PTCUL	Power Transmission Corporation of Uttarakhand Limited
PQ	Pre-Qualification
PWD	Public Works Department
RBI	Reserve Bank of India
R&D	Research and Development
RE	Revised Estimates
REAP	Rural Enterprise Acceleration project
RIDF	Rural Infrastructure Development Fund
RKVY	Rashtriya Krishi Vikas Yojana
RoR	Right of Record
RTV	Refrigerated Transport Vehicle
SAUs/KVKs	State Agricultural Universities and Krishi Vigyan Kendras
SC/ST	Scheduled Castes/ Scheduled Tribes
SDGs	Sustainable Development Goals
SE	Superintending Engineer
SFAC	Small Farmers' Agribusiness Consortium
SH	State Highways
SHEP	Smallholder Horticulture Empowerment and Promotion
SHGs	Self-Help-Groups
SHM	State Horticulture Mission
SIDCUL	State Infrastructure and Industrial Development Corporation of Uttarakhand Limited
SLDC	State Load Despatch Centre
SLEC	State Level Executive Committee
SRLM	State Rural Livelihood Mission
TOC	Table of Content
TOR	Terms of Reference
TP	Training Pruning
UFRMP	Uttarakhand Forest Resource Management Project
UJVN	Uttarakhand Jal Vidyut Nigam Limited
UK	Uttarakhand
UKAPMB	Uttarakhand Agricultural Produce Marketing Board
UKDHFP	Uttarakhand Department of Horticulture and Food Processing
UKHMB	Uttarakhand Horticulture Marketing Board
UKIHDP	Uttarakhand Integrated Horticulture Development Project
UK PWD	Uttarakhand Public Works Department

ULIPH	Uttarakhand Livelihood Improvement Project for Himalayas
UNDP	United Nations Development Programme
UPCL	Uttarakhand power Corporation limited
U.S. Nagar	Udham Singh Nagar
USN	Udham Singh Nagar
USPSP	Uttarakhand State Perspective & Strategic Plan
USRLM	Uttarakhand State Rural Livelihood Mission
UTs	Union Territories
UUHF	Uttarakhand University of Horticulture and Forestry
U5MR	Under Five Mortality Rate
WEF	World Economic Forum
WHR	Western Himalayan Region
WMD	World Meteorological Department
WUAs	Water User Associations
WWF	World Wild Fund
XEN	Executive Engineer

Measurement Units and Currency

Area

cm² = Square-centimetre(s)
m² = Square-metre(s)
km² = Square-kilometre(s) (1,000,000 m²)
ha = Hectare(s) (10,000 m²)
acre = Acre(s) (4,046.8 m² or 0.40468 ha.)

Length

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

Currency

JPY = Japanese Yen
INR = Indian Rupee

Volume

cm³ = Cubic-centimetre(s)
m³ = Cubic-metre(s)
L = Litre(s) (1,000 cm³)
MCM = Million Cubic Metre (s)

Weight

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

Time

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

Indian Numbering

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

Summary

Chapter 1 : Introduction

1. This Draft Final Report is prepared in accordance with the terms of reference of the contract agreement between the Japan International Cooperation Agency (JICA) and Nippon Koei Co., Ltd. signed on February 25, 2021 for the Preparatory Survey on Uttarakhand Integrated Horticulture Development Project (UKIHDP). In the Preliminary Project Report (PPR) prepared by the Department of Horticulture and Food Processing under the Government of Uttarakhand (UKDHFP), it was indicated that the main objective of the Project is to enhance production, productivity, quality of produces, processing, and market linkage and expects seven outcomes, namely: (i) to improve the socio-economic status of agrarian community of Uttarakhand, (ii) to optimize utilization of the natural resources of Uttarakhand, (iii) to improve access to horticulture input, (iv) to improve farmers' access to credits and markets, (v) to generate diverse and inclusive employment opportunities, especially for women and youth in agriculture sector, (vi) to increase availability of nutritious farm produces and reduce damages from wild animals and climate change, and (vii) to increase livelihood opportunities to facilitate reverse migration.
2. The Survey aims at reviewing the project details described in the PPR focusing on technical and economic feasibilities and its eligibility to be implemented as an official development assistance (ODA) loan project through data collection at the project site, interview with stakeholders of the Project, and discussion with UKDHFP, the related institutions, and JICA. The survey area is the entire Uttarakhand with emphasis on the four districts of Uttarkashi, Tehri Garhwal, Pithoragarh, and Nainital.

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

3. Uttarakhand is located on the southern slope of the Himalayan ranges and situated under the Western Himalayan Region (WHR) as per the distribution of 15 agroclimatic regions in India. Based on the agro-ecological environment, agro-climate conditions and physiographic factor, the state is divided into four major zones – plain and valley region [Zone-A], mid-altitude [Zone-B], high altitude [Zone-C], and very high altitude [Zone-D]. In the WHR, the climate is a combination of cool and hot hilly environment with high to low precipitation from high hills to foothill plains, respectively. The state is rich in natural resources especially water and forests with many glaciers, perennial rivers, dense forests, and snow-capped mountain peaks. Most of the northern parts of the state are portions of the greater Himalayan ranges covered by high mountain peaks and glaciers. Two of India's mightiest rivers, Ganga and Yamuna, originate from the glaciers of Uttarakhand.
4. Presently, change of temperatures and precipitation are generally more moderate in the lower area in comparison with which in the higher area in Uttarakhand. Although the fluctuation of annual precipitation seems unstable and large, it is normal and observed in long-term weather data. Monthly temperatures are projected to increase in all scenarios after 2040, while the range of their variation is different. Monthly maximum and minimum temperatures increase at 2.9°C in Zone A and Zone D, respectively, in the most extreme case, namely RCP8.5. The increase of monthly temperatures around 3°C may impact crop cultivation and the optimum areas of each crop may be shifted.
5. The local governance system of the state is based on the three-tier system of Panchayat Raj Institutions (PRI) comprised Gram Panchayat composed of a few revenue villages – Panchayat Samiti at the block level - District Panchayat. The state has 95 blocks and 15,745 inhabited villages (Total villages – 16,793) in the total of 13 districts. Regarding horticulture administration, each division is anchored by a Chief Horticulture Officer and District Horticulture Officer, whereas Horticulture Mobile Teams (HMT/ 319 teams in total), providing ground level support, are situated at the block level. There is limited technical training opportunities provided for them after joining the services.

6. In Uttarakhand, the average family size is five. Out of the total households, majority are living in the rural areas. The gender population ratio of Uttarakhand is on an average 963 females for every 1,000 males as per the data of 2011 Census. A district-wise analysis of the Scheduled Caste and Scheduled Tribe population reveals that the state has an average of 18.76% for Scheduled Castes and 2.89% for Scheduled Tribes. Out of the total workers in the state, 74.1% is main worker engaged in economic activities for more than six months in a year and 25.9 % is categorized under marginal workers engaged in economic activities for less than six months in a year. Out of the main workers category, 36.4% are main cultivators engaged in farming activities and 8.6% are main agriculture labors who work on the agriculture field owned by others.
7. The Government of Uttarakhand has developed a policy document “Uttarakhand Vision 2030” in 2018. In the document, the process to attain inclusive and sustainable development was depicted. The state economy of Uttarakhand has indicated steady growth between 2011/12 – 2020/21. During the period, Gross State Domestic Product had grown by 4.11%, which largely derives from the growth in the secondary and tertiary sectors. Especially, storage and trade, repair, hotel and restaurants have shown significant growth.
8. The per capita income in Uttarakhand has grown at an annual rate of 10.5% since 2011-12 and reached INR 182,320 per capita in 2017-2018. The lowest growth rate was seen in the hill districts. Over the period, the population of the poor has halved and the indices of health, education, and living standards have improved. Uttarakhand is also known for its high number of migrants. The percentage of rural hill households having long-term migrant in family has increased to 35.3%. Out migration is seen more frequently in the hill region and lower in the plain districts, and 85% of the migrants moved out of their home base for longer period.
9. Out of the total geographical area of 5.35 million ha in the state, 4.6 million ha (86%) is hilly area and 0.74 million ha (14%) is plain area. Only about 14% of the geographical area is cultivable, which is mainly attributed to the topography of the state. Like many other hill economies, the people of Uttarakhand practice integrated systems of farming, forestry, horticulture, livestock husbandry and off-farm activities. The recorded forest area constitutes 64.79% of the total reported area, although the green cover based on remote sensing and satellite imagery is shown only 44%. The net sown area for the region is a little over 13% of the total reported area, although there are wide variations in this percentage from district to district. About 12% of agricultural land has got irrigation and about 90% land is used for growing cereals, fodder (berseem) and some vegetables. The total area of agriculture landholdings is recorded at 747,320 hectare, out of which, 74.78% of landholdings in the state is less than one ha. A total of 91.67% landholdings are categorized as small and marginal farmers.
10. Uttarakhand has enormous potential of water resources in the form of glaciers and rivers but groundwater resources are limited. The State Government of Uttarakhand has been implementing and operating several schemes for irrigation development with the purpose of providing adequate irrigation facilities to promote vegetable production in the state. Construction of Hauz (water storage tanks) and ponds for irrigation is supported by the central government through ‘*Pradhan Manti Krishi Sinchayee Yojna*’ (PMKSY). Under the scheme, funds are available for irrigation projects and watershed development.
11. In Uttarakhand, public transport facility is reported to be the common means of transportation used by 83% of farmers, while the remaining 17% use their own vehicles. Uttarakhand markets are usually located in the plain regions of the state, therefore, roads and transportation facilities are relatively better as compared to those of hilly terrains. Cold storage facility exists only with 9% farmers in the state. The means of transportation in Uttarakhand vary as the terrains of different areas vary. It has a limited railway set up with various gauge widths but has a good network of motor roads including highways, main roads, and feeder roads. Also, according to the data provided by the Information Technology Development Agency, out of a total of 15,745 villages in the hill state, 434 of these did not have network service availability until May 2020.
12. In Uttarakhand, various departments and projects promote community-based organizations among the farmers. Farmers’ organizations such as cooperatives are registered under the Uttarakhand

- Cooperative Society's Act or other related acts. Some are also registered under Company's Act 2013 as producer company. Self-Help Groups (SHGs) and their federations mostly among women in the rural areas have also been promoted by the State Rural Livelihood Mission (SRLM) across the states. In addition, the Department of Agriculture and Cooperation (DAC), Ministry of Agriculture, Government of India launched a pilot program for promoting member-based Farmer Producer Organizations (FPOs) in 2011-12, in partnership with the state governments, which was implemented through the Small Farmers' Agribusiness Consortium (SFAC). Presently, there are FPOs in Uttarakhand that are supported mainly by National Agriculture Bank for Rural Development (NABARD), SFAC and National Cooperative Development Corporation (NCDC) .
13. Regarding gender status in Uttarakhand, around 85% of the total female labors are employed in the agriculture sector in rural India, and it is also true especially in the hill districts of Uttarakhand. Women are the backbone of hill farming system and are engaged in all agricultural activities from tilling, sowing to harvesting and post-harvest processing activities. Apart from this, women are responsible for livestock activities such as collection of fodder, cleaning of shed, milking the cattle, and preparation of milk products. Moreover, some studies show that women in Uttarakhand, like in most part of India, have limited ownership of agriculture land and access to agricultural credit and information.
 14. Uttarakhand being a hill state has an inclination to traditional food crops and vegetables which form the basis of the daily diet intake; these include use of wild plant resources in agricultural systems. Although traditional food crop and wild plants are rich in minerals, vitamins and micro nutrients, their production in limited quantities hampers the overall health status of the natives of the hilly areas. In places where agriculture is a major source of livelihoods, agriculture income affects the food expenditure, which is linked to food access and diet. Some NGOs and Anganwadi have set up school gardens and conducted awareness creation for education to children and their families.

Chapter 3: Present Condition of Agriculture Sector in the Survey Area

15. The National Policies on Agriculture Policy (1) : The first national agriculture policy (2000) promoted mission for integrated horticulture development to spearhead the technological research and development. In addition, interventions to improve access to agriculture credit, promotion of cooperatives and infrastructure investment, and utilization of media and ICTs for agriculture, establishment of Agri clinics and agribusiness centers. This was followed by Agriculture Policy Vision 2020. The vision emphasized on improvement of crop yield and soil nutrient management, soil testing, application of GIS in agriculture, and promoted high value and labor intensive crops among other measures. Government of India's main focus now is to double the farmer's income and one of the strategies is the liberation of the agriculture to invite more private investments in production and market, strengthening/ promoting FPOs and FPCs; sustaining MSP and etc were also recommended. With this background, three bills were passed in 2020, namely "The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Bill", "The Farmers' (Empowerment and Protection) Agreement of Price Assurance and Farm Services Bill" and "The Essential Commodities Act (Amendment) Bill". Subsequently these bills were abolished but alternative strategies to enhance farmers' income need to be explored.
16. Centrally Sponsored Schemes for Horticulture Development:
 - The Horticulture Mission for North East and Himalayan State (HMNEH) is being implemented in the state since 2003-04 for the holistic development of the horticulture sector, duly ensuring forward and backward linkages by adopting cluster approach, covering production, postharvest management, processing and marketing with the active participation of all the stakeholders.
 - A single window system has been created to expedite sanction/clearance of projects under micro, small and medium enterprises (MSME). A separate Horticulture Marketing Board has been setup to promote marketing of horticulture produce and to ensure better price of produce to farmers.

- To promote protected cultivation especially among small and marginal farmers in hilly areas, Mukhyamantri Sanrakshit Kheti Yojana (A state government scheme on protective farming launched by the Chief Minister of Uttarakhand) has been launched in 2011-12 with provision of 30% additional subsidy from the state budget up to 500 sqm greenhouses per beneficiary.
 - The Weather-based Crop Insurance (Pradhan Mantri Fasal Bima Yojana/ PMFBY) is a central scheme administered by the Ministry of Agriculture and Farmers Welfare to provide financial safety net against the loss of yield incurred during various stages of production such as sowing/ planting/ germination, growing stage of crops, post-harvest, natural disasters, and also damages caused by wild animals.
 - The Ministry of Food Processing Industries sets its goals to promote food processing to reduce the postharvest losses and value addition, to improve shelf life, and through which, the ministry aims to improve income of the farmers and to create surplus to export. Under the central government assistance, four agri-export zones and two mega food parks have been established in Uttarakhand.
17. State Policy and Plan for Horticulture Sector: The Government of Uttarakhand has formulated MSME Policy 2015 to provide incentives for setting up of industries including food processing industries which have been subsumed in the Special Integrated Industrial Promotion Policy 2008 for Hilly & Remote Areas of Uttarakhand. In addition, the government has promulgated the Mega Industrial and Investment Policy 2015 to promote large-scale units above INR 750 million investments. Several agencies are engaged in the implementation of the policy.

The State Infrastructure and Industrial Development Corporation of Uttarakhand Limited (SIDCUL) plays a key role in industrial development of the state, both in terms of policy formulation and infrastructure development. The Industries Association of Uttarakhand (IAU) is an apex body of small- and medium-scale industries of Uttarakhand and assists in the development of small- and medium-scale enterprises in the state. For promotion and growth of food processing industries in the state, the Department of Horticulture & Food Processing is the nodal agency. Besides the scheme of MSME, food processing industries are setup under HMNEH and the state food processing mission.

18. Growth Centers Concept in Uttarakhand: Uttarakhand has tremendous potential to turn into a hub for production and export of several local products. However, despite producing specialized/niche products in different parts of the state, Uttarakhand has been facing challenges in the development of MSMEs for niche products in the absence of commercial cultivation practices and standardization of the quality of its products. As a way to address these challenges, the Government of Uttarakhand has embarked upon a growth center (GC) scheme in 2018, for establishment of growth centers in specific rural areas to promote identified economic activities and help specialized/niche local produce and services reach national and international market. This is expected to help create income-generating opportunities and reduce out-migration of the youth, which is currently a major challenge for the state. The growth centers shall be established in remote parts of Uttarakhand that are witnessing high out-migration of rural youth, to seek to empower entrepreneurs, farmers, and craftsmen/artisans to engage in product-specific value chains, upscale their products, and improve productivity through access to new designs, technology and knowledge. Ultimately, this will enable them to successfully operate micro and small enterprises. As per the information of MSME Department, there are 42 growth centers related to horticulture, promoted mainly by the ILSP Project of IFAD, SRLM and the Directorate of Watershed.
19. Cluster Development Policy on Horticulture Crops: Based on geographical location and climate in Uttarakhand, a total of 1,050 clusters are identified that include 6,563 villages. Out of the total clusters, 384 (36.57%) clusters are for fruits, 437 (41.62%) for vegetables, 179 (17.05%) for spices, and 50 (4.76%) for horticulture. In the present context, 34,824 ha of land is identified under the selected clusters.
20. Mission for Integrated Development of Horticulture (MIDH): The MIDH is a centrally sponsored scheme for the holistic growth of the horticulture sector covering fruits, vegetables, root and tuber

crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew, cocoa, and bamboo. Under MIDH, the Government of India (GOI) contributes 60% of the total outlay for developmental programs in all the states except states in North East and Himalayas, 40% share is contributed by the state governments. In the case of North Eastern and Himalayan states, GOI contributes 90%. The schemes are described below.

- National Horticulture Mission (NHM) is one of the sub-schemes of MIDH which is being implemented by the State Horticulture Missions (SHM) in selected districts of 18 states and 6 union territories.
 - Horticulture Mission for North East & Himalayan States (HMNEH) is one of the sub-schemes of MIDH which is being implemented by State Horticulture Missions (SHM) in the North Eastern and Himalayan states.
 - National Horticulture Board (NHB) is implementing various schemes under MIDH in all states and UTs.
21. Uttarakhand State Plan 2021-22 as Outcome / Performance Budget: The outcome performance budget have provisions for financing various horticulture related schemes and specialized bodies like the National Horticulture Board/APEDA, and to mobilize support from NABARD support on horticulture, Chief Minister Integrated Horticulture Development Scheme, Central Government Schemes - National Horticulture Mission, PM Agriculture Irrigation Scheme – Per Drop Crop Component, and Micro Food Processing Enterprises Scheme (PM FME Scheme). Externally Funded Projects are also anticipated in the budget. The support for District Sector Project, Uttarakhand Tea Development Board, and financial provisions for horticulture sub-sectors like Herbal Sector Support under State Plan, MAP (Bhesaj Development) Plans through Cooperative Sector, District Sector Support for MAPs (Bhesaj Federations) Sericulture Development were made.
22. Budget for Horticulture Sector: Uttarakhand being a special category state, its budget is assisted by the central government. According to the budget at a glance for 2020-2021: 56.4% of the total is derived from the grants from the central government for various sectors. In the case of the budget allocated for horticulture development, 98.7% accounts for grants from the central government. Annual budget and expenditure of UKDHFP is released to the District Magistrate (DM) by the state government and its expenditure and progress of the activities undertaken with this budget will be monitored by the DM of each district.
23. Economic Performance of the Horticulture Sector: As per the economic survey of Uttarakhand 2020-21, 0.181 million ha land was utilized for the cultivation of fruit produce of 0.677 million MT in 2019-20. A total of 0.296 million-hectare area is under horticulture, producing around 1.79 million MT of horticulture produces. Around 0.450 million farmers are associated with horticulture. Out of the total farmers, 88% are small and marginal farmers. In the state, the annual business of horticulture is of the extent of INR 32,500 million and of the total local produce of the agriculture sector, horticulture's share is 30% (including food processing).
24. Horticulture Sector and COVID-19: The Government of Uttarakhand is taking several steps to retain migrants who returned to the state after a nationwide lockdown was imposed to curb the spread of COVID-19. Also, literature review was attempted to capture the implication of the COVID-19 on horticulture sector. The problems in vegetable, fruits, and flowers value chains were identified and solutions were suggested through a study of Indian Agricultural Research Institute (ICAR).
25. Irrigation: The Irrigation Department of Uttarakhand is headed by the Secretary Irrigation and consists of engineers, such as Engineer in Chief, Chief Engineer (CE), Superintending Engineer (SE), Executive Engineer (XEN), Assistant Engineer (AE), and Junior Engineer. Main activities of the Irrigation Department are: investigation, planning, and design of water resources and hydropower development projects, hydraulic modelling, geotechnical investigations, material testing, fabrication of hydromechanical equipment, and imparting training to engineers. The Minor Irrigation Department of Uttarakhand is also operated, which is headed by the Minor Irrigation Minister and consists of engineers similar to the Irrigation Department.

26. **Agriculture Produce:** Under the agro-ecological situation in Uttarakhand as above mentioned, Uttarakhand has shown its presence in specific agricultural produces in India. The agricultural produces of Uttarakhand which are positioning at higher ranks in India are mainly fruits. The major tree fruits grown include apple, pear, peach, plum, apricot, walnut, lemon, citrus variety, mango, litchi, aonla and guava. It suggests that Uttarakhand has opportunity and possibility to enhance agriculture and marketing of these crops in the supply chain. The total area under fruit cultivation in the year 2019-20 has been 181,485.55 ha and the total production of all the fruits combined together is 677,369.75 MT. The climatic conditions of the region are suitable for plantations like apple, walnut, apricot, and litchi. The fruit plantations can serve dual purpose of maintaining forest cover and at the same time provide employment and economic benefits to farmers. Uttarakhand has about 13% of its geographic area under cultivation out of which about 80% of the land does not have assured irrigation facilities thus making agricultural crops, especially vegetables, totally dependent on vagaries of nature. Regarding spices, the average increase rate is calculated to identify the production status in each district by comparison between data of 2019-20 and 2012-13. In case of flowers, data availability was poor to fully capture the current condition and assess the potential.
27. **Supply Chain of Vegetables and Fruits:** The supply chain of agricultural produce in India is characterized by a segmented structure. The supply chain involves various kinds and a lot of intermediaries in its multi-layered structure. It is reported that, on the average, vegetables and fruits must pass five to six different distribution channels from the farm gates to the consumers. Rural markets are the most popular marketing place of horticultural produce for farmers in the four UKIHDP target districts. In rural areas in India, traditional/voluntary markets are held weekly, every two weeks or every so often depending on the local circumstances in certain open spaces in rural hub villages/towns. They are usually managed by a community council, a cooperative or trusted individual entrepreneurs, where an administrative facilitation is provided in some cases. All horticultural produces are dynamically traded in both the inflow and the outflow across state borders. Even though there is a surplus produce, such as apple, which is the most famous fruit produce in Uttarakhand, only a small percentage of the locally produced horticultural crops are marketed in the four UKIHDP target districts.
28. **APMC Market Model:** The stated APMC Acts have aimed at regulating, controlling, and monopolizing the agricultural market, while the contents differ slightly from state to state. There are 23 principal markets, 30 submarkets and 27 weekly markets for marketing of agricultural produce in Uttarakhand. Several APMCs in the state are managing additional market facilities namely, collection centers and Apna Bazaars. Most of the principal markets have a relatively large site space and with water and electricity supply. However, very few of them have basic facilities necessary for daily market transactions. As for cold storage facilities, these have been installed in APMC principal markets and are served for the users to store perishable produce with a storage fee.
29. **APMC Mandi:** APMCs have a registration system of intermediaries doing business in their market facilities. Most of the registered market intermediaries are categorized into the “wholesaler-cum-commission agent (CA)” who sometimes play a role of CA as well as wholesaler in transactions in APMC mandis. According to the collected information, most wholesaler-cum-CAs place much importance on the role of wholesaler rather than the role of CA in Uttarakhand. They procure horticultural produce directly from local farmers, via village aggregators sometimes, or from other APMC mandis located in and outside Uttarakhand. The wholesaler-cum-CAs marketing vegetables tend to procure the produce often from local farmers while the wholesaler-cum-CAs marketing fruits tend to procure the produce often from other APMC mandis. The following frustration against the management of APMC mandis was becoming to emerge among farmers, as well as the market intermediaries: Fewer and fragmented APMC mandis, inadequate or poor condition of the infrastructures, high and vague market fee or charges and intermediation costs, imposed restriction in licensing, asymmetrical market information.
30. **Market Price of Vegetables and Fruits in APMC Mandi:** Vegetable crops have several patterns of the correlation probably influenced by their different supply chain status. Fruits crops have a

remarkably short arrival season to mandis except for several small exemption cases, probably due to their short harvesting season and perishability (and/or undeveloped cold chain technology). The price gap is higher than vegetable crops because of high price of off-season arrival (inflow from other states or imported). Apple is an exemption fruit crop as it has a relative long-term arrival season and a smaller price fluctuation compared with other fruits crops. In addition, market price changes in APMC mandis in Uttarakhand and in APMC mandis in NCT Delhi are compared for selected horticultural produce to find relationships among them. As limitation of data availability in Agmaknet, only nine produce, namely, cabbage, cauliflower, onion, peas, potato, tomato, ginger, apple and mango are chosen for the comparison. In general, the APMC *mandis* in both areas are bound up to each other as almost all crops share a similar pattern of the price changes.

31. Demand forecast: The demand is forecasted by analyzing the correlation between the consumption and the gross domestic product (GDP), and a forecasted trend of the population and the GDP. Availability of reliable information about the consumption is always a bottleneck to estimate the demand, especially for a crop other than essential food of the people like ordinary vegetables and fruits, even in countries which have a sophisticated statistical information system. The following comprehensive future demand for vegetables and fruits in India is forecasted with the above analysis.
 - The total demand continuously increases mainly with the increase of the population (forecasted at 8.4% in 2021-31, Report of the Technical Group on Population Projections, Census of India), as income elasticity of vegetables and that of fruits have been static for several years and the per capita consumption level has become to a certain high level compared with neighbor countries;
 - The total demand of tomato and onion will be influenced much by the economic growth in the foreseeable future, probably in parallel with the increased demand for meat; and
 - The market demand gradually shifts to be diversified and quality-oriented.
32. Popular Horticulture Produce in Uttarakhand and Delhi: According to the market survey in Uttarakhand and Delhi, popular horticulture crops have been identified. In Uttarakhand, <Market intermediaries in APMC *Mandis*> Vegetables: beans, capsicum, peas, potato and tomato, Fruits: apple, banana, citrus, peach and mango, <Retailers and restaurants/hotels> Vegetables: Beans, capsicum, cauliflower, onion, peas and potato, Fruits: Apple, banana, citrus and mango. In Delhi, Vegetables and Spices: broccoli, capsicum, onion, potato, tomato and garlic, Fruits: apple, banana, citrus, kiwifruit, litchi and mango.
33. eNAM: eNAM is a platform for e-trading of agricultural produce aiming at networking APMC mandis in the whole country to develop a nationwide agricultural market. According to the information from UKAPMB, there are several difficulties in operating the eNAM system at present, such as that i) A lot size is too small to sell on eNAM, ii) too small value of the produce to take it to a bank account, iii) farmers' preference of cash payment, iv) lack of manpower for operation and maintenance. Consequently, farmers and traders continue to have a limited awareness about eNAM trading, and they are stuck in the accustomed trade practices.
34. Value Change of Vegetables and Fruits: At the growers' level, many vegetables recorded the highest losses at the harvesting stage, while cauliflower and eggplant recorded losses in grading and packing stage, and chili and French beans recorded the losses in handling and transportation stage. The most effective countermeasure to overcome the issue of postharvest losses should be capacity-building of growers through training on appropriate harvesting time and proper management practice in handling, grading, packing, and storing.
35. GOI's Agricultural Market Reform Policies: Currently, GOI's reform policies aiming at promoting a competitive business environment in agricultural marketing could establish a foothold in streamlining the local supply chain. Empowerment of producers is an indispensable option to allow them enjoying a fair share of the benefits generated by the supply chain reforms. Producers should be motivated and trained so that they will be well united in overcoming difficulties in their

- marketing. The State Horticulture Mission of UKDHFP is a coordination body to facilitate the supply chain development in Uttarakhand.
36. **Agribusiness Industries:** The Directorate of Industries (DI) of Uttarakhand has a registration system of industries newly invested in the state. According to the record of DI, there are 48 large-scale industries and 1,511 medium-, small- & micro-scale industries registered in the last five years (2016-21) in the agriculture sector including food processing industries, as of September 2021. These food processing industries are located mainly in the four districts of Dehradun, Haridwar, Nainital, and Udham Singh Nagar which are in the plain regions in Uttarakhand. Food parks in Uttarakhand are founded in Haridwar and Udham Singh Nagar, respectively.
 37. **Cold Storage Facilities:** Every food business operator including food storage facilities in India is required to be licensed under the Food Security and Standards Authority of India (FSSAI). According to UKDHFP, there are 55 cold storage facilities with capacity of 191,314 ton in Uttarakhand. A comprehensive information covering the 55 cold storage facilities is, however, not available in UKDHFP, as the facilities were constructed at the initiative of various GOI schemes, as well as through investments from the private sector.
 38. **Irrigation:** There are 1,548,985 ha of arable land in Uttarakhand State. Among the arable land, net sown area and net irrigated area are 698,359 ha and 329,837 ha, respectively. There are chiefly three types of irrigation scheme in India, namely major irrigation, medium irrigation, and minor irrigation system, and there are three major types of minor irrigation system, i.e., flow irrigation, lift irrigation, and tube well irrigation systems. Under the scheme, micro irrigation has been introduced to Uttarakhand and 5,681 ha are covered until 2016-17. The most major irrigation methods are drip irrigation and sprinkler irrigation. The Minor Irrigation Department is headed by a Chief Engineer. For creation of a minor irrigation scheme, farmers of a village or a cluster of villages submit a resolution with proposal of development of the scheme to Gram Sabha attended by representatives from all village(s) concerned. Although the constructed facilities are owned by the government, the responsibility for O&M is transferred to the concerned Water Users' Association (WUA). While the major works on irrigation schemes such as construction and major repair of structures are implemented by the department, minor repair and usual maintenance such as dry-stone masonry and cleaning of gullies are carried out by the WUA.
 39. **Impact of Climate Change to Horticulture:** Climate change impacts to horticulture have been reported by several articles. Frequently occurring damages on the growth or production included heat, wind, rainfall, pests/diseases, etc. However, the data regarding impact of climate change to fruit crops are not yet enough in Uttarakhand. The related policy and action plans on climate change have been considered by the state of Uttarakhand in past ten years. Especially in Agenda for Climate Action, 2016, some actions are suggested as action to be taken for adapting to climate change in horticulture sector. Current practices as adaptation measure for climate change in horticulture are quite basic such as using hail-net or plastic tunnel mainly. Further, measures including 1) application of effective techniques for crop cultivation, 2) introduction of quality planting materials which are tolerant of climate change, 3) changing new variety crops or shifting land especially for fruits cultivation can also be applied for climate change. Effective climate change adaptation measures specifically for horticulture in Uttarakhand needs continuous research and verification.
 40. **Other Rural Infrastructure:** Uttarakhand Public Works Department (UK PWD) is engaged in the planning, construction, and maintenance of roads in the state. According to the national norms (Indian Roads Congress recommendations), the roads are classified into five types: national highways (NH), state highways (SH), major district roads, other district roads, and village roads. The Uttarakhand Jal Sansthan is the responsible organization for the provision, operation, and maintenance of drinking water.
 41. **Supporting System for Farmers:** Extension services for horticulture development are provided mainly by KVK and by the horticulture mobile teams of UKDHFP, among others.
 - KVK is an institution that provides agriculture extension services across the state, and 13 KVKs are existing in Uttarakhand. Most of the KVKs are associated either with Govind Ballabh Pant University of Agriculture & Technology (GBPUAT) in Pantnagar or VCSG

- Uttarakhand University of Horticulture & Forestry in Bharsar, Pauri Garhwal District. They conduct technical extension training mainly on horticulture and livestock.
- UKDHFP has its own extension services focusing on horticulture crops, which is the Horticulture Mobile Team (HMT, 319 teams in Uttarakhand). Their main role is to distribute the farm inputs and to disseminate technical information to the horticulture farmers.
 - Other institutes for capacity development are the State Agricultural Management and Extension Training Institute (SAMETI), Agricultural Technology Management Agency (ATMA), and Agriculture Technology Information Centre (ATIC) in Uttarakhand.
42. **Market Information:** For the horticulture sector in Uttarakhand, market information is an important part of the business for the farmers. There have been several efforts from the central government for the farmers to facilitate the process of marketing by providing various platforms. These platforms are created under the Ministry of Agriculture and Farmers Welfare. Horticulture is also being dealt by the same ministry.
43. **Agriculture Credit:** Government and NABARD provide various agriculture credit scheme for farmers. As per the NABARD Focus Paper 2021-22, total farm credit in 2020-21 was INR 118,019.60 million. In 2021-22, INR 126,485.0 million is proposed for farm credit. The Government of Uttarakhand has introduced a farm loan scheme called Deendayal Upadhyay Sahkarita Kisan Kalyan Yojana and Kisan credit card scheme to farmers.

Chapter 4: Review of Preliminary Project Report (PPR)

44. Uttarakhand is blessed with its natural conditions and proximity to the major market of Delhi has provided uncultivated potentials for horticulture development. Some of the issues to be addressed for further development of the sector in Uttarakhand included the small and marginal landholdings which accounts for the 65.53% of the total agriculture landholdings. The hilly regions of the state are severely constrained by this factor. Furthermore, a range of technical issues need to be resolved to integrate horticulture development in the state. Main issues that require immediate intervention include: 1) insufficient production capacity of the farmers; 2) inadequate supporting system for production and marketing for the farmers; 3) absence of appropriate institutions for the small/marginal farmers to access market; and 4) appropriate marketing strategy to promote Uttarakhand brand. To address these issues, project components have been proposed in the PPR, which are reviewed and discussed below.
45. In the PPR, four components were proposed 1) enhancement of production support, 2) area expansion, 3) supply chain development including integrated postharvest management, and 4) institutional development. An overview of the project components in the PPR is given in the table below.

Project Outlines as Proposed in the PPR

Item	Description
Project Name	Uttarakhand Integrated Horticulture Development Project (UKIHDP)
Project Area	Four districts (Nainital, Pithoragarh, Uttarkashi, Tehri Garhwal) of Uttarakhand State
Project Goals and Objective	Goal: To holistically enhance production, productivity, quality of produce, processing, and market linkages for the selected horticulture commodities. Objectives: There are 12 specific objectives listed in the PPR. 1. To provide holistic farming salutation through value chain enhancement 2. Empowerment of farmers through FPOs/ FIGs and strengthening their capacities 3. Further advancement of horticulture development in the state through convergence 4. Promoting ancillary subjects including medicinal & aromatic plants and mushrooms 5. Creation of sustainable irrigation facilities 6. Introduction of good global agriculture practices 7. To generate sustainable livelihood opportunities for the youth 8. Human resource enrichment 9. Introducing horticulture as a subject in schools up to secondary levels 10. Reduction of human-animal conflict 11. Promotion of gender inclusive and climate adaptation activities 12. To uplift the social-economic status of farming community

Item	Description
Target Population	Small and marginal farmers in Nainital, Tehri Garhwal, Uttarkashi and Pithoragarh districts
Project Component	- Enhancement of production support - Establishment of advanced nursery, tissue culture units, aeroponics unit, mother plant garden free from virus, and the center of excellence - Import of planting materials - Area expansion - Establishment of new gardens under cost intensive crop, high/ultra-high/normal density planting, mushroom cultivation hut, greenhouse/shade net house for protected cultivation, and custom hiring units (CHU) for farm mechanization - Rejuvenation/Replacement of senile plantation - Promotion of integrated nutrition management (INM) and integrated pest management (IPM) - Water resource development and introduction of micro irrigation - Supply chain development including integrated postharvest management - Establishment of pack house, controlled atmospheric storage (CA storage), and retail outlets for horticulture - Development of cold chain including cold storage and refrigerated transport vehicle (RTV) - Improvement of market infrastructure - Development of infrastructures for collection, sorting, grading, packing, etc. - Institutional development - Brand development and promotion - Standardization of parameters of and testing procedure for quality of horticulture produces - Establishment processing unit - Training for Entrepreneurship development and postharvest management - Extension and demonstration for technology dissemination
Target Indicator	- Center of excellence established: 3 nos. - Farm developed - fruit:2,800 ha, vegetables*: 6,500 ha, spices: 5,000 ha, flowers: 400 ha - Farmers group joined: 8 nos. - Storage established: 18 nos. - Processing facility established: 34 nos. - Market facility developed: 16 nos.
Implementation Agency	Department of Horticulture and Food Processing of Uttarakhand (UKDHFP)
Institutional Arrangement	PMU to be headed by Project Director and Deputy Project Director (on deputation from UKDHFP) Seven expert positions and administrative staff are proposed to operationalize PMU Under the PMU, District Coordination Committee and District Implementation Units will be established at each District headed by Chief Horticulture Officer. Horticulture Mobile Team (HMT) headed by the Assistant District Officer of Horticulture will spearhead the implementation of the field level operation.
Supporting Agency	Uttarakhand Agriculture Produce Marketing Board, Uttarakhand Horticultural Marketing, Center for Aromatic Plants, Institute for Medicinal Plants Research, GP Pant University of Agriculture & Technology, Pantnagar & Uttarakhand University of Horticulture & Forestry at Bharsar, VPKAS (Almora), CITH (Mukteshwar)
Project Period	From 2019 to 2024 (5 years)

*: "vegetables" including potato: 1,500 ha
Source: JICA Survey Team

46. The survey team reviewed the PPR and further scrutinized with emphasis from the following perspectives: 1) relevance to the project objectives; 2) justification/ need for proposed quantity and work volume; 3) modus operandi; 4) institutional arrangement; 5) overlapping with other programs/ schemes; 6) sustainability including O&M arrangements for the proposed assets created under the project, and 7) farmers' and FPO's requirements for assistance. According to the review, various points were discussed for clarity. Taking into account all the points scrutinized during the survey, UKDHFP and the survey team arrived at the project scope as proposed in Chapter 6.

Chapter 5: Situational Analysis of the Proposed Project Area based on the Preliminary Findings from the Supply Chain Survey

47. A supply chain survey was conducted in the survey to collect current situation on supply chain in the project target area. Survey data was collected to assess the following areas: 1) actors on the supply chain; 2) issues concerning value addition and its enhancement in each stage of the supply chain; 3) benefit-sharing mechanism between actors on the supply chain; and 4) high-end market needs/requirement. The results of the analysis are provided in Attachment 5.1.3.
48. Prior to the survey, the JICA Survey Team conducted preliminary screening on major agricultural produce in Uttarakhand using the data of district-wise yearly production status (production, cultivated area and production trend), transaction volume in wholesale markets, and status of cluster presence. The survey team discussed closely with UKDHFP for final selection of the crop clusters to be surveyed. Considering UKDHFP's request, the target crops for the survey were finalized, as shown in the following table.

Target Crops for Supply Chain Survey

Crop Group	Nainital	Pithoragarh	Tehri	Uttarkashi
Fruit	Peach (ODOP) Litchi	Apple Citrus (Sweet Orange)	Plum	Apple (ODOP) Kiwi Walnut
Vegetable	Tomato	-	Potato, Pea	Potato
Spice	Garlic	Turmeric, Garlic	Ginger	-
No. of Crops	4	4	4	4

Source: JICA Survey Team

Note: ODOP means One District One Product program promoted by the Ministry of Food Processing Industries.

49. The result of analysis is given in Attachment 5.1.1. Once the focal crops were selected, the target clusters to be surveyed were listed by UKDHFP, based on the decided target crops. Details of each cluster such as location and existing FPOs and other cooperatives/federations are shown in Attachment 5.1.2.

Target Clusters for Supply Chain Survey

No.	District	Crop Name	Cluster Name
1	Nainital	Peach	Ramgarh
2		Litchi	Ramnagar
3		Tomato	Alchouna
4		Garlic	Kuwarpur
1	Pithoragarh	Citrus Sweet Orange	Udhyari
2		Apple	Bhilot to Baman
3		Turmeric	Koteshwer
4		Garlic	Kuntola
1	Uttarkashi	Potato	Gorsali
2		Apple	Aarakot
3		Walnut	Gangtadi
4		Kiwi	Dunda
1	Tehri Garhwal	Plum	Chopriar Gaon
2		Potato/Pea	Batwaldhar
3		Pea/ Potato	Jwarana
4		Ginger	Khadi

Source: UKDHFP

50. Semi-structured interviews with individual farm households and key informant interviews with farmers' organizations have been carried out using the questionnaires and checklists prepared by the JICA Survey Team. Questionnaires are given in Attachment 5.1.3.
- (1) Interview with supply chain stakeholders in four districts in Uttarakhand: Interviews with the identified stakeholders engaged in transportation, trading, wholesale, storage and processing have been carried out in four districts of the project target area. Questionnaire for the interviews were prepared by the JICA Survey Team, given in Attachment 5.1.3.
 - (2) Interview with the stakeholders in the high-end market: Major retailers, hotels, restaurants, food manufacturers, major retailers (i.e., Big Bazaar, Reliance Fresh) and other stakeholders engaged in interstate marketing in Uttarakhand have been interviewed using the questionnaire prepared by the JICA Survey Team (Attachment 5.1.3). The potential informants were listed and have been interviewed by the JICA Survey Team. Under curfew and lockdown in Uttarakhand and other states, interviews have been carried out with phone and online tools.

- (3) Interviews with the Supporting Actors: Interviews with the financial institutions, farm inputs suppliers, agri tech working with the horticulture farmers in Uttarakhand have been carried out by the JICA Survey Team with the preliminary list of informants and questionnaire as in Attachment 5.1.3.

Chapter 6: Outline of the Proposed Project Scope

51. Outline of the Proposed Project:

- (1) Executing Agency: Department of Horticulture and Food Processing in the state of Uttarakhand (hereinafter referred to as “UKDHFP”).
- (2) Location of the Project: The target area of the Project is the four districts in the state of Uttarakhand, namely Uttarkashi, Tehri Garhwal, Pithoragarh, and Nainital.
- (3) Impact and outcomes expected at project completion: The Project will contribute to economic and social development in the state of Uttarakhand by enhancing the market competitiveness of its horticulture crops and increasing the farmers’ incomes through the horticulture crop supply chain development.
- (4) Scope of Works: The project components are broadly divided into i) area expansion and production enhancement, ii) supply chain development, and iii) institutional development for project management. Under the project components, the scope of works is arranged as shown below.

Scope of Works

Component	Scope of Works
1. Area Expansion and Production Enhancement	1.1 Climate change adaptation 1.2 Infrastructure development 1.3 R&D support (pre-harvest) 1.4 Provision of farm equipment and materials 1.5 Capacity development for farmers
2. Supply Chain Development	2.1 Infrastructure development 2.2 FPO development 2.3 R&D support (postharvest) 2.4 Promotion of private sector collaboration
3. Institutional Development for Project Management	3.1 Procurement of equipment and materials 3.2 Strengthening of PMU/DIU and HMT 3.3 Capacity development for R&D 3.4 Branding and marketing development 3.5 Exposure visits 3.6 Baseline survey and mid-& end-line surveys

Source: JICA Survey Team

52. Framework of the Project: To share the awareness of the Project, a draft Project Design Matrix (PDM) has been created by the JICA Survey Team making minor modification to the Preliminary Project Report (PPR) as follows:

Draft Project Design Matrix (PDM)

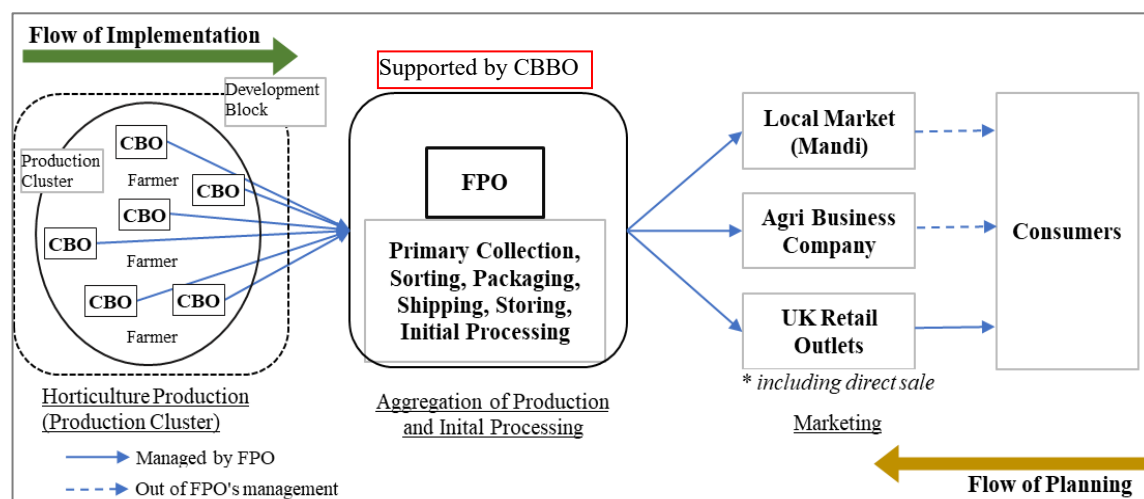
Project Outline (Narrative Summary)		Important Assumption
Overall Goal (Project Impact)		
	Economic and social development in Uttarakhand State.	•No decline in demand for horticultural crops
Project Purpose (Outcomes)		
	- Market competitiveness of Uttarakhand horticulture crops is enhanced. - Farmer’s income is increased.	•Uttarakhand State government's horticulture and agriculture clustering strategy continues.
Outputs		
1	Horticulture crop production is increased.	•Infrastructure for training/research, irrigation, production to postharvest and markets will be used effectively and continuously. •A system to provide continuous support for strengthening FPOs and their marketing will be established and enhanced. •Horticultural technology and knowledge will be continuously provided to farmers. •Liberalization of horticultural crop distribution will be promoted and private
2	Supply chain system of horticulture crops is strengthened.	
3	Project management system is strengthened to establish the models of horticulture crop supply chain development in Uttarakhand.	

Project Outline (Narrative Summary)		Important Assumption
		investment will increase. ▪Market information networks will be strengthened and made more accessible.
Activities		
1	Area Expansion and Production Enhancement	
1.1	Climate change adaptation	▪Proper maintenance (manpower & budget) of the established facilities ▪Trained FPOs to continue their own operation for marketing and business activities ▪Trained officials continue their work
1.2	Infrastructure development for irrigation and production facilities	
1.3	R&D support (pre-harvest)	
1.4	Provision of farm equipment and materials	
1.5	Capacity development for farmers	
2	Supply Chain Development	
2.1	Infrastructure development	Pre-condition ▪Farmers in the target cluster area agree to promote horticultural crops.
2.2	FPO development	
2.3	R&D support (postharvest)	
2.4	Promotion of private sector collaboration	
3	Institutional Development for Project Management	
3.1	Procurement of equipment and materials	
3.2	Strengthening of PMU/DIU and HMT	
3.3	Capacity development for R&D	
3.4	Branding and marketing development	
3.5	Exposure visits	
3.6	Baseline survey and mid-& end-line surveys	

Source: JICA Survey Team

53. General Approach to the Project

- Typical supply chain proposed under the cluster approach is depicted in the following figure.



Source: JICA Survey Team

Typical Supply Chain under Cluster Approach

- FPOs will play an important role: backward linkage with community-based organizations (CBOs) and farmers in the production cluster area for joint activities in purchasing of farm inputs and sales of farm outputs, forward linkage with players for processing and marketing of horticulture produce.
- FPOs will prepare an annual production plan in consideration of production capacity of the member-farmers and support them in horticulture production including purchasing farm inputs and selling farm outputs in order to maintain the quality and quantity of produce at the production stage.
- FPOs will also support in primary processing such as sorting, grading, packaging, shipping and/or storing at the marketing stage.

54. Target District for the Project

Based on the general situation of each district, the current horticulture situation, and the reasons for the recommendation by UKDHFP, the four districts (Uttarkashi, Tehri Garhwal, Pithoragarh and

Nainital) are confirmed to have a reasonable conditions for improving horticulture supply chain in UK state as a pilot.

- Overall Marketing Strategy: Direction of the overall marketing strategy has been analyzed by SWOT using the interview data and information obtained at APMC (Azadpur) in Delhi as shown below.

Strategic Direction of the Supply Chain Development for Uttarakhand Horticulture Produces based on the Market Survey at APMC (Azadpur)

		External Environment Analysis	
		Opportunity	Threat
		- Demand of temperate fruits and vegetables is increasing due to change of people's diet. - Uttarakhand government puts higher priority on horticulture development.	Jammu and Kashmir (J&K) and Himachal Pradesh (HP) are competitors of Uttarakhand (UK), being ahead of Uttarakhand in horticulture development.
Internal Environment Analysis	Strength	1. Aggressive Offensive	3. Differentiation Strategy
	- Uttarakhand has comparative advantage for growing temperate crops by making good use of hilly topography and climate. - Uttarakhand is ranked as Indian No.1 in production of peach, plum, apricot, and pear. - Uttarakhand is located closer to the capital Delhi than Himachal Pradesh and J&K.	(1) Acceleration of a supply chain development for Uttarakhand selected crops targeting Delhi market.	(1) Promotion of a prompt cultivation of selected Uttarakhand crops for early shipment. (2) Promotion of game changing crops such as kiwi (to start with R&D)
	Weakness	2. Step-by-Step Measures	4. Self-defense or Withdrawal
	- Uttarakhand has poor basic infrastructure (roads, irrigation, water, power supply) due to hilly topography. - Only a few Uttarakhand crops are famous such as litchi from Ramnagar and mango from Dehradun. - Uttarakhand crops are limited in supply in quantity and period. - Uttarakhand crops are second choice in quality after J&K and Himachal Pradesh produce.	Raising of presence/ reputation of selected Uttarakhand crops in the market through: (1) Increase in production of selected crops (new variety seeds, cultivation technology, irrigation). (2) Improvement in quality of selected crops (freshness, color, size, and taste). (3) Improvement in aggregation and distribution of selected crops (road improvement, system for aggregation and distribution). (4) Creation and propagation of brand strategy for selected Uttarakhand crops.	(4) Rejuvenation/replacement of senile plantations with recommended crops when the time comes.

Source: JICA Survey Team

55. Area Expansion and Production Enhancement

(1) Climate Change Adaptations

Item	Description
Survey on Climate Impact/Climate Adaptation Measures	Recently, climate change has become a serious factor to impact agricultural production all over the world. The impact is varied such as increase of temperature, change of water resources, increase or decrease of rainfall depending on agro-climatic and geological area. Especially for fruits, once a fruit tree is transplanted on the ground, tree replacement has to be done every 20 to 40 years. Otherwise, the tree plant would get negative effects gradually in a long term compared to vegetables and cereal crops that are replaced every year. From this point of view, the impact assessment of climate change to fruits is quite important for sustainable agriculture. In the Project, the survey on current situation will be conducted for assessment of climate impact on fruits production in the target area, and the necessary climate

	change adaptation measure will be proposed by PMU/DIU supported by PMC in collaboration with research institutions such as a university in Uttarakhand (GB Pant University).
Development and Dissemination of Proper Farming Techniques	The adaptation measures proposed based on the survey results are categorized into; i) improvement of cultivation techniques, ii) development of tolerant varieties, and iii) conversion of crops (such as apple to orange). Although the measure i) is the easiest for farmers and PMU/DIU to undertake out of the three, it is required to identify the specific techniques to be applied for adaptation to climate change. The PMU/DIU and PMC will conduct analysis carefully with advice of the relevant institutes, and disseminate the appropriate techniques to farmers.
Development of Varieties	The adaptation measure ii) development of tolerant varieties is necessary to research and conduct trial for the long term. Generally, it takes more than ten years to develop and register new crop varieties. The project duration is eight years which is too short to complete and to develop new varieties. Therefore, the Project could target to establish and manage the research system through this activity, and expect to conduct the research and monitoring for identification of adaptation measures continuously in Uttarakhand.

Source: JICA Survey Team

(2) Infrastructure Development

Indicative Quantity of Infrastructure to be Developed under the Project

Infrastructure	Quantity	Description
Water Source Facility	1, 886 nos.	Condition - 1 no./HH - If the farmer is eligible to receive irrigation facility, he/she will be also eligible to receive water source facility. Assumption - No. of households in one FPO: 200 HH/FPO - Farm size of one household: 1.0 ha/HH - If a farmer does not have irrigation access, he/she will not have access to irrigation water source.
Micro Irrigation	2,090 ha (Drip: 1,545 ha, Micro Sprinkler: 545 ha)	Condition - Ratio of farmers with access to irrigation system coincide with HH survey conducted by the JICA Survey Team. Assumption - No. of households in one FPO: 200 HH/FPO - Farm size of one household: 1.0 ha/HH - 100% of farmers can irrigate after development.
Farm Machinery Bank	16 nos.	Assumption - 1 no./FPO, 16 nos. for 16 FPOs - Procurement of farm machinery shall be included into this infrastructure development.

Source: JICA Survey Team

(3) R&D Support (Pre-harvest)

Outline of R&D Support for Pre-harvest

Items	Qty. of PPR	Qty. of proposed project scope	O&M Organization	Remarks
(1) Hi-tech Nursery				
Hi-tech Nursery (4 ha), Public Sector	2 nos.	2 nos.	UKDHFP / Private sector (PPP mode)	Govt Garden-Ramgarh, Nainital, and Govt Garden Dwari, Uttarkashi
(2) Planting materials (nursery)				
Import of planting materials (fruits)	5,000 nos.	40,000 nos.	UKDHFP	To be conducted at Government Gardens/
Establishment of virus free mother block for fruits	2 no.	1 no.	UKDHFP	To be conducted at Government Garden Chaubatia, Almora/
Rejuvenation and replacement of senile orchards	500 ha	500 ha	UKDHFP	In all project districts
(3) Integrated Center of Excellence (CoE)				
Integrated COE for Kiwi	1 unit	1 unit	UKDHFP/Private sector (PPP mode)	Narendranagar Tehri,

Items	Qty. of PPR	Qty. of proposed project scope	O&M Organization	Remarks
Integrated COE for off-season/ exotic vegetables	1 unit	1 unit	UKDHFP/Private sector (PPP mode)	Govt Garden- Dhanaulti
Area Expansion for Ultra High Density-Apple	400 ha	120 ha	UKDHFP/Farmers	Integrated package with drip and trellis
New Area expansion for KIWI-Integrated package with drip and trellis	400 ha	300 ha	UKDHFP/Farmers	Integrated package with drip and trellis
Area Expansion for Other Plantation fruit crops (Litchi and Citrus)	2000 ha	100 ha	UKDHFP/Farmers	Integrated package with drip and trellis
(4) Upgrading of food science training center	1 unit	1 unit	UKDHFP	To be established at Ramnagar Nainital
(5) Leaf/ Tissue analysis lab for IPM	2 units	1 unit	GBPUAT, Pantnagar	Chaubatia

Source: JICA Survey Team

(4) Provision of Farm Equipment and Materials

Indicative Quantity for Farm Equipment and Materials

Items	Qty. of PPR	Qty. of proposed project scope	Objectives	Remarks
(1) Equipment and materials for protected cultivation	Poly house	140,000 m ²	90,000 m ²	To apply vegetables such as tomato, pea, etc for control growth and harvest.
	Plastic mulching (fruits and vegetable crops)	2,000 ha	2,000 ha	To apply plastic mulching for apple, sweet orange, tomato and pea.
	Anti hail net	4,200,000 m ²	1,500,000 m ²	To apply hail net for apple, peach and Plum.
(2) Planting materials (farmers)	Planting material and cultivation of flowers under poly house	50,000 m ²	32,000 m ²	To promote the improved quality of flowers cultivation
	Planting material and cultivation of vegetable under poly house	90,000 m ²	58,000 m ²	Tomato grafted seedling will be started production in the Hi-tech nursery or CoEs
	Open Pollinated Vegetable Seeds (Peas, etc.)	1,500 ha	1,540 ha	Pure and vigorous peas seed will be applied for pea production
	Potato Seed	1,500 ha	1,000 ha	Virus free potato seed would be prepared by the project in the concept of seed village as well
	Hybrid Vegetable Seeds (Tomato, etc)	2,000 ha	2,000 ha	Hybrid F1 tomato seed would be applied for the production under the project
	Rhizomatic Spice Seeds (Ginger, Garlic, Turmeric)	2,500 ha	2,500 ha	The project estimated the area for Garlic: 173 ha

Items		Qty. of PPR	Qty. of proposed project scope	Objectives	Remarks
				Turmeric: 133 ha Ginger: 155ha in the concept of seed village as well	and Ginger 0.3 x 1.2, 40g/piece
	Bulbous Flower Seeds (Lilium, Tulip, Carnation, Gerbera)	100 ha	100 ha	To promote flower production meeting market needs	- All project districts
	Aromatic Plant (Damask rose)	-	100 ha		-
(3) Promotion of INM and IPM	-	14,700 ha	7,775 ha	To promote integrated pest management and nutrient management.	- As per area expansion of fruits, vegetable, potato, and spices
(4) Materials for livelihood improvement and nutrition improvement	Mushroom: Production unit under natural condition (Button, Shiitake and Oyster), Private	330 units	330 units	To promote mushroom and bee keeping supplementary livelihood	-
	Mushroom: Production of Ganoderma species, - Pilot basis (R&D), Private	55 units	55 units		-
	Bee Keeping: Production unit under natural condition	-	330 units		-

Source: JICA Survey Team

(5) Capacity Development for Farmers

Item	Description
Training on Farm Planning and Management	The farmers are engaged in conventional horticulture based on their own historical experience succeeded by cascade of generations so far. The Project aims at deploying improved horticulture equipment and materials, which will be effectively utilized based on proper farm management. In the Project, farm management for beneficiary farmers shall be integrated by; a) creation of awareness of market demand by access to market information and competitors, b) identification production techniques and crops to be applied, and c) continuous updating of farm management and techniques to meet market demands. This flow of farm management can be called the Smallholder Horticulture Empowerment & Promotion (SHEP) approach promoted by JICA ODA scheme. Training contents could be set up based on SHEP approach in the Project.
Technical Training on Cultivation and Postharvest Handling	Technical training on cultivation and post-harvest should cover the items of the table above. Details of the items should be refined based on the market demand and the selected crop/varieties.
Livelihood Improvement	Mushroom cultivation and beekeeping are two main activities proposed for the marginalized farmers in the project area.
Nutrition Improvement	Three types of activities are visualized under nutrient improvement: 1) school nutrition garden; 2) promotion of kitchen garden; and 3) awareness program for nutrition. The information dissemination materials used during the project will be prepared jointly by Cluster Based Business Organization (CBBO) and the project.

Source: JICA Survey Team

56. Supply Chain Development

(1) Infrastructure Development

Proposed Project Scope and Outline of Proposed Infrastructure

No	Proposed Project Scope Facility/Components and Number		Remarks	Operation & Management	Proposed Location
1	Pack House with Primary Processing Unit	16	• 1 pack house/target FPO • With equipment for cleaning, washing, grading, weighing etc.	FPO	04 in each district.
2	Cold Storage (30 MT) at field level	16	Incorporated into the Pack House	FPO	04 in each district.
3	Refrigerated Transport Vehicle	16	Incorporated into the Pack House	FPO	04 in each district.
4	Cold Storage (30 MT) at market level	4	1 storage/target District	Market intermediary (commission agent, wholesaler, etc.) closely working with target FPOs	01 in each district.
6	Rural Markets/ <i>Apni</i> Mandies (farmers' own market)/Direct Markets	8	• 1 market/target FPO • Improvement of the existing rural market facilities	Market committee (community council, cooperative or trusted individuals) managing the rural market being familiar with target FPO members	1. Pithoragarh 2. Jauljivi-Pithrogarh 3. Bhimtal (Nainital) 4. Okhalkanda(Nainital) 5. Chamba (Tehri) 6. Nainbagh (Tehri) 7. Purola(Uttarkashi) 8. Uttarkashi
7	Outlets of Horticulture Products	2	• 1 outlet/Division (selected FPOs)	FPO	1. Muni ki Reti-Tehri 2. Nainital
8	Basic Food Processing Equipment (furnished in the Pack house)	2	• Advanced FPOs (pilot trial) • Depending on FPO's business plan	FPO	-

Source: JICA Survey Team

(2) FPO Development

Selection Procedure of Project Target Area

Step	Item	Description
Step 1	Selection of Crops	- The final list of target crops will be determined based on the result of horticulture market research to be conducted during the initial stage of the Project.
Step 2	Updating the Production Clusters in 4 districts	- List of production cluster will be updated by PMU.
Step 3	Selection of Development Blocks	- PMU / PMC in consultation with Horticulture Offices in the target districts will select the development block to promote FPOs for supply chain development of horticulture crops.
Step 4	Selection of Development Clusters	- PMU in consultation with DIUs in the target districts will select the target development clusters.
Step 5	Selection of FPOs	- CBBO with assistance of PMU/PMC will select target FPOs in the selected blocks.

Source: JICA Survey Team

FPO Development Activities

Item	Description
Employment of CBBO for Promotion of FPOs	Before the commencement of the Project after L/A signing, UKDHFP shall start the procurement of CBBOs on basis of district level with accordance of the guideline of central scheme. CBBOs to be hired shall have an appropriate person with knowledge and experience to formulate and promote FPOs. One CBBO shall be allocated to support four FPOs for one district, so four CBBOs will be hired in the Project. Financial cost for employment of CBBOs can be referred to/from government scheme, and the cost included all of direct cost and remuneration for FPO development.
Baseline Survey by CBBO	After employment, CBBOs shall conduct baseline survey of the selected clusters by PMU/PMC and identify the gaps and issues to be resolved for the areas of production, infrastructure and technology, post-harvest management, marketing/ value chain and

Item	Description
	organizational management of FPO. These locations will be plotted on a map along with the road network and marketing facilities. In addition, current situation of management and operation of the FPOs and facilities will be assessed. The baseline survey will be completed within three months approximately.
Orientation for CBBO Engaged at DIU Level	Since the CBBOs engaged at the district level (DIU) will be required to execute the works to achieve the project objectives, the PMU/ PMC will provide orientation for them. This orientation will be given as soon as the CBBOs sign the contract with PMU.
Community Mobilization and Registration of FPOs	Mobilization of the farmers will be undertaken as soon as the target clusters and blocks are identified. At this stage, for the cluster where the FPO already exist, awareness sessions and consensus building towards their participation to the Project will be undertaken by CBBOs to the selective FPOs screened by selection criteria.
Organizational Capacity Building for FPOs	During the 1st year when the participating FPOs are selected, the training needs assessment shall be conducted by the CBBOs advised by subject matter specialist (SMS) at DIU to plan the training activities. Based on the training needs assessment, the CBBOs will prepare the Annual Training Schedule for the entire duration of the project. The necessary training material based on the learning needs identified through the training needs assessment will also be developed by the CBBOs with support of PMU and DIU jointly. The organizational capacity-building for FPOs will be done through lecture mode and on-the-job training (OJT) mode on a day-to-day basis which will be conducted by the CBBOs and the SMS engaged at DIU level.
Business Planning with Marketing Strategy	Preparation of a business plan from the viewpoint of market needs is required for sustainable development of FPOs. At the stage of business planning, FPOs shall conduct a marketing survey to identify market needs and search for market opportunity, which is one of the steps of the SHEP approach and market-oriented management will be shared with farmers in the training program for the component of area expansion and production. CBBOs shall facilitate and make necessary arrangement for the FPOs to carry out the marketing survey.
Implementation of Business Plan	At first, the selective existing FPOs will implement business plan to be generated in the above mentioned stage in advance of new FPOs, since the selection procedure for existing FPOs would be done earlier. After allocation of the CBBOs, the existing FPOs will be expected to take 12 months to finish preparation of the business plan. Existing FPOs will start business with facilitation of CBBOs, and at the same time, the first step for new FPOs (Employment of CBBO for promotion of FPOs) will basically be started, which depends upon the activity progress of existing FPOs. Implementation schedule and activities for implementation of the business plan shall be arranged by CBBOs in accordance with the guideline for the central scheme.
Technical Training on Postharvest Handling and Processing	a) Pack House with primary processing and packaging unit, b) Cold Storage Room, c) Refrigerated Transport Vehicle, d) Outlet of Horticulture Products, and e) Basic Food Processing Unit will be established or procured as the purpose of FPO activities by the Project. The facilities will be handed over to the FPOs after construction and procurement, so that FPOs will have the responsibility to operate and maintain the facilities properly.
Corpus Fund Management	The systems and rules for O&M of facilities to be handed over to FPOs are critically needed for proper management. Particularly, collecting charges from farmers using the facility shall be prepared to ensure sustainability of the facility. It is proposed that the charges to be collected could be used for management of facilities by FPOs as a corpus fund.

Source: JICA Survey Team

(3) R&D Support (Postharvest)

Items	Qty.	Remarks
Upgrading of postharvest and food processing centers	8 nos.	2 nos. for each target district Tehri, Nainital, Uttarkashi and Pithoragarh

Source: JICA Survey Team

(4) Promotion of Private Sector Collaboration

Item	Description
Matching FPOs with Agribusiness Companies	UKIHDP is planning to provide matching opportunities for agribusiness companies to connect to local partners in Uttarakhand. The necessary information and assistance include, but not limited to, organizing investment seminars, intermediating FPOs and agribusiness operators, and introducing available government schemes through the Single Window Clearance System for intended investors operated by the Investment Promotion and Facilitation Cell (IPFC) of the Directorate of Industries of Uttarakhand
Facilitation of Pilot Business Trial	Effective involvement of the private sector is a major project approach of UKIHDP. UKIHDP will encourage the private sector to intervene in the whole supply chain development through a pilot demonstration of innovative technologies and/or a joint

	venture operation in collaboration with local partners, such as private firms, farmers groups and government agencies.

Source: JICA Survey Team

57. Institutional Development for Project Management

(1) Procurement of Equipment and Materials

Item	Description
ICT-related Equipment and Establishment of MIS & GIS and Monitoring System	The Project will be covering 16 FPOs mainly for supply chain development and beneficiaries under the FPOs which will be 3,200 farmers in the target area. In addition, collaboration with various stakeholders for the supply chain and convergence activities will be planned for the Project, so that it is necessary to correctly grasp the progress of project activities. In addition, it must be required to carry out the preparation, follow-up and troubleshooting for every activity. Therefore, in the Project, an MIS system will be introduced for efficient project management with ICT general equipment. The desired functions are for (1) showing progress of the overall project implementation and each FPO, (2) identification and mapping of clusters and FPOs with the use of GIS, (3) display of photos and the project documents. The MIS systems with these functions will be newly developed for the Project.
Equipment and Tools for PMU and HMT	The equipment including office, furniture and vehicles for project implementation by PMU/DIU is tentatively considered in the following table. In addition, equipment for 34 offices of HMT, which will be expected to conduct extension activities to farmers even in the Project is also required from UKDHFP.

Source: JICA Survey Team

(2) Strengthening of PMU/DIU and HMT

Item	Description
Recruitment of PMU/DIU Staff (Outsourcing)	PMU/DIU will hire qualified and experienced personnel from an external agency on contractual basis. The selection of the external agency is done through open local competitive bidding.
Project Management including Planning and Implementation	The Project will be implemented as per the Project Operation Manual prepared upon the formation of the PMU. Thus, all the project staffs at various levels need to understand their roles and responsibilities in the project, its annual planning process, M&E system, and financial management process.
Preparation, Monitoring and Updating of Annual Action Plan	The Project requires action plan implementation, monitoring and evaluation for project activities, and the action plan shall be updated annually from the assessment of the progress and review of present action plan.
Technical Training to DIU and HMT	For capacity development of DIU/HMT, the training will be planned based on the capacity assessment of farmers and FPOs, and demand of target crops and markets. The COEs and training centers could be utilized for the trainings. The training curriculum must be composed for fulfilment of the requirement. The trainees will be expected to extend their knowledge and experience learned from trainings to colleagues and to practice it on the job.

Source: JICA Survey Team

(3) Capacity Development for R&D

Item	Description
Technical Training to Staff of Nursery, Training Center and Labs	The government staff of nurseries, COEs, training centers and laboratories shall be trained for technical capacity building since the facilities would be used for strengthening of DIU and HMT for the project implementation. In addition, the facilities could be the location for pilot activity by private companies as well. Technical trainings will be conducted periodically by KVK and university supported by PMU/PMC. Training contents will be clarified based on capacity assessment of the relevant staff. As for O&M training, it shall be provided by suppliers as their maintenance service. Proper documents and manuals with instructions shall be shared with the facility staff by suppliers, which shall be taken care of and monitored by DIU/PMU.
O&M Training on Facilities to Government Staff	

Source: JICA Survey Team

(4) Branding and Marketing Development

Item	Description
Horticulture Market Research at Major Mega-cities	Market research of horticultural produce covering major cities in Uttarakhand and the whole India shall be conducted at the beginning stage of UKIHDP in order to elaborate its implementation plan. The PMU of UKIHDP shall organize a research survey by hiring outside source personnel.
Branding Promotion	The market promotion of horticultural produce shall be carried out in UKIHDP by re-establishing a shared understanding of all stakeholders under a branding strategy in

Item	Description
	accordance with the crop cluster development policy of the state government. While the branding promotion should be facilitated by mutual interaction between farmers, the private sector and the government, the latter's intervention shall be systematically implemented under the re-established strategy mainly through capable farmers' groups like FPOs taking a leading role in crop clusters. The branding strategy should be comprehensive but be realistic considering available resources in Uttarakhand without chasing a far-off dream in a short time. Stepwise development of farmers' skills in production and marketing shall be the main approach of the branding strategy. The branding strategy shall gradually shift its development focus in accordance with the local farmers' ability and market circumstances.
Food Fairs/Exhibitions	PMU shall organize food fairs or exhibitions annually in order to promote horticultural production mainly focusing on crops produced in clusters supported by UKIHDP. The fairs or exhibitions shall provide good opportunity not only to advertise the crops, but also to match up FPOs/local traders and agribusiness operators, as well as to exchange market information between various stakeholders.
Branding Development and Quality Management	Two expert staff shall be assigned in PMU to facilitate the branding promotion as mentioned above. They shall perform a daily operation under technical support and supervision of the Agribusiness Experts assigned as the Project Management Consultants.

Source: JICA Survey Team

(5) Exposure Visits

Item	Description
Domestic Training	Exposure visits within and outside of the state will be organized three times in the neighboring districts and states. The places of visits will be identified by PMU and DIU subject matter specialist as per the requirement and the crops to be grown in the cluster. The farmers along with HMT members, DIU, and PMU officers will also join. Durations of two days for the "within the state" visit, and five days for the "outside of the state" visit will be budgeted.
Overseas Training	Overseas training will be planned for PMU, DIU, FPO members and progressive farmers. The purpose of the overseas training is to provide the participants an opportunity to be exposed to various farm management technologies and methods as well as how the farmers and farmers' organizations work on production, post harvesting, and marketing. To meet the learning objectives, Thailand and Japan may be considered as possible destinations. In case the overseas training is not feasible, on-line study tour will be organized. Ten days of overseas training will be budgeted.

Source: JICA Survey Team

(6) Baseline Survey and Mid- & End-line Surveys

Type of Survey	Contents	Remarks
(1) Baseline Survey	Household survey in approximately 10% of farmers in target blocks in four districts, samples in each site would depend upon the number of households in each block.	Survey to be carried out by resource agency, supervised by DIUs under overall coordination of PMU with technical and managerial support by PMC for TOR preparation, selection of survey contractors, field execution, analysis and evaluation, report preparation, and dissemination. Through the process of these activities, capacity of PMU will be strengthened.
(2) Mid-line Survey	Household survey in community-based impact assessment (CBIA) for capturing indicators of change in 10% of farmers in implemented blocks.	Survey to be carried out by resource agency, supervised by DIUs under overall coordination of PMU. Through the process of these activities, capacity of PMU will be strengthened.
(3) End-line Survey	Household survey in community-based impact assessment (CBIA) for capturing indicators of change in 10% of farmers in implemented blocks.	Survey to be carried out by resource agency, supervised by DIUs under overall coordination of PMU. Through the process of these activities, capacity of PMU will be strengthened.

Note: Activities carried out after the baseline survey such as climate change, nutrition improvement, livelihood improvement programme etc. shall be covered at mid-line survey, and impact assessment survey for the same will be conducted at end-line survey.
Source: JICA Survey Team

58. Convergence

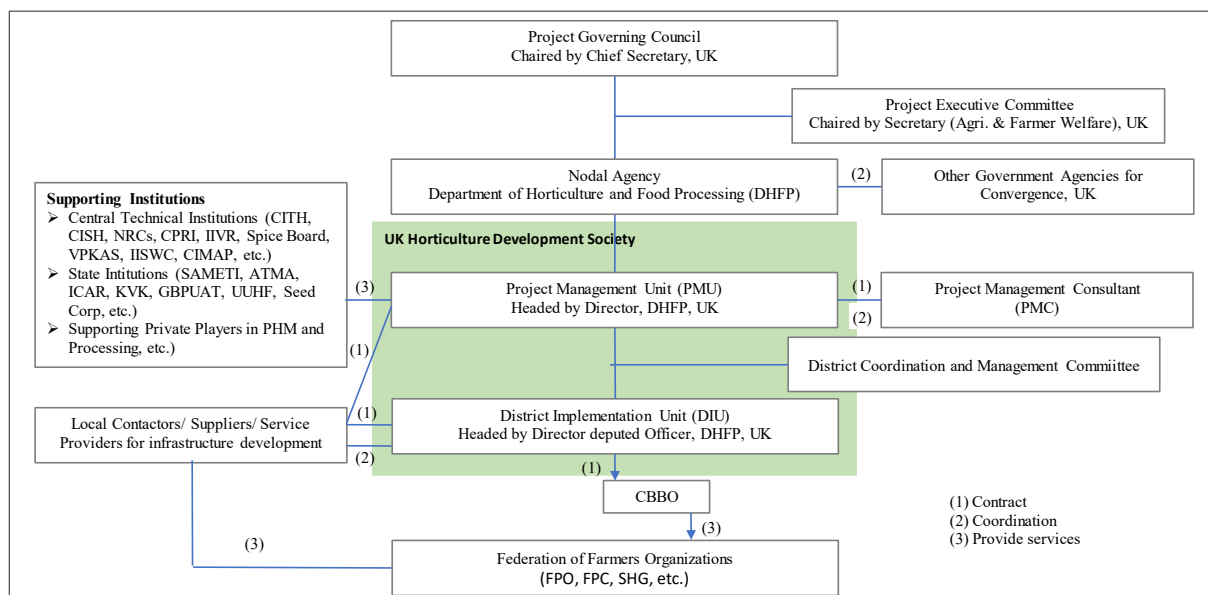
Item	Description
Policy Decision To be Taken by the Governing Council	To facilitate convergence, the Governing Council shall discuss the policy and issue a letter to all the concerned departments to converge with the project during the initial stage of the project. This will give basis for other departments in the state to work with the project.

Item	Description
Taking Part in the District Monitoring Meeting Chaired by the District Magistrate	At each district, the District Magistrate will hold the meeting with all the departments to follow up with the work progress. This provides a good opportunity for the CHO/ DHO to raise the requirement for convergence. In this meeting, the potential departments/ schemes can be identified, and DIU will begin negotiation with concerned officers.
Direct Consultation with Projects and Other Organizations	In case of the projects assisted by donor organizations, the PMU will directly approach the respective projects for consultation.

Source: JICA Survey Team

Chapter 7: Implementation Plan

59. The overall project organizational structure is proposed as shown below.



Source: JICA Survey Team

Overall Organization Structure for Project Implementation

(1) Project Governing Council

The Department of Economic Affairs will be the nodal agency at the GOI level to review and monitor the project progress of the JICA-funded UKIHDP. The Government of Uttarakhand will establish a state-level Project Governing Council (PGC) chaired by the state Chief Secretary. The state Secretary of Agriculture and Farmers Welfare (also serves as Horticulture) will be the Secretary of this Committee. The PGC will meet once in six months to review progress, provide overall guidance and policy support, and facilitate inter-departmental coordination. The members of the PGC will include the: (i) Finance Secretary; (ii) Secretary, Forest and Environment (iii) Secretary, Cooperatives (iv) Secretary, Rural Development; (v) Secretary, Irrigation, (vi) Secretary, MSME (vii) Secretary, Industry; and (viii) Project Director of UKIHDP.

(2) Project Executive Committee

The PGC will establish a Project Executive Committee (PEC) chaired by the state Secretary of Agriculture and Farmers Welfare. The Project Director (PD), Project Implementation Agency and government line departments will be the members. The Project Director of UKIHDP will be the Secretary of the PEC. The PEC will meet every quarter.

(3) District Coordination and Management Committees (DCMCs)

A DCMC would be established in each of the four districts covered by the Project and would be chaired by the Chairman of the Zila Panchayat (elected head of the district government). Members would include the district Chief Development Officer, project staff of District Implementation Unit (DIU), members of government line departments and representatives of FPOs, and Block Development Officers. The committee would coordinate project implementation at the district level

and ensure linkages between the Project, line agencies and other government agencies. The District Project Manager of the DIU will be the Secretary of the DCMC. The DCMC will meet every month.

(4) Project Implementing Agency

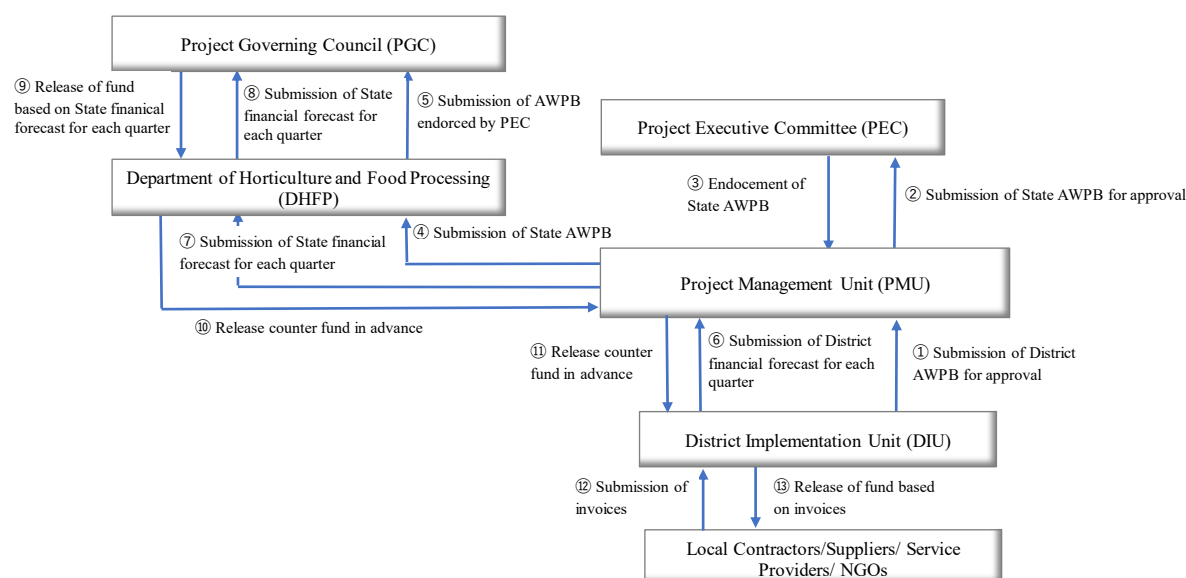
UKDHFP will establish a separate society to implement the Project. This society will be a project implementing agency, tentatively named as Uttarakhand Horticulture Development Society. The society mode is preferred as it has the flexibility to retain unspent funds at the end of the financial year as against the normal system of surrendering the unspent balance to the government treasury. The State Government will nominate an experienced official from the central services as full-time Secretary of the Society and this person will be the full-time Project Director for implementation of project activities.

In the Uttarakhand Horticulture Development Society, the Project Management Unit (PMU) and District Implementation Units (DIUs) will be formed.

(5) Project Management Consultant (PMC)

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

60. Overall Fund Flow: The financial year of the Project is from 1st April of this year to 31st March of next year. As shown in the following figure, the project funding procedure will start with the submission and approval of the annual budget (AWPB) from PGC, and the same for financial forecast for every quarter, and then funds will be released to PMU's account in advance.



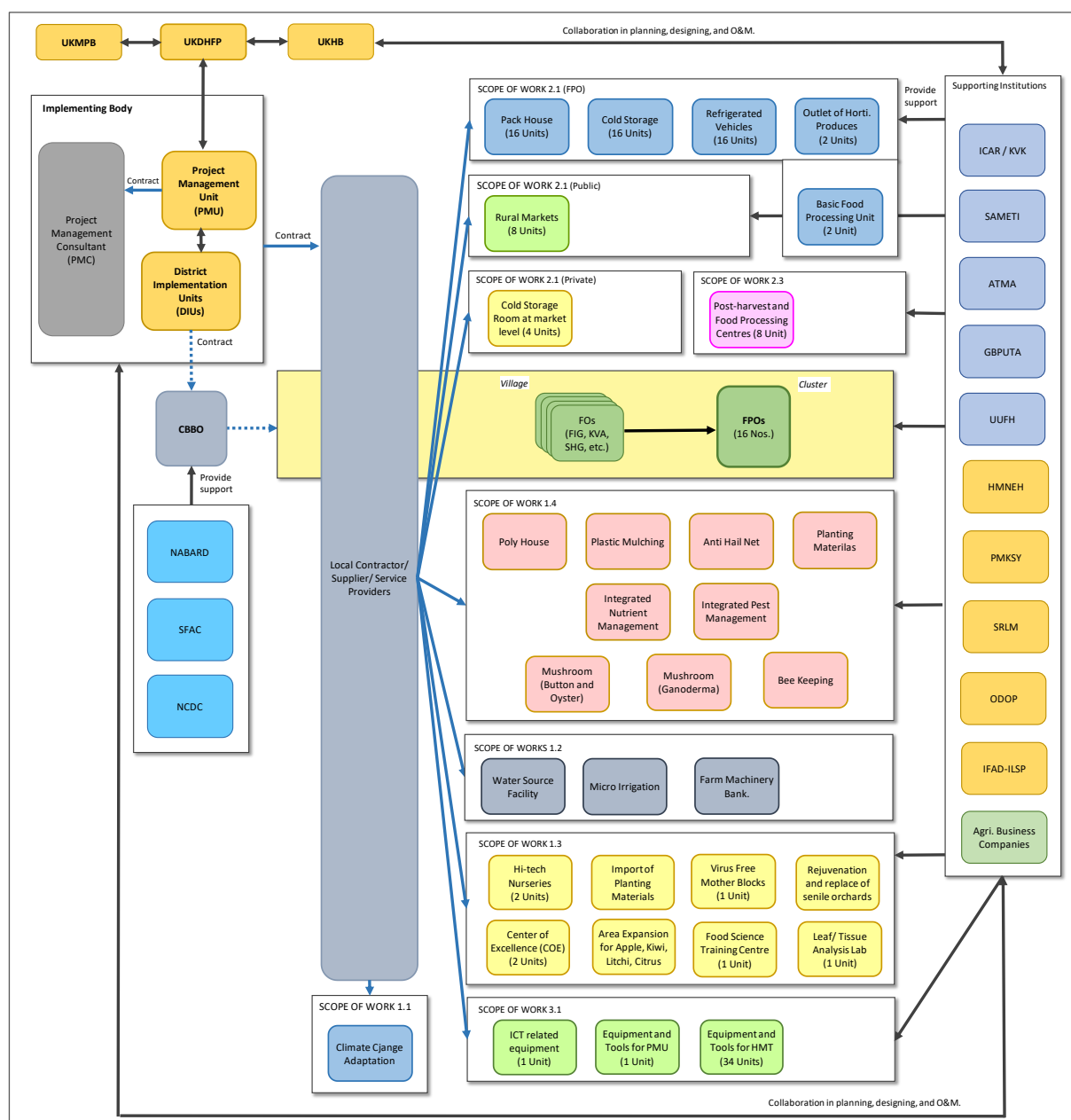
Source: JICA Survey Team

Overall Fund Flow

61. Implementation System for the Project: As discussed in the preceding chapter, the Project consists of three major components; namely, i) area expansion and production, ii) supply chain development and iii) project management. Various supporting institutions will be involved in the project implementation. In addition, many work items are expected to be implemented in convergence with other projects and programs.

- Implementing System for Infrastructure, Equipment and Materials: The figure below simply shows the overall correlation diagram focusing mainly on work items of infrastructure, equipment and materials. These work items will be constructed and/or provided by local

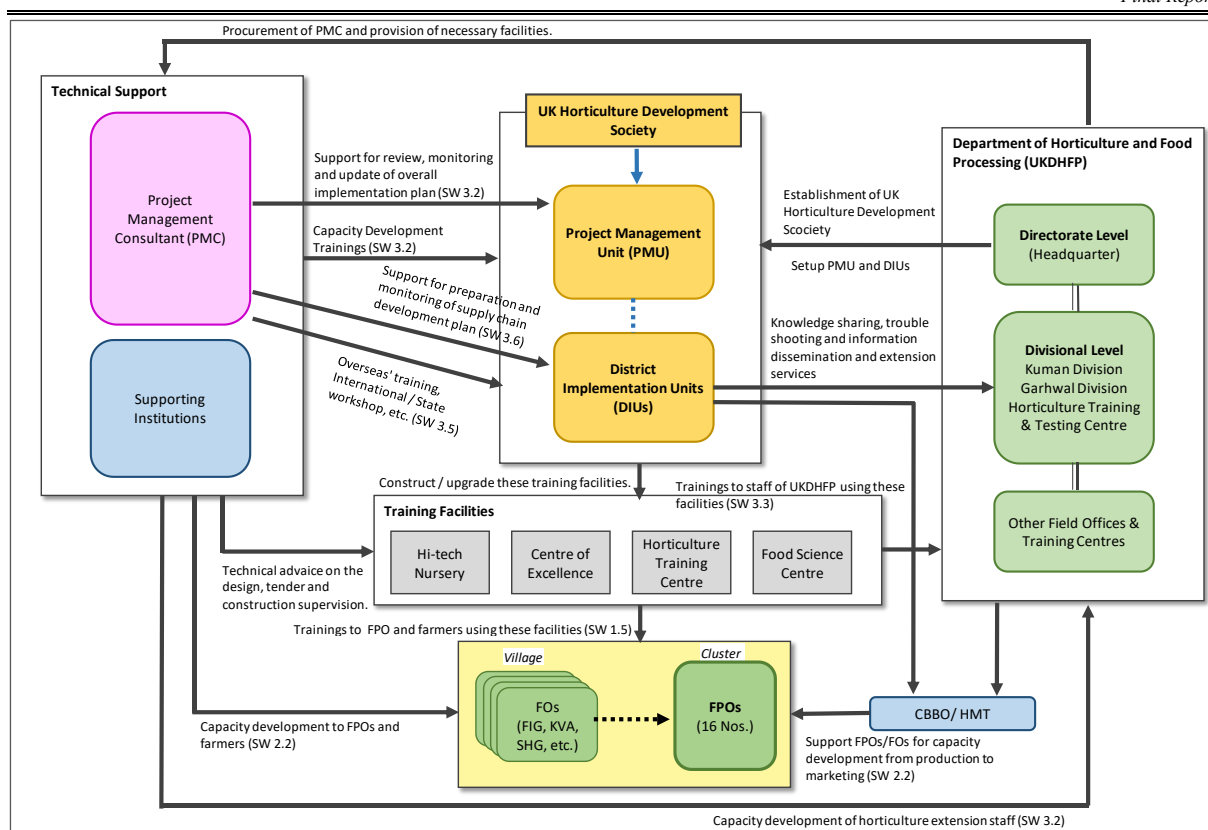
contractors, suppliers, or service providers who are selected by adhering to bidding rules of the Uttarakhand state.



Source: JICA Survey Team

Implementing Organization for Work Items 1.1, 1.2, 1.3, 1.4, 2.1, 2.3 and 3.1 (Infrastructure, Equipment and Materials)

- Implementing System for Project Management and Capacity Development: The figure below indicates the overall correlation diagram mainly focusing on capacity development. The PMU and DIU will plan and implement the Project with technical support from PMC and various supporting institutions. It is noted that FPO development will be implemented in collaboration with the centrally sponsored scheme of Formation and Promotion of 10,000 FPOs under the Project.



Source JICA Survey Team

Implementing Organization for Work Items 1.5, 2.2, 2.4, 3.2 -3.6 (Capacity Development)

62. Procurement Method

Item	Description
Procurement Method	The Project plans to procure (a) construction works, (b) supply of goods, which include various items such as office equipment and furniture, transportation equipment, farm machinery and inputs, laboratory equipment, and (c) services provided by PMC, NGOs or universities. The PMU will prepare the plan, design, specifications, special requirement or other descriptions pertaining thereto in advance to the procurement. The descriptions referred to shall be based on international standards, where such exist; otherwise, on national technical standards, regulations, or codes. Procurement of construction works or goods or services can be made either through (a) international competitive bidding only for PMC, (b) local (or national) competitive bidding, (c) quotation method and (d) direct undertaking.
State Procurement Rules	In principle, the Uttarakhand Procurement Rules 2008 will be used for the local competitive bidding. The rules specify all necessary procedures for the procurement of goods, works and services and for public-private partnership arrangements in infrastructure and service delivery projects and to regulate the matters connected.

Source: JICA Survey Team

63. Implementation Schedule of the Project: The project implementation period will be seven years starting in 2022.

Chapter 9: Project Evaluation

66. **Project Benefits and Economic Evaluation:** The project benefit is generated on a monetary basis by crop diversification to be achieved from the implementation of project components. It is concluded that the Project is economically feasible with an economic internal rate of return (EIRR) of 10.6% and a B/C of 1.51. Intangible benefits are the increase of farm household income in the project area, strengthening of management capacity of FPOs, and capacity development of government institutions.
67. **Operation and Effect Indicators:** In order to monitor and evaluate the project effects, operation and effect indicators have been set up. Operation indicators are 1) Number of beneficiary farmers (FPO members), 2) Number of FPOs starting business, 3) Introduction of micro irrigation, 4) Percent of beneficiary farmers who get technical advice from HMT, 5) Organization/participation of food fairs and exhibitions. Effect indicators are 1) yield of selected crops under FPOs in the target area, 2) cultivation area of fruits under FPOs in target area, 3) rate of shipping price of FPOs to farm gate price of fruits, vegetables and spices in target area.
68. **Risk Management:** Risks of the Project are identified and assessed from the viewpoints of 1) stakeholder risk, 2) executing agency risk, and 3) project risk based on JICA's Risk Management Framework, and each treatment for risks to be conducted by the Project are proposed.

Chapter 10: Environmental and Social Considerations

69. The appropriate environmental and social considerations are required to be made as per the JICA Guideline on Social and Environmental Consideration. In compliance to the JICA Guideline, the Survey Team has reviewed the environmental administration system, EIA procedures, and the concerned policy, laws and regulations of Uttarakhand and conducted stakeholder analysis to clarify their roles and responsibilities in environmental and social considerations processes required in the Project. Furthermore, the project specific potential environmental and social impacts were assessed in the JICA survey. Particular attention was paid to the potential impacts associated to land acquisition if required for constructing the Center of Excellence or any other new building under the project, development of irrigation facilities, usage of agrochemicals, and human wildlife conflict. Further, social impacts on scheduled tribes and gender are assessed. After identifying the potential negative impacts or risks, mitigation measures were elaborated for each project component. Basing on the results of preliminary assessment, the Environment and Social Management System including its implementation structure and necessary stakeholder capacity development program was developed.

Chapter 11: Recommendations

70. UKDHFP will establish a PMU for the smooth implementation of the project. PMU will be registered as an Independent Public Benefit Corporation (Society) under the Uttarakhand Society Registration Act 1860, which has its own constitution and by-laws covering finance, accounting, human resources and administrative norms. The Society functions as a dedicated organization for the implementation of the project. For the smooth implementation of the project, therefore it is necessary to establish the Society as soon as possible. It is proposed that the following activities be implemented immediately after the start of the project, in parallel with the procurement process of the PMC.
 - Establishment of the implementation and monitoring system
 - Appointment of staff of PMUs/DIUs and procurement of office equipment
 - Comprehensive market survey at accessible large markets
 - Scrutiny of production clusters in the target districts and selection of the development blocks
 - Procurement of CBBOs
 - Preparation of the basic design of hi-tech nurseries and Centers of Excellence

At the initial stage of the Project, a comprehensive market research is to be conducted targeting large-scale markets that are relatively easy to access. In this section, the JICA Survey Team proposes to clarify the purchasing conditions of promising crops from the market (buyer) side and

reflect them in the cultivation plan and R&D plan, while referring to the results of a simple survey in the Delhi market conducted in this survey.

UKDHFP has data on production clusters created by HMNEH. However, the reliability of the data is questionable because the sizes of the clusters vary widely from district to district, and the names and numbers of villages included in the production clusters are not systematically organized and readily available. It is suggested therefore that UKDHFP should promptly examine the production clusters of the four target districts. UKDHFP will select the development blocks based on the market survey results and the latest information on production clusters. In doing so, care will be taken not to overlap with the development plans and interventions of other projects and programs.

71. **Development of FPOs:** It is understood that the main component of the Project, supply chain development, which aims to develop and strengthen FPOs that operate in production clusters based on development blocks for creating a system to bring economic benefits to their member-producers. FPOs must have at least a certain number of members in order to achieve viable scale of business. In this project, keeping the focus with the existing farmer groups, other farmers are also encouraged to participate. The Project shall anticipate that even with the existing FPO that meets the requirements to take part in the training and strengthening, it will take time to confirm with them the FPO concept in the Project, build consensus among the FPO members, or to mobilize the additional number of farmers in the surrounding area. In case there is no existing FPO, even longer time is needed to initiate the formation process and build capacity of the organization to the level of self-supporting stage. Therefore, the Project shall be recommended to engage CBBOs with proven track records in implementing FPO development.
72. **SHEP Approach:** In the preparation of the FPO business plan, a market survey will be conducted by the farmer group to understand not only price fluctuations, but also the crops, varieties, quality, quantity, and timing demanded by the market (buyers), which will be reflected in the business plan. The JICA Survey Team proposes the introduction of the PDCA (Plan-Do-Check-Action) cycle to reflect what is learned through the implementation of the business plan, including crop management, in the next year's business plan, which will provide an opportunity for individual members to recognize the issues they face as an organization and work on solutions with a sense of ownership and responsibility.
73. **Strengthening of Horticulture Extension Services:** Under the Project, new varieties and cultivation technologies will be introduced. In this process, agriculture extension services play a critical role in achieving the planned outcome. The crop selection shall be done based on the results of market surveys conducted by experts and farmer groups so that the crops with higher market potential can be selected for promotion by the Project. The project extension system shall also be designed to promote climate change adaptation measures in order to build the resilience of the farmers against climate change impact. The HMTs shall become the contact point at the field level to provide horticultural trainings to beneficiary farmers in collaboration with the UKDHFP's training centers, ICAR, universities, KVK and other agricultural institutions. It is also proposed to promote the dissemination of online cultivation consultation system and other systems using familiar ICT devices such as smart phones.
74. **Measures for Climate Change Impact:** As for the strategic horticultural crops in the target districts of the Project, the Project aims to establish a relative advantage in the horticultural crop market through R&D efforts related to cultivation technology, variety improvement and crop conversion as a measure against climate change. In order to achieve this, it is proposed to continuously conduct surveys, verification and research on climate change impact during the project period.
75. **Formation of Production Centers and Branding Strategy:** The brand strategy is a two-stage process that includes the formation of production centers, which should be tackled from a long-term perspective, and the registration of production area brand names and logo marks, advertising through media such as TV and newspapers, and participation in product exhibitions and displays, which can be dealt with in the short term. In order to establish the brand image in the market (buyers), it is necessary to constantly supply the market with a certain quantity and quality of

- horticultural produce. The JICA Survey Team suggests that the producers and the government work together on the brand strategy for the long term.
76. **Public-Private Partnership:** In case of collaboration with the private sector in the preparation of business plans for FPOs and horticultural extension activities, this will be promoted through activities that comply with the SHEP approach. In the case of introducing advanced technologies from the private sector, it is proposed to match private companies with FPOs through the Single Window System of the Department of Industry, and to support those to be highly evaluated as a pilot trial under the Project.
77. **Gender and Nutrition:** In order for women to participate in the training conducted by the Project, it is proposed that a training program shall be designed by taking into consideration of the location of the training venue, duration of the training and their learning needs. With regard to women's participation in FPOs, it is recommended that the bylaws of the organization shall stipulate both the head of the household and spouse to be entitled to a membership, if currently not defined so. To encourage women's engagement in the decision-making process of the organization, it is also recommended that at least 30% of FPO office bearers shall be reserved for women members. As far as nutrition is concerned, it is recommended to promote home gardens under the Project to improve nutrition, as most of the women prepare meals using crops grown in nearby areas. It is also recommended that the nutritional information is to be painted on the walls of buildings that are easily visible to the villagers, and school gardens to be implemented to disseminate knowledge on nutrition.
78. **Convergence:** Convergence involves multiple numbers of stakeholders. The success of the convergence lies on the coordination, i.e., how efficiently and effectively coordination can be done. This is also one of the common challenges faced in implementing an action through convergence. Sometimes the activities may not be implemented in a timely manner as planned in the Project due to the time spent for coordination with the partner programs, or the status of budget execution, or the lack of facilities and personnel. Since the activities to be implemented in the convergence will also need to contribute to the achievement of the project goals, if the convergence is hampering the progress of the project activities, it may not be a wise option for the Project to follow. Thus, in order to avoid such risks, adequate budgetary arrangement of necessary resources including budget funds shall be made by the Project. It is also recommended that an official notification on convergence is to be issued in the name of the Chairman of the Project Governing Council to ensure smooth coordination with government departments and projects.
79. **Any Changes for the Project Components and Others:** A list of proposed infrastructures have been decided in consultation with UKDHFP. However, during the project implementation, if needed, location can be changed. In case of any change for the benefits of the project can only be made by the approval of PEC. Any addition or deletion of component and others can also be changed by the consent of PEC.

Chapter 1 Introduction

1.1 Authority

1.2 Background of the Survey

Agriculture is the most crucial industry in India for securing employment and improving livelihood, where more than 65% of the people live in rural settings. Uttarakhand is a state of India located at the foot of the Southwestern Himalayas, with the total land area of 53,483 km² which consists of 13 districts. The state is divided into the two regions of Garhwal and Kumaon, located in the western and eastern parts of the state, respectively. Total population of the state is 10.1 million, of which 70% live in the rural area (Census of India 2011). More than 75% of the total population of Uttarakhand depends on agriculture for their livelihood (ibid). However, the landholdings are small and fragmented, and irrigation facilities are not developed enough due to its topographic feature of a hilly terrain. The net sown area in the state has been on a declining trend since 2000-2001 and was reported as 698,413 ha in 2015-2016. This accounted for 13.05% of the total geographical area of the state and 56.42% of the area is located in the hilly regions of the state, while the remaining areas are in the plains (Agriculture Statistics of Uttarakhand 2014-2015 & 2015-2016). Out of the total net sown area, 47.22% is under irrigation and 86.89% of the irrigated area is located in the plain areas of the state (ibid). Although the Government of Uttarakhand is promoting modern input-intensive agriculture, it is severely constrained in the hilly areas due to physical, geographical, and environmental difficulties. As a result, majority of the rural people remains to be engaged in subsistence agriculture and tends to migrate to other areas of the country for employment. The Uttarakhand Human Development Report (2018) reported that 35.3% of the sample households in the rural hills have at least one family member migrating more than 9 months a year while the same figure remains as low as 2.6% in the rural plain area. This gap reflects the hardship in making both ends meet in the rural hilly regions of the state. The state faces such challenges of promoting livelihoods to retain people by generating better income and local employment. The Government of Uttarakhand regards horticulture as one of the leverages to overcome the challenges.

Horticulture has been proven to boom in the hilly states of the country due to its much higher potential in comparison with that of traditional field crops. Crops suitable for temperate and sub-temperate climate like horticulture crops are cultivated in limited areas in the country due to these specific conditions. On the other hand, demand for such fruits and vegetables is increasing fast due to the changing profile and preferences of consumers in the urban areas. As a result, India is a net importer of apple, nuts and stone fruits. Among the net sown area in Uttarakhand, about 280,000 ha¹ are covered under horticulture crops. In 2015-16, 37.36% of the gross value produced by agriculture crops in the state is derived from fruits, vegetables, and nuts and dry fruits². Production of pears, peaches, and plums in Uttarakhand is the top in India. On the other hand, production of walnut and apple in Uttarakhand is the second and third in the country, respectively³.

Based on the potential of horticulture and Uttarakhand mentioned above, the Department of Horticulture and Food Processing under the Government of Uttarakhand (UKDHFP) developed the Preliminary Project Report (PPR) for the formulation of a Detailed Project Report (DPR) for the “Uttarakhand Integrated Horticulture Development Project (UKIHDP)” (hereinafter referred to as the Project).

The PPR has indicated that the Project aims to enhance production, productivity, quality of product, processing, and market linkage by achieving success and expects seven outcomes: (i) to improve the socio-economic status of agrarian community of Uttarakhand, (ii) to optimize utilization of natural resources of Uttarakhand, (iii) to improve access to horticulture input, (iv) to improve farmers’ access to credits and markets, (v) to generate diverse and inclusive employment opportunities especially

¹ <https://shm.uk.gov.in/pages/display/6-state-profile>

² Estimated by the survey team based on the State Domestic Product of Uttarakhand 2011-12 to 2016-17, Directorate of Economics & Statistics, Department of Planning, Government of Uttarakhand.
(https://des.uk.gov.in/files/GSDP_BOOK_2016-17.pdf)

³ Horticulture & Floriculture Sector Profile, State Horticulture Mission, the Government of Uttarakhand

women and youth in the agriculture sector, (vi) to increase availability of nutritious farm product and reduce damage by wild animals and climate change, and (vii) to increase livelihood opportunities to facilitate reverse migration. The Government of Uttarakhand expected to implement the Project as an official development assistance (ODA) loan project funded by the Japan International Cooperation Agency (JICA) and submitted the PPR to JICA for review.

1.3 Outline of the Project in the PPR

According to the PPR developed by UKDHFP, the outline of the Project is summarized as below.

Table 1.3.1 Project Outline Indicated in the PPR

Item	Description
Project Name	Uttarakhand Integrated Horticulture Development Project (UKIHDP)
Project Area	Four districts (Nainital, Pithoragarh, Uttarkashi, Tehri Garhwal) of Uttarakhand State
Project Component	1. Enhancement of production support ▪ Establishment of advanced nursery, tissue culture units, aeroponics unit, mother plant garden free from virus, and the center of excellence ▪ Import of planting materials 2. Area expansion ▪ Establishment of new gardens under cost intensive crop, high/ultra-high/normal density planting, mushroom cultivation hut, greenhouse/shade net house for protected cultivation, and custom hiring units (CHU) for farm mechanization ▪ Rejuvenation/Replacement of senile plantation ▪ Promotion of integrated nutrition management (INM) and integrated pest management (IPM) ▪ Water resource development and introduction of micro irrigation 3. Supply chain development including integrated postharvest management ▪ Establishment of pack house, controlled atmospheric storage (CA storage), and retail outlets for horticulture ▪ Development of cold chain including cold storage and refrigerated transport vehicle (RTV) ▪ Improvement of market infrastructure ▪ Development of infrastructures for collection, sorting, grading, and packing. 4. Institutional development ▪ Brand development and promotion ▪ Standardization of parameters of, and testing procedure for, product quality ▪ Establishment of processing unit ▪ Training for entrepreneurship development and post-harvest management ▪ Extension and demonstration for technology dissemination
Target Indicator	1. Center of excellence established: 3 nos. 2. Farm developed - fruit: 2,800 ha, vegetables*: 6,500 ha, spices: 5,000 ha, flowers: 400 ha 3. Farmers group joined: 8 nos. 4. Storage established: 18 nos. 5. Processing facility established: 34 nos. 6. Market facility developed: 16 nos.
Implementation Agency	Department of Horticulture and Food Processing (DHFP) of Uttarakhand
Supporting Agency	Uttarakhand Agricultural Produce Marketing Board (UKAPMB)
Project Period	From 2019 to 2024 (5 years)

*: "vegetables" including potato: 1,500 ha

Source: JICA Survey Team

1.4 Objective of the Survey

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

1.5 Survey Area

The survey area is the entire Uttarakhand with emphasis on the four districts of Uttarkashi, Tehri Garhwal, Pithoragarh, and Nainital.

1.6 Scope of the Survey

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

1.7 Work Schedule of the Survey

The survey work has commenced in March 2021 and completed in February 2022. Due to COVID-19, all of field works have been carried out on a remote work mode. The Japanese experts worked from Japan while the national team members worked in Uttarakhand or in their respective states. The summary of the survey schedule is given in the table below.

Table 1.7.1 Overview of Work Schedule

Sl. No	Work Item	Schedule	Reports
1	1st Home Work	March 2021	IC/R
2	1st Field Work (Switched to Home Work)	End of March – end of June 2021	-
3	2nd Home Work	July 2021	IT/R
4	2nd Field Work (Switched to Home Work)	August – September 2021	-
5	3rd Home Work	October 2021	DF/R
6	3rd Field Work (Switched to Home Work)	November – December 2021	-
7	4th Home work	January – February 2022	F/R

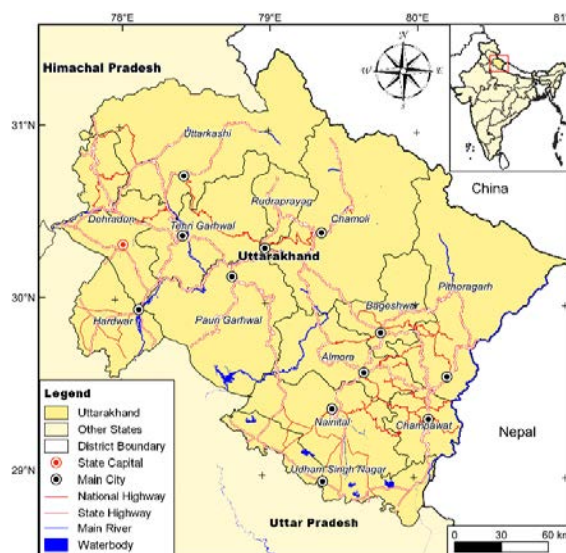
Source: JICA Survey Team

Chapter 2 Natural and Socio-Economic Status of Uttarakhand

2.1 Area and Demography

2.1.1 Geographic Features

Uttarakhand is located on the southern slope of the Himalayan ranges and has a total geographical area of 53,483 km². It lies between the latitudes 28°43'N to 31°27'N and longitudes 77°34'E to 81°02'E. The districts of Uttarkashi, Chamoli and Pithoragarh of Uttarakhand share international boundary in the north-west with China. In the east, the districts of Pithoragarh, Champawat, and Udham Singh Nagar also share international boundary with Nepal. Uttarkashi and Dehradun share inter-state boundaries with Himachal Pradesh in the north-west, while Dehradun, Haridwar, part of Nainital and Udham Singh Nagar touches the boundary of Uttar Pradesh in the south.



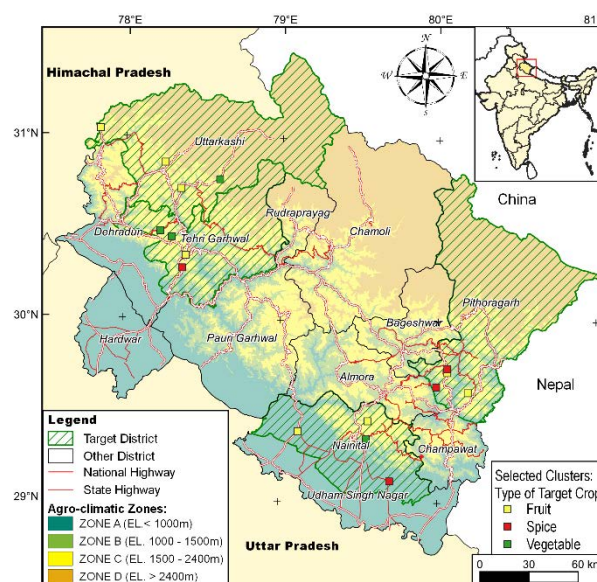
Sources :- Prepared by the JICA Survey Team
- Base map and data from OpenStreetMap and
OpenStreetMap Foundation

Figure 2.1.1 Map of Uttarakhand

(1) Agro-climatic Zone

Uttarakhand is situated under the Western Himalayan Region (WHR) as per the distribution of 15 agroclimatic regions in India (Planning Commission, Khanna, 1989)¹. Based on the agro-ecological environment, agro-climate conditions and physiographic factor, the state is divided into four major zones - plain and valley region [Zone-A], mid-altitude [Zone-B], high altitude [Zone-C] and very high altitude [Zone-D]. In the WHR, Uttarakhand is mainly geo-climatologically characterized by both cool and hot hilly environment with high to low precipitation from high hills to foothills and plains, respectively. Out of 13 districts, it has three districts in plains and the rest are the remaining middle to upper hilly areas.

Geographically, the WHR can broadly be divided into three major zones within the state, namely; (1) Upper hills (Uttarkashi, Chamoli, Rudrapur, Pithoragarh and Bageshwar); (2) Middle hills (Tehri Garhwal, Garhwal, Almora, and Champawat, the hill regions of Nainital and Chakrata tehsil of Dehradun); and (3) Foothills and Plains (Haridwar, Udham



Sources :- Prepared by the JICA Survey Team
- Climate of Uttarakhand, Indian Meteorological Department

Figure 2.1.2 Location of Target Cluster and Agro-climatic Zones

¹ http://apps.iasri.res.in/agridata/19data/chapter1/db2019tb1_2.pdf

Singh Nagar and the part of Dehradun and Nainital).

Geologically and geographically in part, there are five physiographic divisions which differ from each other in their geomorphic, hydrographic and vegetational features. These divisions are: 1. Plain Region (Northwestern extension of the Upper Ganga Plains), 2. Tarai-Bhabar Region, 3. Sub-himalaya or Outer Himalaya (Shivalik Range); 4. Lower Himalaya or Lesser Himalaya; 5. Higher Himalayas or Greater Himalaya (Himadri) - 5a. Central High Ranges; 5b. Trans Himalayas.

In summary, the total geographical area of Uttarakhand is divided into four main physiographic zones, namely; Tropical Zone (Zone A: up to EL. 1,000 m, Plains, Tarai, Shivalik Hills, valleys); Subtropical Zone (Zone B: EL. 1,000-1,500 m, largely non-irrigated area); Cool Temperate Zone (Zone C: EL. 1,500-2,400 m, mid Himalayas), and Sub-Alpine and Alpine Zone (Zone D: more than EL. 2,400 m, mostly covered with snow). The main crops produced in each zone are summarized in Table 2.1.1. The locations and agro-climatic zones of the selected clusters for the Project are shown in Figure 2.1.2.

Little agricultural activities are carried out in the geographical area falling under Zone D but pastures and alpine herbs grow in wild in these areas.² Irrigated area in Uttarakhand is shown on the map in Attachment 2.1.1.

Table 2.1.1 Agro-climatic Zones of Uttarakhand

Zone	Farming Situation	Soil	Rainfall mm/yr	Districts	Principal Farm Produce and Livestock
Zone A Up to 1,000 m	Terai Irrigated	Alluvial	1,400	Udham Singh Nagar Haridwar	Rice, wheat, sugarcane, lentil, chickpea, rapeseed, mustard, mango, litchi, guava, peach and plums. Livestock: Buffalo and cattle
	Babhar Irrigated	Alluvial mixed with boulders and shingles	1,400	Nainital Dehradun Pauri Garhwal	Rice, wheat, sugarcane, rapeseed mustard, potato, lentil, mango, guava and litchi. Livestock: Buffalo and cattle
	Irrigated lower hills (600-1,000 m)	Alluvial sandy soil	2,000-2,400	Champawat Pauri Garhwal Dehradun Nainital Tehri Garhwal	Rice, wheat, onion, chili, peas, potato, radish, cauliflower, pulses, oilseeds, soybean, mango, guava, plums and peaches Livestock: Buffalo and cattle
	Rainfed lower hills (600-1000 m)	Residual sandy loam	2,000-2,400	Champawat Nainital* Pauri Garhwal Dehradun Tehri Garhwal* Bageshwar	Finger millet, maize, rice, wheat, pulses, mango, guava, plums and peaches. Livestock: Buffalo, cattle and goat
Zone B 1,000-1,500 m	Mid-hills south aspect (1000-1500 m)	Sandy loam	1,200-1,300	Champawat Nainital* Almora Dehradun Tehri Garhwal* Bageshwar	Rice, finger millet, wheat, potato, tomato, peas, cole crops, pulses, peach and plums. Livestock: Cattle, sheep and goat
Zone C 1,500-2,400 m	High hills (1500-2400 m)	Red to dark	1200-2500	Pithoragarh* Almora Chamoli Bageshwar	Amaranth, finger millet, French beans, cole crops, potato, peas, peaches, plums, pear, apple, stone fruits. Livestock: Cattle, sheep and goat
Zone D >2,400 m	Very high hills	Red to dark Black clay	1,300	Pithoragarh Chamoli Uttarkashi*	Amaranth, cole crops, buckwheat, peas, apple, potato. Livestock: Sheep and goat

*Remarks: the bold letters show the zone where the survey clusters are located in each project district.
Source: Uttarakhand State Perspective and Strategic Plan 2009-2027

² State Focus Paper 2021-22, NABARD

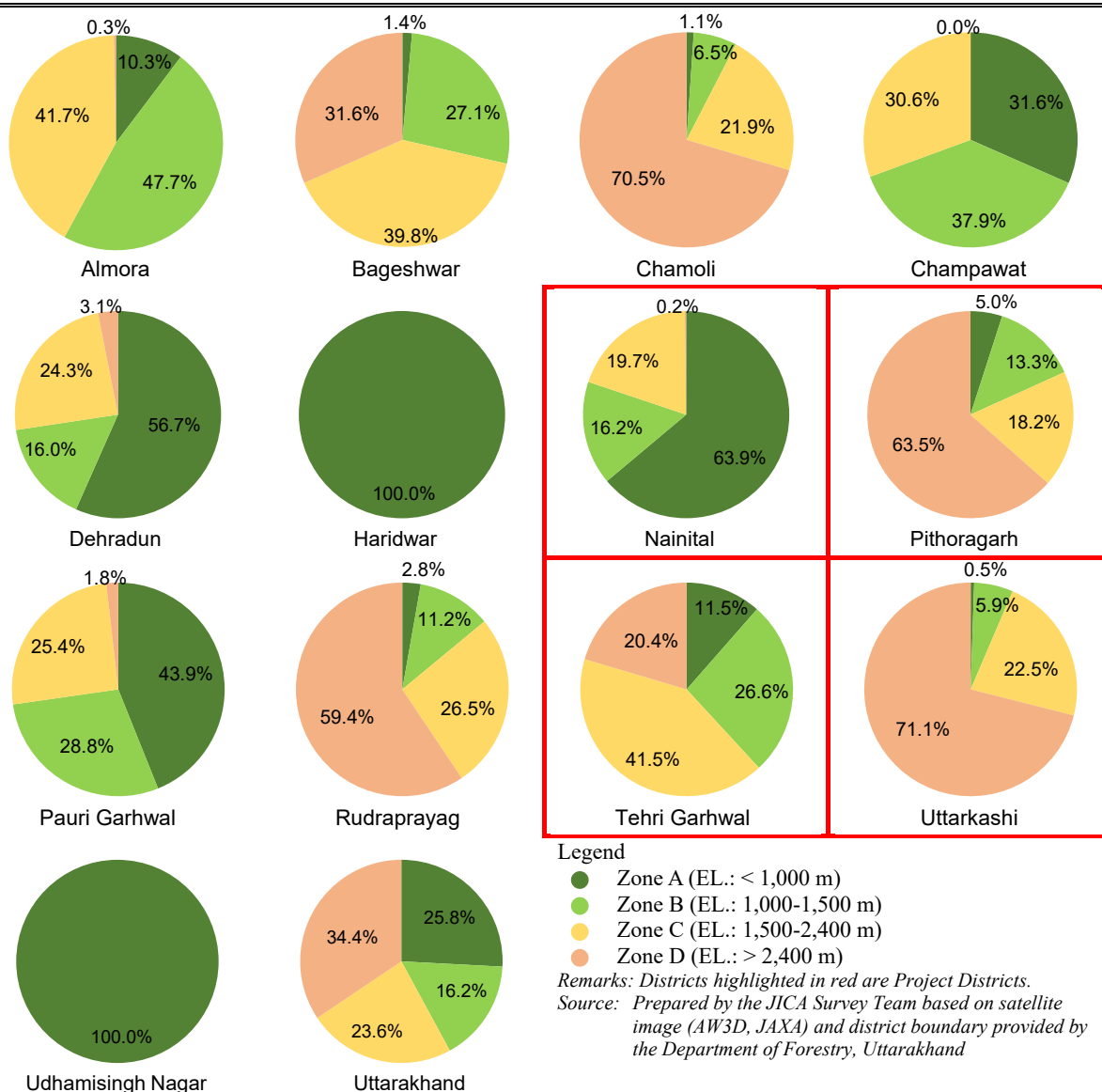


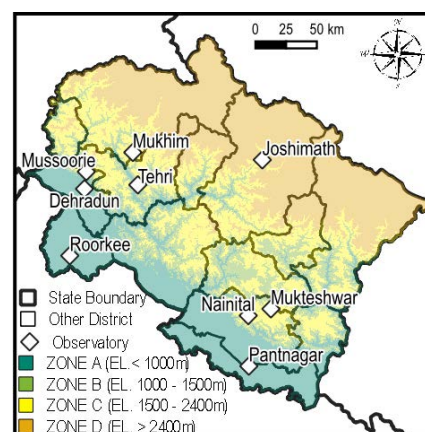
Figure 2.1.3 District-wise Distribution of Agro-climatic Zones

(2) Temperature³

Uttarakhand State has two distinct climatic regions: the predominant hilly terrain and the small plain region. The temperatures in the state vary from place to place according to topography and from time to time strongly affected by monsoon.

The temperature has been observed at nine observatories, of which locations are shown in Figure 2.1.5. The monthly mean maximum and minimum temperatures as a result of long-term observation are described in Figure 2.1.6.

The temperature rises from March and reaches the peak in May to June. The monthly mean maximum temperature reaches up to more than 34°C in the valley and plain areas such as Dehradun, Pantnagar, Tehri, and Roorkee. From September, the temperature tends to drop until January. The monthly mean

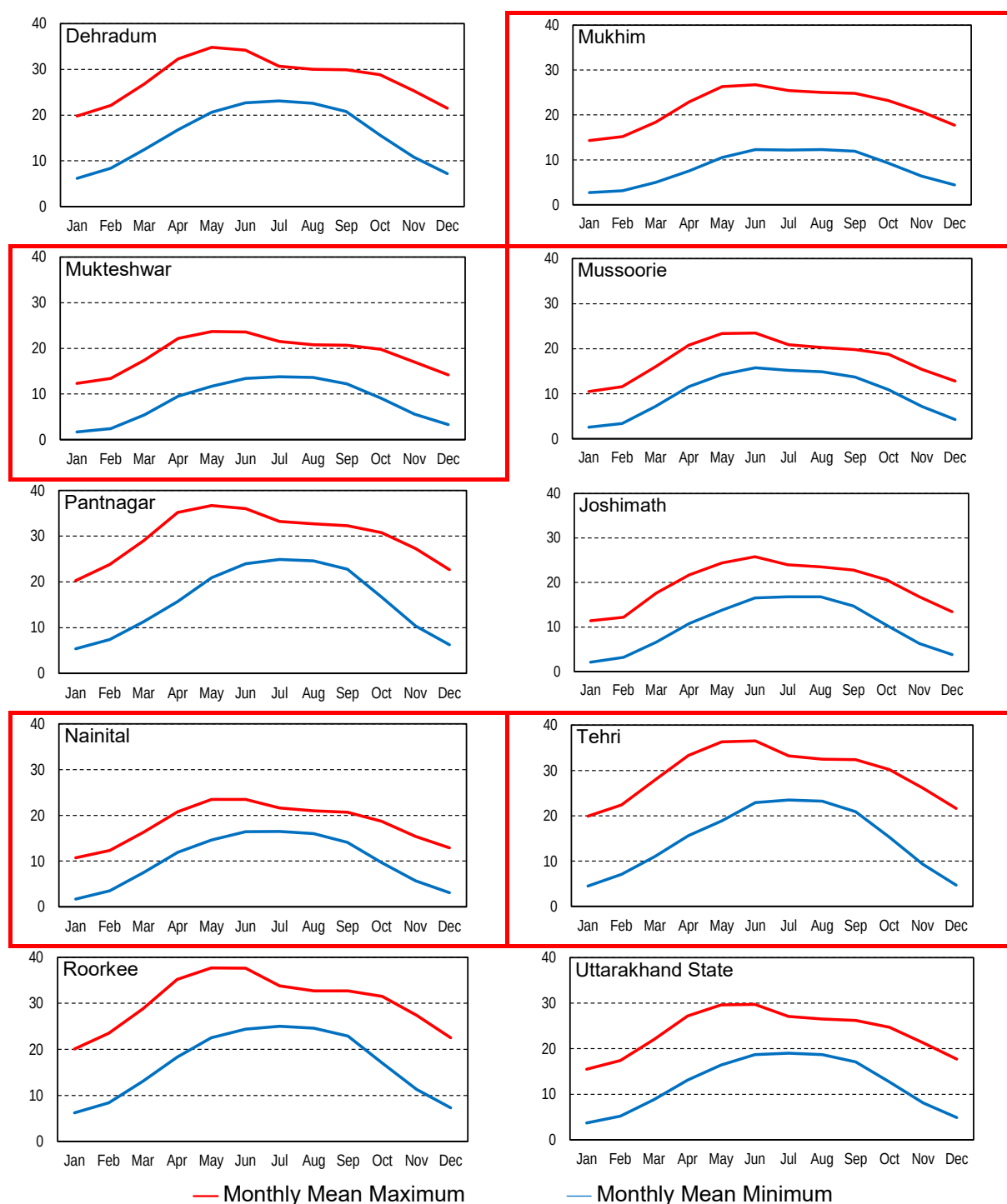


Source: Climate of Uttarakhand, Indian Meteorological Department

Figure 2.1.4 Location of Observatory

³ Uttarakhand Action Plan for Climate Change -Govt. of Uttarakhand

minimum temperature approaches to 0 °C in hilly and mountainous areas such as Mukhim, Mukteshwar, Mussoorie, Joshimath, and Nainital.



Remarks: Locations highlighted in blue are the nearest locations to the project districts.

Source: Climate of Uttarakhand, India Meteorological Department

Figure 2.1.5 Monthly Mean Maximum and Minimum Temperature in Uttarakhand

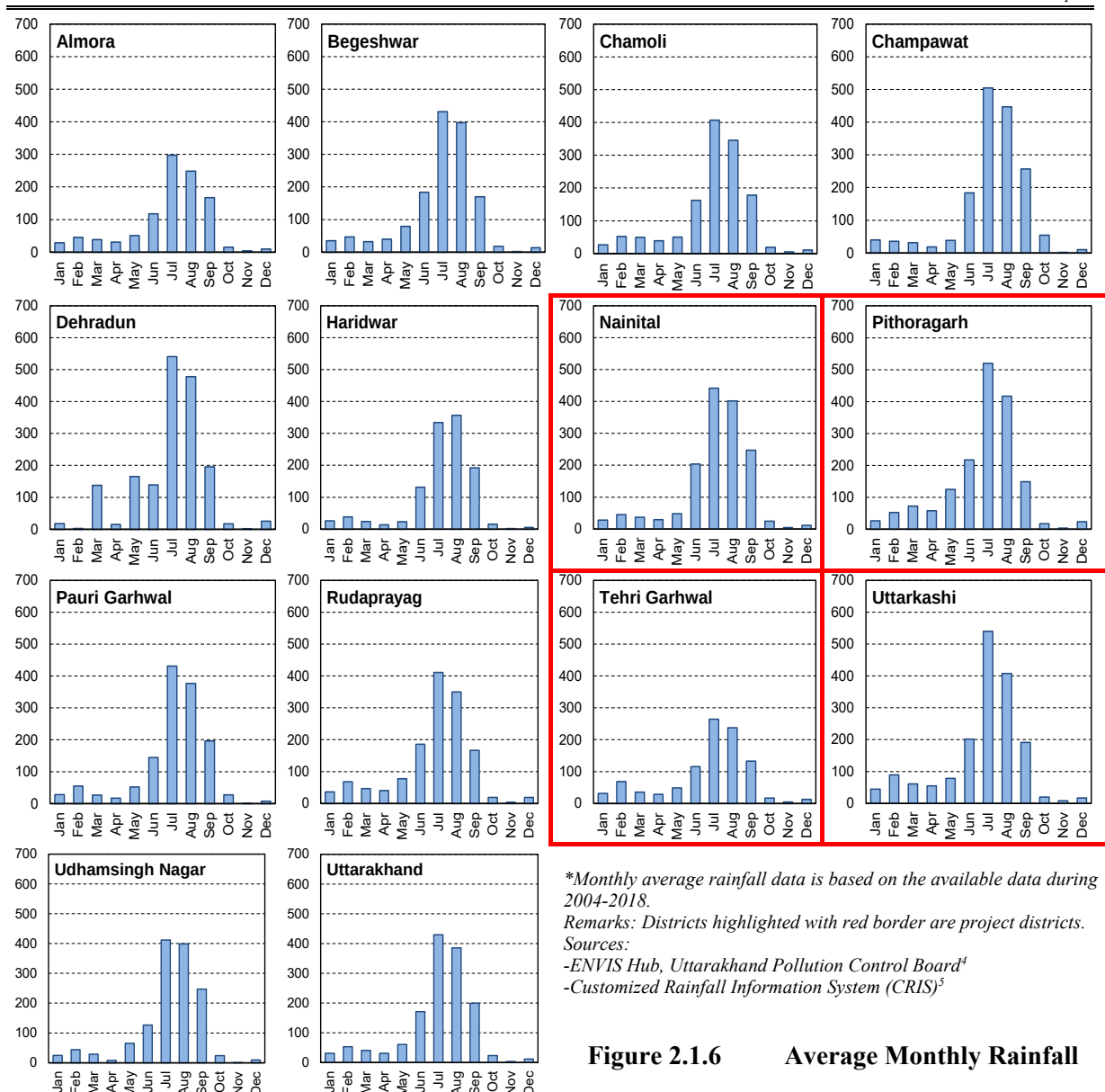


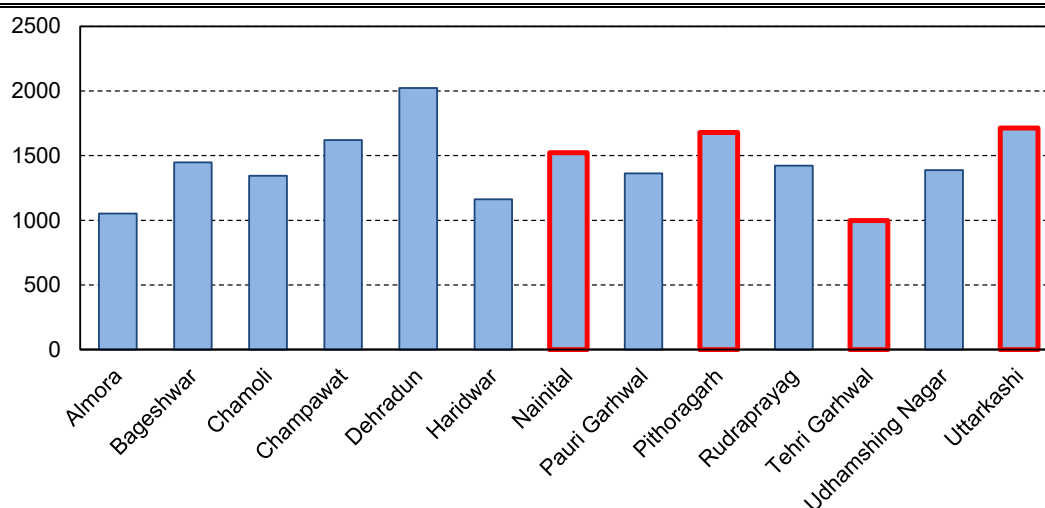
Figure 2.1.6 Average Monthly Rainfall

(3) Rainfall

The average annual rainfall of the 13 districts in Uttarakhand is around 1,400 mm and varies widely among the districts from less than 1,000 mm in Tehri Garhwal to more than 2,000 mm in Dehradun. The form of precipitation in the state is not only rain but also snow. Snow falls mostly in winter months from December to February. In particular, January is the month with the heaviest snowfall. On the other hand, the heaviest rainfall happens in the months of July and August, namely; the monsoon season. The southwest monsoon season is the main rainy season over the state. About 80% of annual rainfall occurs and 70% of annual rainy days are distributed in the southwest monsoon season (June to September)⁹.

⁴ <http://utrenvis.nic.in/rainfall%20data.html>

⁵ [http://hydro.imd.gov.in/hydrometweb/\(S\(uiqj4045fkp4etadz2qvjdeq\)\)/DistrictRaifall.aspx](http://hydro.imd.gov.in/hydrometweb/(S(uiqj4045fkp4etadz2qvjdeq))/DistrictRaifall.aspx)



Sources: ENVIS Hub, Uttarakhand Pollution Control Board and Customized Rainfall Information System (CRIS)¹¹

Figure 2.1.7 District-wise Average Annual Rainfall

2.1.2 Topography

(1) Topographical Features

Uttarakhand State is located between 28°43' - 31°27' N latitude and 77°34' - 81°02' E longitude in the northern part of India. The state is mostly hilly and has international boundary with China (Tibet) in the north and Nepal in the east and state boundary with Himachal Pradesh in the northwest. The state has foothills areas in the south and southwest, which are bounded by Uttar Pradesh. Uttarakhand has a total geographical area of 53,483 km², of which 86% is mountainous and 65% is covered by forest. The state is rich in natural resources especially water and forests with many glaciers, perennial rivers, dense forests, and snow-capped mountain peaks. Most of the northern parts of state are part of Greater Himalaya ranges covered by the high mountain peaks and glaciers. Two of India's mightiest rivers, Ganga and Yamuna, originate in the glaciers of Uttarakhand⁶.

Uttarakhand lies on the south slope of Himalaya ranges and the climate varies from sub-tropical forests at lower elevation to glaciers at higher elevation. The altitude in the state varies from 210 to 7817 meter above mean sea level. Within this altitudinal variation, the state comprises five litho-tectonically and physiographical distinct sub-divisions, namely,

- Outer Himalaya comprising Tarai and Bhabhar
- Sub-himalayan belt of Siwalik
- The Lesser Himalaya
- The Great Himalaya
- The Trans-Himalaya or Tethys

The highest elevations are covered by ice and snow. The upper Gangetic Plains, moist deciduous forests and the drier Tarai savanna and grassland cover the lowlands along the border of Uttar Pradesh.¹

The Garhwal Himalayas along with Kumaon and a part of Himachal Pradesh has unique characteristics as it has Tibet in the north, Upper Gangetic Plain in the south and Eastern Himalayan provinces in the east. Physiographically, Uttarakhand represents a cross-section of the Himalaya on the basis of its evolutionary history, namely; the Trans-Himalaya, Greater Himalaya or Himadri, Lesser Himalaya, Shiwalik Ranges foothills, and Terai and the Plains of Dehradun, Haridwar and Udham Singh Nagar⁷.

The floral & faunal composition is diverse and interesting. Between the Himalaya in the north and the hills and the plateau in the south lies a vast Gangetic Plains, which is one of the largest homogenous alluvial plains in the world. In Uttarakhand, the Bhabhar skirts the Shiwaliks mainly in Garhwal and Nainital- Pilibhit while the Terai extends from the River Yamuna in the west and a large portion of it lies in Nepal. The Terai in Uttarakhand covers a lower portion of Nainital² District.

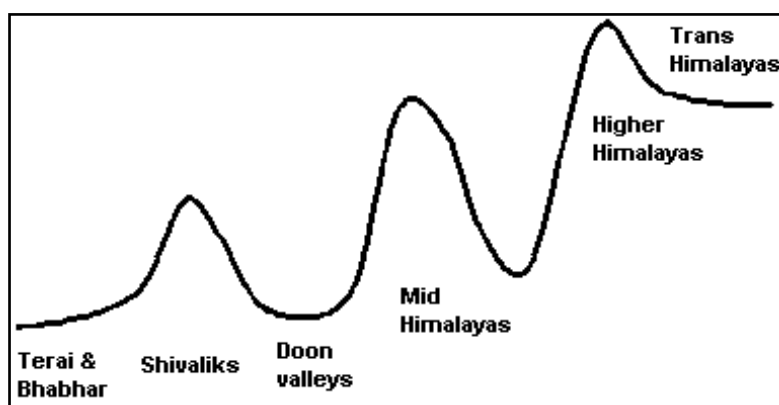
⁶ Observed rainfall variability & changes over Uttarakhand IMD Pune (Indian Meteorology Department) 1. Introduction

⁷ State Profile- Uttarakhand Biodiversity Board (www.sbb.uk.gov.in)

Major portion of the state is mountainous and these mountains (Himalayas) are one of the youngest mountain systems in the world (40 million years in age compared with peninsular mountains of 1,500-2,500 million years old) and hence, ecologically very fragile and relatively much more susceptible to earthquakes and landslides. Shiwalik Formations are one of the most important eco-regions due to their **endemism** and **past geological history**. The era of Shiwalik Ecosystem of rocks is called “**Age of Mammals**”. It is the filtering zone for migration of fauna and flora from highlands to lowlands and vice-versa. It is not only a **gateway to the enhanced biodiversity** but also to the green and white revolutions, industrialization and creation of livelihood opportunities. This region harboured a rich fauna in the geological past as evidenced by the discovery of fossils of amphibians, reptiles, and mammals. The wide altitudinal range is the richest zone in terms of habitat and biodiversity².

(2) Physiography⁸

The Uttarakhand Himalaya is divided into the distinct non-montane and montane physiographic zones as follows:



Source: Uttarakhand state perspective & strategic plan (2009-29) USPSP

Figure 2.1.8 Physiographic Zones of Uttarakhand

1) Non-montane

- **Bhabhar:** This is a level surface zone at the foothills of the Himalaya, 34 km wide, where the Himalayan torrents rush down from the steep slopes and disappear under boulders and gravels due to the extremely porous soil type of the Bhabhar.
- **Terai:** Situated below the Bhabhar and parallel to it, the Terai is a marshy and damp tract (once 80–90 km wide) containing fertile soils with good water retention capacity.

2) Montane

- **Sub-himalaya:** Called the Sub-himalaya because it possesses the least Himalayan features. It consists of two zones, the **Shivaliks**, the youngest of the Himalayan ranges and the **Doon** (flat longitudinal structural valleys) to the north of the Shivaliks. The Shivaliks extend in a narrow varying width of 6 to 30 km, with altitudes of 300–1,000 m.
- **Mid Himalayas:** This zone extends in a varying width of 60–90 km in an abrupt rise in elevation between 1,000 m and 3,000 m. It contains two types of physiographic sub-units: The Himachal ranges and the Himachal valleys and lake basins.
- **Higher Himalayas:** This zone has a varying width of 40–60 km. The altitude varies between 3,000 and 7,000 m. Except for the lower valleys, this zone is perpetually covered with snow and hence it is called Himadri. The region covers glacial landforms above 3,000 m. 1. State Profile Uttarakhand Action Plan for Climate Change 37
- **Trans Himalayas:** Also known as the Tethys Himalaya and the Indo-Tibet Plateau, the region is in the rain shadow of the Greater Himalaya and is therefore a cold desert; the region is within the watersheds of Ganga and Sharda.

2.1.3 Climate Change

(1) Climate Condition

Generally, climate is defined as the long-term average of weather. The present climate condition, the related information can be collected on long-term weather data, namely monthly maximum temperature, monthly minimum temperature, and monthly rainfall, from observatories in Uttarakhand. Spatial and temporal information of the observatories is summarised in the table below and mapped in Attachment 2.1.2.

Table 2.1.2 Observatories in Uttarakhand

SN	Observatory Name	District	Latitude	Longitude	Period
1	Almora	Almora	29.5892	79.6467	1981-2020 (40 years)
2	Bageshwar	Bageshwar	29.8404	79.7694	
3	Champawat	Champawat	29.3209	80.0088	
4	Joshimath	Chamoli	30.5506	79.5660	
5	Pantnagar	Pantnagar	29.0176	79.4825	
6	Pauri Garhwal	Pauri Garhwal	29.8688	78.8383	
7	Pithoragarh	Pithoragarh	29.5829	80.2182	
8	Rudra Prayag	Rudra Prayag	30.2844	78.9811	
9	Uttarkashi	Uttarkashi	30.7268	78.4354	
10	Dehradun	Dehradun	30.3349	77.9991	1997-2017 (21 years)
11	Nainital	Nainital	29.3584	79.4578	1982-2020 (39 years)
12	Ranichauri	Tehri Garhwal	30.3130	78.4065	1985-2020 (36 years)
13	Roorkee	Haridwar	29.8614	77.8933	2000-2020 (21 years)

Source: India Meteorological Department, NASA POWER Worldwide Energy Resources (<https://power.larc.nasa.gov/>)

The following table shows a summary of the long-term trends in the target districts and figures of the long-term weather data, namely line charts, are compiled in Attachment 2.1.3.

Table 2.1.3 Long-term Weather Trends in Target Districts

District	Monthly Max. Temp.	Monthly Min. Temp.	Monthly Rainfall	Observatory
Nainital	-0.002 °C month ⁻¹	+0.003 °C month ⁻¹	+0.10 mm month ⁻¹	Nainital
Pithoragarh	-0.002 °C month ⁻¹	+0.002 °C month ⁻¹	+0.14 mm month ⁻¹	Pithoragarh
Tehri Garhwal	+0.001 °C month ⁻¹	-0.003 °C month ⁻¹	+0.00 mm month ⁻¹	Ranichauri
Uttarkashi	-0.003 °C month ⁻¹	+0.002 °C month ⁻¹	+0.12 mm month ⁻¹	Uttarkashi

Sources: India Meteorological Department, NASA POWER Worldwide Energy Resources (<https://power.larc.nasa.gov/>)

(2) Projected Climate Change

Projected weather data of all the 13 districts of Uttarakhand can be referred to MarkSim (<http://gismap.ciat.cgiar.org/markSimGCM>) weather generator website, which is ensemble of all 17 GCMs to analyse trends of climatic parameters. The weather data has been generated for 2030, 2040, 2050, 2060 and 2070. The available data on website is the MarkSim web version for IPCC AR5 data (CMIP5) under the RCP scenario 2.6, RCP4.5, RCP 6.0 and RCP 8.5. The weather parameters viz. rainfall, maximum temperature and minimum temperature have been used for the trend analysis.

IPCC models use emission scenarios to estimate increase in average global temperature. The IPCC's 2007 assessment projected a worst-case temperature rise of 4.30 to 11.5 °F (2.4 to 6.4°C), with a high probability of 7.2°F (4.0 °C)⁹. The intensity of precipitation events shall likely increase on an average, particularly in tropical and high-latitude regions. These regions are also expected to experience overall increases in precipitation.

Increases in average global temperature are expected to be within range of 0.5 to 8.6 °F (0.3 to 4.8 °C) by 2100, with a likely increase of at least 2.7 °F (1.5 °C) for all scenarios except the one representing the most aggressive mitigation of greenhouse gas emissions. Based on existing commitments by countries to curb their emission, the world is on track for global temperature warming. The current global warming trends overall are likely to lead an increase in annual mean precipitation over India, with more severe rains expected over southern India in the coming decades, as per the IPCC sixth assessment report 2021.

⁹ IPCC (2007). AR4 Climate Change 2007: Synthesis Report, <https://www.ipcc.ch/report/ar4/syr/>

1) District-wise Analysis

The projected variation of monthly minimum, average, and maximum temperatures as well as annual precipitation between 2020 and each projected year, namely 2030, 2040, 2050, 2060 and 2070, under each emission scenario in the target districts are summarised in the following tables. The projected data is area-averaged in each district and analysed through GIS. Data provided by the download site and generated through GIS analysis are compiled in Attachment 2.1.4.

Table 2.1.4 Projected Variation of Temperature and Precipitation from 2020 in 50 years in Nainital

Item	Monthly Ave. Temp. (°C)				Monthly Max. Temp. (°C)				Monthly Min. Temp. (°C)				Annual Precipitation (mm)			
	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
RCP	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
2030	+0.786	+0.013	+0.239	+0.323	+0.798	-0.144	+0.246	+0.380	+0.722	+0.191	+0.206	+0.240	-153.73	+123.37	-283.13	+19.52
2040	+0.771	+0.518	+0.773	+0.966	+0.647	+0.201	+0.617	+1.033	+0.868	+0.829	+0.948	+0.916	+205.8	+13.73	-7.94	+133.89
2050	+0.509	+0.570	+1.352	+1.135	+0.520	+0.686	+1.470	+1.037	+0.497	+0.454	+1.257	+1.203	-10.84	-19.34	-499.84	+144.57
2060	+0.475	+0.895	+1.215	+1.649	+0.469	+1.195	+1.026	+1.618	+0.434	+0.646	+1.383	+1.684	-26.55	-302.93	+113.13	+201.81
2070	+0.637	+1.016	+1.470	+2.577	+0.59	+1.149	+1.323	+2.809	+0.675	+0.873	+1.654	+2.384	+38.97	+109.86	+44.99	-156.42

Source: Prepared by JICA Survey Team based on the data downloaded from MarkSim (<http://gismap.ciat.cgiar.org/markSimGCM>)

Table 2.1.5 Projected Variation of Temperature and Precipitation from 2020 in 50 years in Pithoragarh

Item	Monthly Ave. Temp. (°C)				Monthly Max. Temp. (°C)				Monthly Min. Temp. (°C)				Annual Precipitation (mm)			
	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
RCP	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
2030	+0.651	-0.108	+0.143	+0.196	+0.535	-0.368	+0.072	+0.225	+0.756	+0.157	+0.219	+0.231	-230.61	+173.40	-172.53	+12.56
2040	+0.518	+0.449	+0.681	+0.874	+0.327	+0.052	+0.529	+0.839	+0.731	+0.794	+0.893	+0.948	+295.94	+55.36	+58.26	+63.00
2050	+0.374	+0.778	+1.305	+1.240	+0.251	+0.766	+1.249	+1.065	+0.563	+0.757	+1.438	+1.480	-134.57	-116.97	-546.90	+100.76
2060	+0.377	+0.981	+1.049	+1.846	+0.237	+1.184	+0.834	+1.652	+0.508	+0.799	+1.304	+2.074	-162.10	-516.88	+188.74	+206.51
2070	+0.267	+1.269	+1.715	+2.694	+0.168	+1.323	+1.371	+2.634	+0.398	+1.175	+2.086	+2.877	+64.44	+155.69	+257.78	-286.75

Source: Prepared by JICA Survey Team based on the data downloaded from MarkSim (<http://gismap.ciat.cgiar.org/markSimGCM>)

Table 2.1.6 Projected Variation of Temperature and Precipitation from 2020 in 50 years in Tehri Garhwal

Item	Monthly Ave. Temp. (°C)				Monthly Max. Temp. (°C)				Monthly Min. Temp. (°C)				Annual Precipitation (mm)			
	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
RCP	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
2030	+0.576	+0.053	+0.127	+0.455	+0.487	-0.237	+0.037	+0.448	+0.591	+0.414	+0.252	+0.337	-77.67	+102.31	-170.53	-206.47
2040	+0.775	+0.607	+0.838	+1.046	+0.591	+0.207	+0.547	+1.038	+0.862	+1.072	+1.180	+0.930	+223.39	+215.90	+337.95	-252.44
2050	+0.524	+0.874	+1.351	+1.478	+0.433	+0.898	+1.292	+1.373	+0.507	+0.853	+1.450	+1.517	-40.60	+34.26	-281.44	-138.11
2060	+0.299	+1.055	+1.168	+1.968	+0.258	+1.373	+0.860	+1.843	+0.332	+0.798	+1.436	+2.030	-131.27	-427.46	+312.53	+180.58
2070	+0.429	+1.304	+1.621	+2.896	+0.329	+1.482	+1.323	+2.933	+0.436	+1.133	+1.988	+2.771	+24.40	+287.81	+557.32	-366.19

Source: Prepared by JICA Survey Team based on the data downloaded from MarkSim (<http://gismap.ciat.cgiar.org/markSimGCM>)

Table 2.1.7 Projected Variation of Temperature and Precipitation from 2020 in 50 years in Uttarkashi

Item	Monthly Ave. Temp. (°C)				Monthly Max. Temp. (°C)				Monthly Min. Temp. (°C)				Annual Precipitation (mm)			
	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
RCP	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
2030	+0.488	-0.147	+0.089	+0.361	+0.445	-0.343	+0.030	+0.375	+0.481	+0.128	+0.166	+0.284	-79.89	+106.46	-107.96	-173.99
2040	+0.625	+0.457	+0.755	+0.931	+0.491	+0.170	+0.533	+0.959	+0.715	+0.822	+0.991	+0.834	+181.34	+215.60	+337.45	-260.10
2050	+0.378	+0.798	+1.261	+1.448	+0.349	+0.867	+1.224	+1.346	+0.333	+0.754	+1.318	+1.491	-97.08	+16.53	-196.30	-111.91
2060	+0.241	+1.005	+1.021	+1.971	+0.244	+1.297	+0.804	+1.832	+0.263	+0.772	+1.224	+2.051	-154.58	-346.91	+283.31	+177.95
2070	+0.341	+1.313	+1.690	+2.863	+0.290	+1.479	+1.407	+2.878	+0.339	+1.176	+2.033	+2.793	-14.09	+270.60	+517.51	-312.12

Source: Prepared by JICA Survey Team based on the data downloaded from MarkSim (<http://gismap.ciat.cgiar.org/markSimGCM>)

2) Agro-climate-zone-wise Analysis

Since climate and its change are affected by topography, the JICA Survey team also analysed climate change on the basis of agro-climate zones in Uttarakhand, which is classified by elevation. The results are described in Attachment 2.1.5 and summarised as follows.

Table 2.1.8 Projected Variation of Temperature and Precipitation from 2020 in 50 years in Agro-climate Zone A (EL. < 1,000m)

Agro-climate Zone A (Elev. < 1,000m)																
Item	Monthly Ave. Temp. (°C)				Monthly Max. Temp. (°C)				Monthly Min. Temp. (°C)				Annual Precipitation (mm)			
RCP	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
2030	+0.684	+0.010	+0.249	+0.356	+0.784	-0.107	+0.269	+0.427	+0.558	+0.131	+0.215	+0.239	-87.77	+106.58	-253.15	-38.61
2040	+0.774	+0.455	+0.759	+0.955	+0.685	+0.217	+0.596	+1.060	+0.835	+0.678	+0.922	+0.834	+179.80	+55.32	+42.55	+41.77
2050	+0.452	+0.529	+1.331	+1.135	+0.541	+0.680	+1.467	+1.108	+0.357	+0.377	+1.213	+1.114	+12.82	+20.16	-396.55	+80.46
2060	+0.426	+0.928	+1.198	+1.628	+0.476	+1.200	+1.014	+1.649	+0.343	+0.679	+1.341	+1.581	-7.18	-236.53	+113.39	+179.26
2070	+0.602	+1.026	+1.445	+2.607	+0.607	+1.156	+1.325	+2.894	+0.598	+0.888	+1.591	+2.322	+45.37	+149.19	+85.10	-160.30

Source: Prepared by JICA Survey Team based on the data downloaded from MarkSim (<http://gismap.ciat.cgiar.org/markSimGCM/>)

Table 2.1.9 Projected Variation of Temperature and Precipitation from 2020 in 50 years in Agro-climate Zone B (EL. 1,000-1,500 m)

Item	Monthly Ave. Temp. (°C)				Monthly Max. Temp. (°C)				Monthly Min. Temp. (°C)				Annual Precipitation (mm)				
	RCP	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
2030		+0.674	+0.042	+0.177	+0.360	+0.615	-0.192	+0.130	+0.393	+0.687	+0.322	+0.219	+0.307	-118.18	+118.39	-232.51	-62.27
2040		+0.778	+0.580	+0.736	+1.009	+0.595	+0.175	+0.517	+1.036	+0.915	+0.986	+0.987	+0.972	+229.56	+67.83	+152.24	+21.71
2050		+0.506	+0.749	+1.283	+1.293	+0.458	+0.771	+1.328	+1.164	+0.543	+0.706	+1.278	+1.394	-31.89	-39.12	-432.96	+19.33
2060		+0.390	+0.953	+1.166	+1.778	+0.351	+1.232	+0.923	+1.690	+0.406	+0.740	+1.373	+1.871	-67.71	-407.40	+239.11	+201.10
2070		+0.544	+1.136	+1.493	+2.689	+0.433	+1.253	+1.255	+2.812	+0.639	+1.017	+1.779	+2.588	+49.83	+191.23	+285.08	-269.75

Source: Prepared by JICA Survey Team based on the data downloaded from MarkSim (<http://gismap.ciat.cgiar.org/markSimGCM/>)

Table 2.1.10 Projected Variation of Temperature and Precipitation from 2020 in 50 years in Agro-climate Zone C (EL. 1,500-2,400 m)

Item	Monthly Ave. Temp. (°C)				Monthly Max. Temp. (°C)				Monthly Min. Temp. (°C)				Annual Precipitation (mm)				
	RCP	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
2030		+0.648	+0.018	+0.161	+0.344	+0.575	-0.227	+0.107	+0.374	+0.678	+0.313	+0.215	+0.302	-133.52	+122.42	-212.24	-80.29
2040		+0.739	+0.560	+0.723	+0.989	+0.555	+0.160	+0.512	+1.003	+0.885	+0.964	+0.975	+0.959	+232.35	+85.73	+171.62	-26.84
2050		+0.484	+0.773	+1.276	+1.314	+0.421	+0.792	+1.293	+1.184	+0.532	+0.737	+1.303	+1.425	-59.79	-45.91	-417.38	+0.47
2060		+0.371	+0.971	+1.134	+1.816	+0.317	+1.245	+0.892	+1.703	+0.410	+0.753	+1.355	+1.924	-99.24	-425.47	+241.33	+199.97
2070		+0.488	+1.180	+1.533	+2.717	+0.376	+1.301	+1.272	+2.797	+0.586	+1.060	+1.839	+2.657	+40.47	+202.99	+327.71	-290.72

Source: Prepared by JICA Survey Team based on the data downloaded from MarkSim (<http://gismap.ciat.cgiar.org/markSimGCM/>)

Table 2.1.11 Projected Variation of Temperature and Precipitation from 2020 in 50 years in Agro-climate Zone D (EL. >2,400 m)

Item	Monthly Ave. Temp. (°C)				Monthly Max. Temp. (°C)				Monthly Min. Temp. (°C)				Annual Precipitation (mm)				
	RCP	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5	2.6	4.5	6.0	8.5
2030		+0.515	-0.174	+0.106	+0.257	+0.464	-0.405	+0.054	+0.263	+0.561	+0.075	+0.187	+0.237	-135.85	+169.57	-114.54	-87.98
2040		+0.484	+0.391	+0.739	+0.865	+0.336	+0.081	+0.569	+0.851	+0.637	+0.713	+0.958	+0.837	+266.66	+220.73	+207.43	-134.82
2050		+0.296	+0.792	+1.322	+1.339	+0.225	+0.828	+1.251	+1.200	+0.380	+0.757	+1.457	+1.493	-111.80	-15.27	-358.04	-18.51
2060		+0.247	+1.028	+1.006	+1.934	+0.188	+1.253	+0.804	+1.748	+0.332	+0.820	+1.248	+2.093	-173.81	-395.38	+222.13	+194.95
2070		+0.176	+1.355	+1.795	+2.816	+0.140	+1.454	+1.465	+2.751	+0.209	+1.230	+2.173	+2.916	+51.12	+245.98	+409.99	-298.50

Source: Prepared by JICA Survey Team based on the data downloaded from MarkSim (<http://gismap.ciat.cgiar.org/markSimGCM/>)

According to the results, change of temperatures and precipitation are generally more moderate in the lower area in comparison with which in the higher area. Although the fluctuation of annual precipitation seems unstable and large, it is normal and observed in long-term weather data. Monthly temperatures are projected to increase in all scenarios after 2040, while the range of their variation is different. Monthly maximum and minimum temperatures increase at 2.9°C in Zone A and Zone D, respectively, in the most extreme case, namely RCP8.5. The increase of monthly temperatures around 3°C may impact crop cultivation and the optimum areas of each crop may be shifted. Therefore, the Project should be organized in consideration with the climate change.

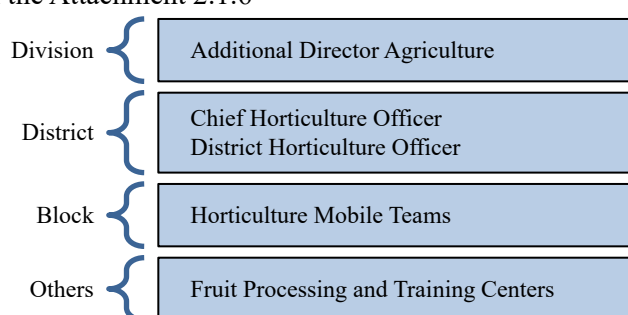
2.1.4 Administrative Structure

(1) Local Administration

The local governance system of the state is based on 3-tier system of Panchayat Raj Institutions (PRI) comprised of gram panchayat consisting of a few revenue villages – panchayat samiti at the block level

(2) Horticulture Administration

Each division is anchored by a Chief Horticulture Officer and District Horticulture Officer, whereas a Horticulture Mobile Team provides ground level support which is situated at the block level. A total of 319 mobile teams are working as of now in the state. Each team comprised 3-4 gardeners (mali) under the leadership of one Assistant Development Officer (ADO). The ADO holds a bachelor's degree in science, agriculture or any other relevant discipline. There is no technical training provided for them upon joining the services. Gardeners with the educational qualification of 5th or 8th standards will attend the one-year diploma program at the Horticulture Research and Training Center at Chaubatiya, Uttarakhand, where they will learn various skills and knowledge related to horticulture crops. In-service training seems to be carried out. In the case of Nainital, in-service training for ADOs and gardeners were conducted for six days¹⁰. The topics included cultivation of sub-tropical and temperate fruits trees, organic farming, and fruits plant propagation. The training topic shared by the Nainital Office concentrates around production technologies and no topics associated with postharvest techniques including value addition and marketing are included. The details of the organizational structure of UKDHFP are provided in the Attachment 2.1.6



Source: <https://shm.uk.gov.in/>

Figure 2.1.10 Horticulture Administration System

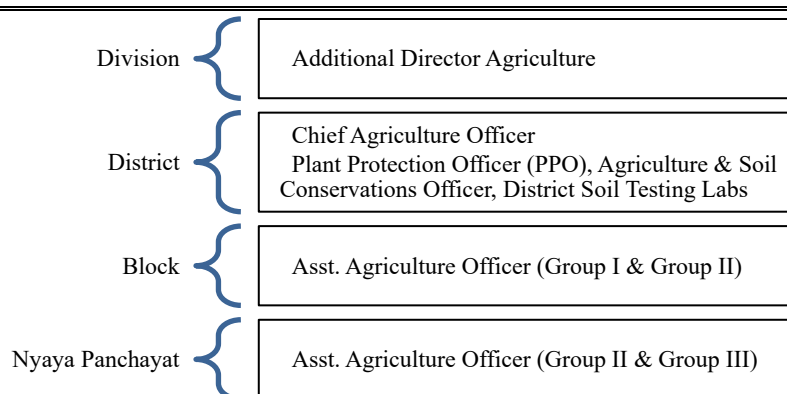
There are 48 fruit processing and training centers, which provide training to the farmers and process their raw fruits. These units of the Horticulture Department provide training to the farmers and entrepreneurs on various food processing such as pickle making, tomato sauce making, and juice making. Besides receiving training, people also come to these centers with all raw materials to get their fruits processed in the form of juice, jam, jelly, and pickles. These are more like 'Service Centers' of the Horticulture Department. The Horticulture Department facilitate farmers but do not produce, process and market their own products. Hence, the department is not producing their own products with some brand. It has its own staff for training and providing processing services. At the fruits processing center, the issues mainly reported were the deficiencies of modern infrastructures.¹¹

(3) Agriculture Administration

In Uttarakhand, the government support system in the agriculture has been established up to Nyaya Panchayat level. Each division is anchored by an Additional Director Agriculture, whereas district-level activities are carried out by the Chief Agriculture Officer.

¹⁰ Information related to the Horticulture Mobile Team and their training is based on the information provided by UKDHFP.

¹¹ Training programs are yet to be received by the survey team. The issues and needs were reported by the UKDHFP as in Attachment 2.1.7.



Source: Administrative Structure of Agriculture Department, <https://agriculture.uk.gov.in/pages/display/224-department-structure>

Figure 2.1.11 Agriculture Administration System

2.1.5 Demographic Feature

(1) Population

The Uttarakhand State has a total population of 10,086,292 and total households 2,056,975. This shows that the average family size in Uttarakhand is 5. Out of the total households, majority (69.28%) are living in the rural areas and remaining (30.72%) in urban areas. The decadal growth of population from 2001 to 2011 was 18.81% with high level of variations in the decadal growth of the districts. There are two districts - Pauri Garhwal and Almora, that have negative population growth. On the other hand there are districts like Udham Singh Nagar and Haridwar showing more than 30% growth in population. Population density per km² in three districts, Haridwar (801), Udham Singh Nagar (649), and Dehradun (549) is quite high whereas in districts like Uttarkashi and Chamoli, it is even less than 50 per km². Table 2.1.13 below provides details of the district-wise area, number of households, population, decadal growth and the density of population.

Table 2.1.13 Area, Density and Decadal Growth of Population by District

District	Area (km ²)	No. of Households (2011)			Population		Decadal Growth in Population (%)	Density per km ² (2011 Census)
		Rural	Urban	Total	2001 Census	2011 Census		
Almora	3,139	125,209	15,368	140,577	630,567	622,506	-1.28	198
Bageshwar	2,246	55,992	2,054	58,046	249,462	259,898	4.18	116
Chamoli	8,030	74,318	14,646	88,964	370,359	391,605	5.74	49
Champawat	1,766	45,741	8,212	53,953	224,542	259,648	15.63	147
Dehradun	3,088	144,112	202,889	347,001	1,282,143	1,696,694	32.33	549
Haridwar	2,360	204,477	133,627	338,104	1,447,187	1,890,422	30.63	801
Nainital	4,251	114,954	76,429	191,383	762,909	954,605	25.13	225
Pauri Garhwal	5,329	136,180	25,598	161,778	697,078	687,271	-1.41	129
Pithoragarh	7,090	96,971	17,759	114,730	462,289	483,439	4.58	68
Rudrapur	1,984	50,882	2,660	53,542	227,439	242,285	6.53	122
Tehri Garhwal	3,642	115,691	17,023	132,714	604,747	618,931	2.35	170
Udham Singh Nagar	2,542	198,645	109,936	308,581	1,235,614	1,648,902	33.45	649
Uttarkashi	8,016	61,914	5,688	67,602	295,013	330,086	11.89	41
Total	53,483	1,425,086	631,889	2,056,975	8,489,349	10,086,292*	18.81	189

Source: JICA Survey Team based on the data of Revenue Department of Uttarakhand; Census of India 2011 and Statistical Diary 2018-19 Uttarakhand, Economic and Statistical Directorate

*The figure includes 187,432 (M: 97,591/F: 89,841) inhabitants in the 244 forest settlements.

(2) Gender-wise Population Details

The gender-wise population details of Uttarakhand in different districts are varying. The state has 963 females on every 1000 males as per the data of 2011 Census. The sex ratio was 962 in the census of 2001. This shows that in Uttarakhand, the average sex ratio has remained almost the same. Leaving aside three districts – Udham Singh Nagar, Haridwar and Dehradun, all other districts have population

below 0.1 million. In most of the districts (7 districts), the sex ratio is higher than 1,000. It is observed that in the earlier census (2001), Champawat District had a sex ratio of more than 1,000 but in 2011, it has gone less than 1,000. Percentage of men in the state, out of the total, is nearly 51% and women, 49%.

Table 2.1.14 Gender-wise Population Details of Districts

District	Population							
	2001 Census				2011 Census			
	Male	Female	Total	Sex Ratio No. of Females per 1,000 Males	Male	Female	Total	Sex Ratio No. of Females per 1,000 Males
Almora	293,848	336,719	630,567	1,145	291,081	331,425	622,506	1,142
Bageshwar	118,510	130,952	249,462	1,106	124,326	135,572	259,898	1,093
Chamoli	183,745	186,614	370,359	1,016	193,991	197,614	391,605	1,021
Champawat	111,084	113,458	224,542	1,021	131,125	128,523	259,648	981
Dehradun	679,583	602,560	1,282,143	887	892,199	804,495	1,696,694	902
Haridwar	776,021	671,166	1,447,187	865	1,005,295	885,127	1,890,422	879
Nainital	400,254	362,655	762,909	906	493,666	460,939	954,605	933
Pauri Garhwal	331,061	366,017	697,078	1,106	326,829	360,442	687,271	1,103
Pithoragarh	227,615	234,674	462,289	1,031	239,306	244,133	483,439	1,021
Rudrapur	107,535	119,904	227,439	1,115	114,589	127,696	242,285	1,120
Tehri Garhwal	295,168	309,579	604,747	1,049	297,986	320,945	618,931	1,078
Udham Singh Nagar	649,484	586,130	1,235,614	902	858,783	790,119	1,648,902	919
Uttarkashi	152,016	142,997	295,013	941	168,597	161,489	330,086	959
Total	4,325,924	4,163,425	8,489,349	962	5,137,773	4,948,519	10,086,292	963

Source: JICA Survey Team based on the data of Revenue Department of Uttarakhand; Census of India 2011 and Statistical Diary 2018-19 Uttarakhand, Economic and Statistical Directorate

(3) Population of Scheduled Castes and Scheduled Tribes

A district-wise analysis of the Scheduled Caste and Scheduled Tribe population reveals that the state has an average of 18.76% Scheduled Castes and 2.89% Scheduled Tribes. As far as Scheduled Tribes are concerned, Dehradun (6.58%) and Udham Singh Nagar (7.46%) has high percentage of Schedule Tribes compared with the other 11 districts. The percentage of Scheduled Caste population is high in Bageshwar (27.73) and Pithoragarh (24.90), while it is low in districts like Dehradun (13.49) and Udham Singh Nagar (14.45) compared with other districts which have more than 15% and less than 28% population of Scheduled Castes. The table below shows the district wise and gender wise percentages of the SC/ST population out of the total population.

Table 2.1.15 Population of Scheduled Castes and Scheduled Tribes – 2011 Census

District	Scheduled Caste				Scheduled Tribes			
	Male	Female	Total	Percentage to Total Population	Male	Female	Total	Percentage to Total Population
Almora	72,695	78,300	150,995	24.26	633	648	1,281	0.21
Bageshwar	35,623	36,438	72,061	27.73	971	1,011	1,982	0.76
Chamoli	39,718	39,599	79,317	20.25	6,021	6,239	12,260	3.13
Champawat	24,188	23,195	47,383	18.25	777	562	1,339	0.52
Dehradun	120,430	108,471	228,901	13.49	58,264	53,399	111,663	6.58
Haridwar	217,981	193,293	411,274	21.26	3,385	2,938	6,323	0.33
Nainital	98,824	92,382	191,206	20.03	3,801	3,694	7,495	0.79
Pauri Garhwal	59,842	62,519	122,361	17.80	1,174	1,041	2,215	0.32
Pithoragarh	60,111	60,267	120,378	24.90	9,558	9,977	19,535	4.04
Rudrapur	23,585	24,094	47,679	19.68	217	169	386	0.16
Tehri Garhwal	50,371	51,759	102,130	16.50	459	416	875	0.14
Udham Singh Nagar	124,385	113,879	238,264	14.45	61,758	61,279	123,037	7.46
Uttarkashi	40,833	39,734	80,567	24.41	1,651	1,861	3,512	1.06
Total	968,586	923,930	1,892,516	18.76	148,669	143,234	291,903	2.89

Source: JICA Survey Team based on the data of Revenue Department of Uttarakhand; Census of India 2011 and Statistical Diary 2018-19 Uttarakhand, Economic and Statistical Directorate

Note: In percentage calculations, digits up to two are taken after the decimal. The percentages are rounded off after the decimal and made limited to two digits. NCES Standard 5-3-3 is used in rounding off. (https://nces.ed.gov/statprog/2002/std5_3.asp)

STANDARD 5-3-3: If the first digit to be dropped is less than 5, the last retained digit is not changed.

6.1273 is rounded to 6.127; If the first digit to be dropped is greater than or equal to 5, the last digit retained is increased by 1. 6.6888 is rounded to 6.69; 5.451 is rounded to 5.5

(4) Population Ratio by Religion

Across the districts, the majority of population is Hindus. In four districts of Dehradun, Nainital, Udham Singh Nagar and Haridwar, sizable population following other religions are seen. The population of various religious communities as per the Census of India 2011 is given in the table below.

Table 2.1.16 Population Data by Religion -2011 Census

District	Population of Different Districts and Religion-wise Total Percentage							
	Total Population	Hindus	Sikhs	Muslims	Christians	Buddhist	Jains	Others and Religion Not Stated
Almora	622,506	611,250	256	7,752	1,895	201	31	1,121
Bageshwar	259,898	257,509	46	1,440	397	102	7	397
Chamoli	391,605	385,818	323	4,395	428	190	11	440
Champawat	259,648	249,563	336	8,693	870	24	28	134
Dehradun	1,696,694	1,424,916	36,454	202,057	13,416	11,778	5,117	2,956
Haridwar	1,890,422	1,214,935	17,364	648,119	4,878	709	2,501	1,916
Nainital	954,605	809,717	17,419	120,742	5,091	570	356	710
Pauri Garhwal	687,271	660,507	619	22,931	2,161	58	212	783
Pithoragarh	483,439	475,105	260	,6015	1,401	185	13	460
Rudraprayag	242,285	240,170	38	1,486	171	9	4	407
Tehri Garhwal	618,931	609,835	290	7,374	656	32	91	653
Udham Singh Nagar	1,648,902	1,104,452	162,768	372,267	6,064	505	738	2,108
Uttarkashi	330,086	324,859	167	3,554	353	563	74	516
Total	10,086,292	8,368,636	236,340	1,406,825	37,781	14,926	9,183	12,601
Percentage out of total	100	82.97	2.34	13.95	0.37	0.15	0.09	0.13

Source: JICA Survey Team based on the data of Statistical Diary 2018-19 Uttarakhand, Economic and Statistical Directorate, Govt. of Uttarakhand

(5) Distribution of Workforce – 2011 Census

1) Agriculture Sector

Out of the total workers in the state, 74.1% (2,870,624 persons) are main workers (engaged in economic activities for more than 6 months a year) and 25.9% (1,001,651 persons) are categorized under marginal workers (engaged in economic activities for less than 6 months a year). Out of the main workers category, 36.4% or 1,045,674 persons are main cultivators who are engaged in farming activities for more than 6 months in a year and 8.6% or 247,256 are main agriculture laborers who work in the agriculture field owned by others for more than 6 months a year¹². About 2.7% or 77,040 persons are engaged in household industries. 52.3% or 1,500,654 are categorized under other works, of which male workers account for 85% of the total for the sector.

Under the main cultivator category, women constitute a bulk of the workforce in the hilly districts (i.e., Rudraprayag, Almora, Bageshwar, Pithoragarh, and Pauri Garhwal, etc.) while the districts located in the plain area like in Haridwar and U.S. Nagar, the male population engaged in agriculture exceeds that of the female. This is partly due to the out-migration of the male family members to other states, which is a common phenomenon in the hilly districts where the livelihood options are limited¹³. On the other hand, male farm laborers outnumber that of the female by accounting for 79.4% of the total number of farm labourers. The gender-segregated main cultivator and agriculture laborer population in each district are given in the table below.

¹² Definitions of main cultivator and main agriculture labourer are as per the Census of India 2011.

¹³ Human Development Report 2018, Department of Planning, Government of Uttarakhand.

Table 2.1.17 Gender-Segregated Workforce – Main Cultivator and Main Agriculture Laborers (2011 Census)

District	Main Cultivator*					Main Agricultural Laborers**				
	Male		Female		Total	Male		Female		Total
	Persons	% in District, Total	Persons	% in District, Total	Persons	Persons	% in District Total	Persons	% in District Total	Persons
Almora	47,028	35.6	85,101	64.4	132,129	2,151	53.4	1,874	46.6	4,025
Bageshwar	20,161	37.3	33,895	62.7	54,056	1,509	55.2	1,224	44.8	2,733
Chamoli	28,071	40.3	41,541	59.7	69,612	623	58.1	449	41.9	1,072
Champawat	17,841	55.8	14,130	44.2	31,971	1,433	72.4	547	27.6	1,980
Dehradun	41,169	68.2	19,204	31.8	60,373	16,847	82.5	3,577	17.5	20,424
Haridwar	81,752	93.0	6,198	7.0	87,950	68,451	90.1	7,502	9.9	75,953
Nainital	57,569	56.9	43,652	43.1	101,221	13,318	67.9	6,300	32.1	19,618
Pauri Garhwal	29,483	39.2	45,770	60.8	75,253	2,596	62.5	1,558	37.5	4,154
Pithoragarh	33,777	38.7	53,412	61.3	87,189	1,218	55.3	986	44.7	2,204
Rudrapur	20,068	35.3	36,816	64.7	56,884	696	45.8	823	54.2	1,519
Tehri Garhwal	42,409	43.5	55,114	56.5	97,523	2,007	56.0	1,575	44.0	3,582
U. S. Nagar	79,644	84.1	15,033	15.9	94,677	84,000	78.1	23,603	21.9	107,603
Uttarkashi	46,589	48.1	50,247	51.9	96,836	1,526	63.9	863	36.1	2,389
Total	545,561	52.2	500,113	47.8	1,045,674	196,375	79.4	50,881	20.6	247,256

Source: JICA Survey Team based on the data of Statistical Diary 2018-19 Uttarakhand, Economic and Statistical Directorate, Govt. of Uttarakhand

Definition: *Main Cultivator: The population engaged in agriculture activities for more than 6 months a year. ** Main Agriculture Laborers: The population engaged in agriculture activities on the land owned by others for more than 6 months a year. (Census of India 2011).

Note: Figures given in parentheses are percentages to the total population

2) Manufacturing and Accommodation and Food Sectors

Manufacturing, and accommodation and food sectors are other major sectors providing employment opportunities. In the state, 7.3% of the total population or 208,597 persons are engaged in manufacturing and 1.5% or 43,403 persons are in the accommodation and food industries. Gender-wise, 85% in manufacturing and 95.1% in the accommodation and food sectors are male workers.

Table 2.1.18 Gender-Segregated Workforce: Manufacturing and Accommodation and Food Sectors

District	Main* Workers	Manufacturing				Accommodation and Food			
	Total	Total		Males	Females	Total		Males	Females
		Persons	%to District Total	Persons	Persons	Persons	%to District Total	Persons	Persons
Almora	201,238	4,328	2.2%	3,608	720	2,502	1.2%	2,452	50
Bageshwar	77,942	1,823	2.3%	1,497	326	848	1.1%	829	19
Chamoli	114,398	3,200	2.8%	2,308	892	1,256	1.1%	1,224	32
Champawat	62,770	1,943	3.1%	1,773	170	877	1.4%	855	22
Dehradun	488,149	40,954	8.4%	34,423	6,531	12,133	2.5%	11,270	863
Garhwal	164,661	6,492	3.9%	5,688	804	2,418	1.5%	2,382	36
Haridwar	495,223	63,238	12.8%	54,834	8,404	5,826	1.2%	5,442	384
Nainital	296,059	20,766	7.0%	18,410	2,356	5,546	1.9%	5,274	272
Pithoragarh	145,385	4,782	3.3%	3,310	1,472	1,368	0.9%	1,276	92
Rudrapur	78,974	1,483	1.9%	1,206	277	831	1.1%	815	16
Tehri Garhwal	165,891	3,880	2.3%	3,392	488	5,328	3.2%	5,224	104
U.S. Nagar	449,960	53,702	11.9%	45,308	8,394	3,694	0.8%	3,474	220
Uttarkashi	128,333	2,006	1.6%	1,592	414	776	0.6%	740	36
Total	2,868,983	208,597	7.3%**	177,349	31,248	43,403	1.5%**	41,257	2,146

Source: Census of India 2011

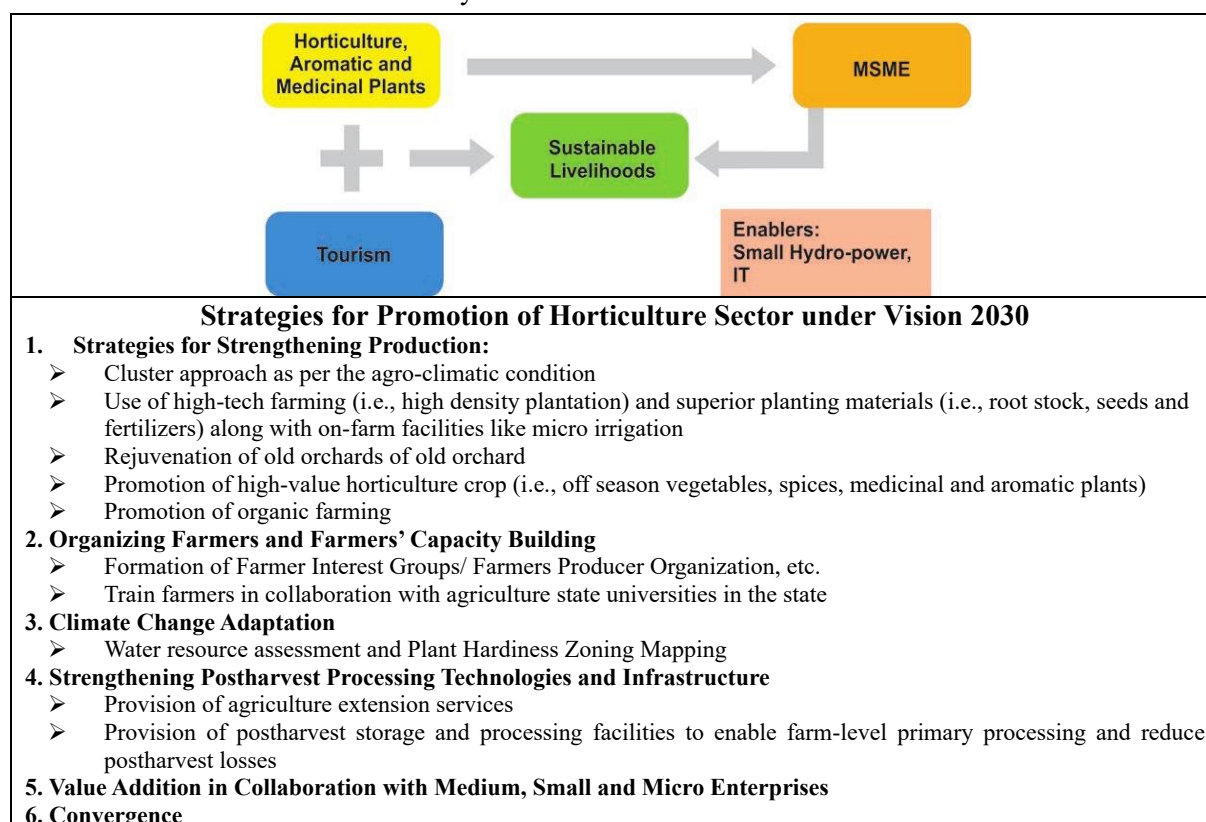
*Main Workers: Those engaged in the work for more than 6 months in a year.

**% to State Total

2.2 State of Economy

2.2.1 Economic Development Policy of Uttarakhand

Uttarakhand, a new state established in 2002, is blessed with rich natural resources. However, making a living in the Himalayan hills was limited and this drove the rural population out to urban areas in order to earn. The Government of Uttarakhand has developed a policy document “Uttarakhand Vision 2030” in 2018. In the document, the process to attain inclusive and sustainable development was depicted. The development scenario is based on horticulture, medicinal and aromatic plants, and tourism. Enhancing the yield of horticulture crops in the hilly regions of the state is critical in this process. The tourism sector also needs to be transformed and further developed and strengthened. By developing these sectors, small and micro enterprise will be activated and will generate employment opportunities within the state. To facilitate the process, the energy sector based on the hydropower and IT sectors will be promoted. Accordingly, the State Government of Uttarakhand shall implement various interventions and investments in the abovementioned key sectors.



Source: Uttarakhand Vision 2030 (2018). Department of Planning, Government of Uttarakhand. (p.8)

Figure 2.2.1 Strategy for Creating Sustainable Livelihood

2.2.2 Major Industry

The state economy of Uttarakhand indicates steady growth between 2011/12–2020/21. During the period, the Gross State Domestic Product (GSDP) had grown by 4.11%, which was largely derived from the growth in the secondary and tertiary sectors. Especially, the storage and trade, repair, hotel and restaurants show the significant growth. On the other hand, the growth of the agriculture sector slowed down over the years and year by year, its contribution to the State GDP declined. Among the agriculture subsectors, the crop sector has been facing negative growth. The table below provides the sector-wise GSDP of Uttarakhand along with the compounded growth rate for the year 2019-20 and 2020-21, taking 2011-12 as the base year .

Table 2.2.1 Growth of Gross State Domestic Product of Uttarakhand at Constant Prices

Sl. No	Sector/ Sub-sector	2019-20 (PE)	2020-21 (AE)	Compounded Growth Rate (%)	
		In 100,000INR		2011/12-2019/20	2011/ 12-2020/21
1	Agriculture, Forestry and Fishing	1,386,495	1,465,380	0.52%	1.08%
1.1	Crops	711,310	739,951	-0.89%	-0.36%

Sl. No	Sector/ Sub-sector	2019-20 (PE)	2020-21 (AE)	Compounded Growth Rate (%)	
		In 100,000INR		2011/12-2019/20	2011/ 12-2020/21
1.2	Livestock	396,276	441,442	4.08%	4.87%
1.3	Forestry and Logging	274,142	278,955	-0.03%	0.17%
1.4	Fishing and Aquaculture	4,768	5,033	3.71%	3.92%
2	Mining and Quarrying	318,441	257,915	6.95%	3.69%
	Total: Primary	1,704,936	1,723,294	1.48%	1.43%
3	Manufacturing	7,345,223	6,792,208	6.72%	5.04%
4	Electricity, Gas, Water Supply and Other Utility Services	704,754	693,925	7.40%	6.37%
5	Construction	1,419,302	1,220,495	6.10%	3.65%
	Total: Secondary	9,469,280	8,706,628	6.67%	4.93%
6	Transport, Storage, Communication and Services Related to Broadcasting	1,201,257	1,027,202	7.14%	4.49%
6.1	Railways	23,854	18,749	6.75%	3.18%
6.2	Transport by Means Other than Railways	388,294	382,186	7.41%	6.37%
6.3	Storage	1,522	1,217	12.84%	8.60%
6.4	Communication and Services Related to Broadcasting	787,586	625,050	7.01%	3.52%
7	Trade, Repair, Hotels and Restaurants	2,663,599	2,090,171	10.56%	6.43%
8	Financial Services	490,348	486,425	6.63%	5.78%
9	Real Estate, Ownership of Dwelling and Professional Services	1,015,316	1,038,099	7.05%	6.50%
10	Public Administration	637,639	765,920	5.86%	7.36%
11	Other Services	1,117,572	1,296,010	10.61%	11.19%
	Total: Tertiary	7,125,729	6,703,826	8.65%	6.92%
12	Gross State Value Added at Basic Prices	18,299,945	17,133,748	6.77%	5.23%
13	Gross State Domestic Product	19,914,508	18,498,242	7.07%	5.39%
14	Per capita GSDP (INR)	177,539	163,038	5.76%	4.11%

Source: JICA Survey Team based on the data in First Advance Estimates of State Domestic Product of Uttarakhand (Year 2020-21)

2.2.3 Establishments¹⁴

The table below shows the number of establishments of the agriculture and allied sectors and persons employed by them. In Uttarakhand, 41,111 units or 91.4% of total number of establishments are located in the rural area and employs about 66,016 persons. Around 97% of these establishments are owned privately and over 90% of them are self-financed. There are 5.2% or 2,361 units which are financed by other agencies or handed over.

In Uttarakhand, the livestock units are dominant in both rural and urban areas, and employs 62,017 persons in the rural areas and 6,039 persons in the urban area. The reported agriculture establishments are rather less in number. There are 875 establishments with 2,113 persons in the rural area and 77 establishments with 258 persons in the urban area.

Table 2.2.2 Number of Establishments and Persons Employed in the Rural and Urban Areas of Uttarakhand

Sector	Rural		Urban		Total	
	No. of Establishment	No. of Persons Employed	No. of Establishment	No. of Persons Employed	No. of Establishment	No. of Persons Employed
Agriculture	875	2,113	77	258	952	2,371
Livestock	39,592	62,017	3,554	6,039	43,146	68,056
Forestry	505	1,662	239	763	744	2,425
Fisheries	139	224	21	41	160	265
Total	41,111	66,016	3,891	7,101	45,002	73,117

Source: 6th Economic Census (<https://des.uk.gov.in/pages/display/117-6th-economic-census>)

The district-wise distribution of establishments and sector-wise employments are given in the table below. Nearly 43.9% of the establishments are located in Udamsingh Nagar and Haridwar districts, in

¹⁴ Establishments: The units engaged in productive activities to earn profit. The data quoted in this subsection is based on 6th Economic Census (<https://des.uk.gov.in/pages/display/117-6th-economic-census>).

which areas are mostly situated in the plains of the state. Almora, Nainital, and Pithoragarh districts constitute 38.9% of the total of establishments.

Table 2.2.3 District-wise Number of Establishments and Sector-wise Employment

S.No.	Districts	Total No. of Establishments	Sector-wise No of Persons Employed			
			Agriculture	Livestock	Forestry	Total
1	Almora	7,611	41	10,243	102	10,386
2	Bageshwar	589	3	656	4	663
3	Chamoli	559	14	704	33	751
4	Champawat	1,441	15	1,439	136	1,590
5	Dehradun	1,761	190	3,128	244	3,562
6	Haridwar	12,519	912	19,644	232	20,788
7	Nainital	5,257	140	9,188	800	10,128
8	Pauri Garhwal	1,313	45	2,047	81	2,173
9	Pithoragarh	4,585	62	5,533	45	5,640
10	Rudraprayag	237	26	296	51	373
11	Tehri Garhwal	268	24	288	23	335
12	U.S. Nagar	7,244	890	11,806	649	13,345
13	Uttarkashi	1,618	9	3,084	25	3,118
	Total	45,002	2,371	68,056	2,425	72,852

Source: 6th Economic Census (<https://des.uk.gov.in/pages/display/117-6th-economic-census>)

2.2.4 Rural Economy

(1) Income

The per capita income in Uttarakhand has grown at the annual rate of 10.5% between 2011-12 and 2017-2018 and reached INR 182,320 per capita. The lowest growth rate was seen in the hilly districts of Chamoli (7.9%) and Uttarkashi (8.1%). The highest growth rate was achieved in Pauri Garhwal (11.9%), Dehradun (11.2%) and Pithoragarh (11.1%).

Table 2.2.4 Trajectory of Growth of Per Capita Income at Constant Price (Base Year 2011-12)

District	2011-12	2012-13	2013-14	2014-15	2015-16 (RE)	2016-17 (RE)	2017-18 (PE)	Compounded Annual Growth Rate
Maybe this Almora	60,550	70,056	79,866	80,512	87,671	99,666	112,350	10.9%
Bageshwar	66,388	74,460	80,417	86,582	92,023	102,538	113,031	9.3%
Chamoli	80,816	90,237	100,320	103,570	110,004	114,268	127,450	7.9%
Champawat	59,600	72,343	86,314	80,495	85,619	91,746	100,646	9.1%
Dehradun	114,020	127,848	142,718	159,807	177,419	191,215	215,064	11.2%
Haridwar	163,869	185,429	204,498	217,931	233,712	258,720	293,078	10.2%
Nainital	69,074	77,203	87,032	99,253	106,469	110,024	122,161	10.0%
Pauri Garhwal	63,559	71,927	82,149	89,247	99,079	113,730	124,920	11.9%
Pithoragarh	66,606	74,656	87,001	87,835	95,167	105,317	124,920	11.1%
Rudraprayag	51,833	63,090	71,327	71,226	77,031	84,058	88,987	9.4%
Tehri Garhwal	54,877	62,735	69,911	71,002	77,182	84,028	93,444	9.3%
U.S. Nagar	119,936	136,169	146,971	159,860	173,752	188,384	220,429	10.7%
Uttarkashi	61,471	67,402	76,362	77,596	82,508	91,364	98,100	8.1%
Uttarakhand	100,305	113,610	126,247	135,881	147,592	161,172	182,320	10.5%

Source: Estimates of District Domestic Product of Uttarakhand

The monthly expenditure of household is reported as INR 2,849 in the hills and INR 3,000 in plains, with the state total average is INR 2,928¹⁵. The expenditure for food items account for 52% in the hills and 46% in the plains. The comparative table is given below.

Table 2.2.5 Spatial and Social Group Distribution of Monthly Per Capita Expenditure Households (in INR)

Area/ Social Group	Particulars	Monthly Per Capita Expenditure
Area	Rural	2,673
	Urban	3,417

¹⁵ Human Development Report of the State of Uttarakhand, December 2018, https://des.uk.gov.in/files/HDR_Report_Uttarakhand.pdf

Area/ Social Group	Particulars	Monthly Per Capita Expenditure
	Total	2,928
Hill plain	Hill	2,849
	Plain	3,000
Social Group	Scheduled Caste	2,306
	Scheduled Tribe	3,109
	Other Backward Classes	2,759
	General Caste	3,231

Source: HDR Survey, 2017(p.94).

(2) Wage Employment

According to the Census of India 2011, a significant number of the male populace was engaged in wage-earning economic activities. The main employing sectors include mining, construction and transport, crafts and related trade workers, laborers in mining, construction, manufacturing and transport. Furthermore, a sizable proportion of the male main workers of 439,308 persons are engaged in elementary occupations which include street vending, watching of properties, and cleaning.

The minimum wage of agriculture sector in Uttarakhand is INR 324 per day for unskilled labor and INR 357 per day for semi-skilled labor under the central government rates. The daily wage of MGNREGA wage rates for 2019-2020 was INR 182 per day.

The Uttarakhand Human Development Report 2018 revealed various dimensions of wage gap. A significant gap is observed between gender, which showed about 40% more wages were earned among regular male workers in comparison to women regular workers¹⁶. In the hills, male regular workers earn about 16% more than those in the plains and 18% for women regular workers in the hills. The report analyzed that the reason behind this is limited availability of manpower in the hills and thus, the higher wages may need to be paid to attract regular workers in the area. Table 2.2.6 below summarizes various gaps in wages in Uttarakhand as reported in the Uttarakhand Human Development Report. An attempt was also made to assess the daily wage for agriculture labor. Table 2.2.7 below summarizes the wages for different tasks of agriculture.

Table 2.2.6 Average Daily Earnings/ Wages

Particulars		Regular* (INR)			Casual** (INR)		
		Male	Female	Total	Male	Female	Total
Sector	Rural	543	352	507	308	249	302
	Urban	612	484	589	314	264	311
Region	Hills	626	446	588	319	248	310
	Plains	540	378	513	288	262	287
Educational Level	Illiterate	291	329	253	301	250	289
	Below Primary	392	730	340	298	256	293
	Primary	444	829	394	308	278	306
	Middle	381	574	359	313	245	309
	Secondary	455	655	437	311	220	307
	Senior Secondary	535	812	524	315	237	310
	Graduation and above	832	1,105	769	322	233	318
	Technical and Professional	912	1,044	848	394	242	329
Total		575	411	545	309	251	303

*Regular: Regular Employment; **Casual: Casual Employment

Source: Uttarakhand Human Development Report 2018, Department of Planning, Government of Uttarakhand (p.93).

Table 2.2.7 Average Daily Wage for Different Works in Agriculture for Four Project Districts in Uttarakhand

District	Ploughing		Sower		Weeder		Repair & Harvester		Other Agriculture Laborer	
	M	F	M	F	M	F	M	F	M	F
Nainital	-	-	-	-	-	-	-	-	321	317
Pithoragarh	500	-	500	500	-	500	500	500	500	500

¹⁶ The definition of “regular” and “casual” workers has not been defined in Human Development Report in Uttarakhand. However, the report also refers to the National Sample Survey Office (NSSO) statistics, which defines the regular workers as those receive wage or salary on a regular basis for a prolonged period in return of their labour, while the casual worker receives wages on a daily basis or for periodic work contract. (http://www.mospi.nic.in/sites/default/files/publication_reports/concepts_golden.pdf)

District	Ploughing		Sower		Weeder		Repair & Harvester		Other Agriculture Laborer	
	M	F	M	F	M	F	M	F	M	F
Tehri Garhwal	527	-	320	320	481	481	-	-	424	424
Uttarkashi	400	-	400	350	400	350	300	263	400	350

Source: Agricultural Wages India 2019-2020, Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare.

(3) Poverty

Over the period, the population of the poor has halved and the indices of health, education and living standards have improved. The poverty head count ratio remains relatively high in Uttarkashi, Almora and Champawat. The intensity of poverty, which indicates the poverty situation in health, education and other social services, is high in Nainital and Uttarkashi, followed by Udam Singh Nagar, Dehradun, Pauri Garh Wal and Champawat. The state-wise poverty headcount ratio is in Attachment 2.2.1.

Table 2.2.8 District-wise Multi-dimensional Poverty Index Score 2015-16

Sl. No	District	Headcount Ratio	Average Intensity of Poverty**
1	Uttarkashi	25.3	42.0
2	Chamoli	16.7	39.2
3	Rudraprayag	13.1	39.4
4	Tehri Garhwal	18.1	39.2
5	Dehradun	7.0	41.9
6	Pauri Garhwal	12.0	41.8
7	Haridwar	12.0	38.6
8	Pithoragarh	15.1	39.2
9	Bageshwar	20.5	38.8
10	Almora	24.9	38.7
11	Champawat	23.9	41.8
12	Nainital	22.7	44.5
13	U.S. Nagar	22.6	42.4
	Uttarakhand* (2020)	11.3	-
	India* (2020)	21.9	-

*Figures quoted from NITI Aayog (<https://sdgindiaindex.niti.gov.in/#/ranking>)

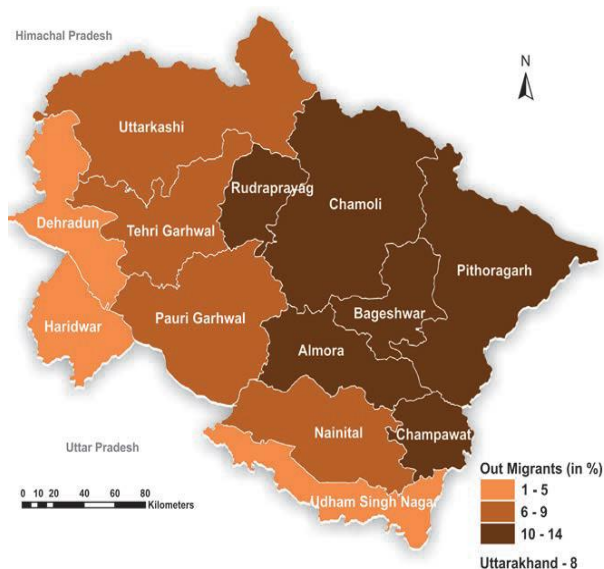
**Shows the depth of poverty in health, education and living standards. Higher the figure, more intense the poverty situation.

Source: Uttarakhand Human Development Report (2018) Uttarakhand Department of Planning

(4) Migration

Uttarakhand is known for its high number of migrants. There is an increasing 35.3% of the rural hills households to have a long-term migrant in the household. The out-migration is seen more frequent in the hilly region and lower in the plain districts and 85% of the migrants move out of their home base for longer (more than 12 months) (HDR 2018).

According to the Rural Development and Migrant Commission Report (2021)¹⁷, the main causes of migration included lack of livelihood employment (50.16%), followed by lack of education facilities (15.21%), and lack of medical facilities (9.83%). When it comes to income level in the state, based on the survey findings of National Sample Survey Organization 2014, the monthly income of a farm household was 4,701 INR which was nearly half of what was earned in the households



Source: Uttarakhand Human Development Report 2018 (p.134)

Figure 2.2.2 District-Wise Out Migration

¹⁷ Locked Houses, Fallow Lands: Climate Change and Migration in Uttarakhand. (2021). Rural Development and Migration Commission, Uttarakhand.

of similar category in Himachal Pradesh (Mamgain. et.al, n.d.)¹⁸. This could be reflected into the large number of males engaged in non-agriculture sector work as reviewed in section male members to move out of the villages and earn in the town or city areas. Two other reasons for migration were associated with agriculture: reduced agricultural productivity and yield (5.44%) and crop damage caused by the wild animals (5.61%) (ibid). The district-wise destinations of migrants are given in the table below.

Table 2.2.9 Destinations of Migrants in Uttarakhand (2018)

District	To Nearby Towns (%)	To District Headquarters (%)	To Other Districts (%)	Outside State (%)	Outside Country (%)
Almora	7.13	13.00	32.37	47.08	0.43
Bageshwar	15.45	22.00	37.19	25.18	0.19
Chamoli	19.79	13.34	50.48	15.88	0.51
Champawat	14	16.86	36.24	32.59	0.3
Dehradun	57.12	23.67	8.08	10.46	0.67
Haridwar	44.27	18.29	16.1	20.85	0.49
Nainital	35.49	17.93	21.47	24.64	0.47
Pauri Garhwal	19.61	9.55	36.15	34.15	0.54
Pithoragarh	15.7	33.07	34.33	16.67	0.23
Rudraprayag	19.34	12.66	40.51	25.69	1.8
Tehri Garhwal	17.73	9.42	40.78	28.98	3.09
Udham Singh Nagar	27.48	8.48	28.04	31.11	4.89
Uttarkashi	39.14	20.27	22.37	17.34	0.89

Source: Lock Houses, Fallow Lands: Climate Change and Migration in Uttarakhand. (2021). Rural Development and Migration Commission, Uttarakhand. (p.60)

2.3 Land Tenure and Land Utilization

2.3.1 Land Tenure

Land tenure is conceptually related to the rules and arrangements connected with owning land, especially that is used for farming¹⁹.

Land is among the most important assets for people around the world. It can be a vital part of cultural and social identities, a valuable asset to stimulate economic growth, and a central component to preserving natural resources and building societies that are inclusive, resilient, and sustainable. All societies have a system to govern property rights—whether formally defined by law or informally established through customary systems—and these rules evolve and change. Land tenure is the relationship that individuals and groups hold with respect to land and land-based resources, such as trees, minerals, pastures, and water. Land tenure rules define the ways in which property rights to land are allocated, transferred, used, or managed in a particular society. When land tenure is secure, land can be a cornerstone for economic growth and an incentive for investment, but when land rights are insecure, this can lead to conflicts, instability and the exclusion of vulnerable groups, such as women, indigenous people and the poor.

While all societies have land tenure systems, each system has a unique set of rules and no single system of governance can be universally applied. Tenure systems define who can hold and use resources, for what length of time, and under what conditions. These rules may be well defined or ambiguous and open to misinterpretation and exploitation. When both formal and informal systems exist within a society, tenure rules can be overlapping leading to confusion and insecurity. Land tenure may also vary by gender, ethnicity, class, and political affiliation. The provision of security of tenure and property rights has become a major vehicle for economic growth, social development, poverty alleviation, and natural resource management.

(1) Key Issues Related to Agriculture Land in Uttarakhand

There are few problems related to land tenure in the hilly region of the state:

¹⁸ Mamgain, Rajendra P. and Reddy, D.N. (n.d.). Final Report Outmigration from Hill Region of Uttarakhand: Magnitude, Challenges and Policy Options. National Institute of Rural Development and Panchayat Raj. Rajendranagar, Hyderabad. India. (http://nirdpr.org.in/nird_docs/srsc/srscrr261016-3.pdf)

¹⁹ <https://dictionary.cambridge.org/dictionary/english/land-tenure>

- Traditionally, agriculture land ownership is in many names as the land is divided among the male siblings. Lately, due to the out-migration of the male members of the family, the ownership of land has not been transferred to the new generation due to the absence of the landowner and also their preference of not to divide the land any further. It is also often the case that there is no necessity to transfer the land ownership in the rural life as there is no such requirement. However, when the land is needed, one may face difficulties when in need of collateral or to lease out under a formal contract.
- In a large number of cases, women are working on the agricultural fields more than men but do not have the land in their name. (Further discussion is given in Section 2.7.4)
- In Uttarakhand, consolidation of lands (Chakbandi) has not been done, therefore farmers have their small landholdings spread in a large area which creates a problem in utilizing it.

(2) Computerization of Land Records

The computerization scheme for land records was launched by the Ministry of Rural Development, Government of India, as a wholly centrally funded scheme in 1994-95. After the creation of the state of Uttarakhand, the work of computerization of land records was done by the National Informatic Center (NIC). at the collectorate level in all the thirteen districts. Now this work of computerization has been completed by the NIC. In the second step, the computerization of land records has also been completed at the Tehsil level in all the districts. Under this program, the works of establishment of data center at the district headquarters, monitoring center at the state level, and of imparting training to the personnel, have also been completed so far. At present, '*khatoni's*' (document depicting land details of farmers in the Revenue Department) have been computerized in all the Tehsils and copies are being issued from the Tehsil as a legal document.

A committee is constituted to look after the account of the income through sale of copies of the *khatoni*. Citizen-centric land records are available on the website of Uttarakhand i.e., "Dev- Bhoomi" (<http://devbhoomi.uk.gov.in>). Landowners from all across the state can view the details of their *khataunies* (land records) - Right of Record (RoR) anytime, anywhere on the internet. Presently, the land record details available on the "Dev-bhoomi" site is for viewing only. An authorized copy of the RoR is available from the Tehsil office by paying a fee prescribed by the state government. In compliance with GoI instructions, the state government has already implemented the Bhoomi Project for creation of online charges, on the lines of Karnataka.

Table 2.3.1 Status of Digitization of Land Records in Uttarakhand

Table 2.3.1 Status of Digitization of Land Records in Uttarakhand											
No. of Cadastral Maps/ FMBs/Tippans					Total Villages	Spatial Data		Cadastral Map	No. of Villages		
Total	In Good Condition		Digitized						Real-time Updating of Data		
	No.	%	No.	%		No.	%	No.	%	No.	%
80,727	59,826	74.11	24,681	30.57	16,990	6,610	38.91	2,305	13.57	39	0.23

Source: State Focus Paper Uttarakhand 2020-21, NABARD, As on 30 October, 2020

(3) Land Lease Policy of Uttarakhand

Tenure security has become an essential part of a large programmatic push aimed at increasing inclusive investment in land, agricultural production, sustainable natural resource management, and the move toward market economies. Increasingly, efforts are focused on multiplying the effects of secure tenure and property rights from various sources.

For several decades, efforts to provide secure tenure and property rights have specifically focused on land law, land titling and registration, land administration, and the redistribution or restitution of land. More recently, the development community has examined ways to expand secure land tenure and property rights by supporting efforts to recognize and respect customary rights to use, manage, and allocate rights to land and resources as a means to contribute to both economic growth and sustainable natural resource management. The State Government of Uttarakhand released a notification that it has made a policy to lease agricultural land, becoming the first Indian state to implement such a policy. Earlier decision was taken that one can have agriculture land on lease until 12.5 acre irrigated and 18 acre unirrigated land²⁰. Keeping in mind the tough terrain, migration and large expanse of barren land,

²⁰ <https://cm.uk.gov.in/upload/pressrelease/Pressrelease-555.pdf>

the State Cabinet had earlier approved the amendments to the Uttarakhand (Uttar Pradesh Zamindari Abolition Land Reforms Act, 1950²¹). After approval from the Assembly and the Governor, it was notified by the government²². As per the new policy, any institution, company, or NGO can take farmland on lease for 30 years, provided the leased land is a maximum of 30 acres.

The farmers who own the land will receive the corresponding rent during the leased period. Difficulties faced earlier in leasing land in hilly regions for the purpose of agriculture, farming, tea plantation, milk production, horticulture, herbs, fruit hybridization and for production of solar energy are expected to be removed by the policy as the state government aims for consolidation of fragmented land to be solved by the policy. Under special circumstances, there is a provision to take more land on lease. If there is a government land around the land that is to be leased, then it has to be leased by paying the fee after obtaining the permission of the District Magistrate.

(4) Ordinance to Give Land Ownership Rights to Daughters

There has been a problem in the state that a daughter does not have ownership rights on the land of her father. Similarly, a wife does not have her name in the land of her husband. In order to solve this problem, the government of Uttarakhand passed an ordinance to give land ownership rights to daughters and wives of male landowners by amending the Uttarakhand Zamindari Abolition and Land Reforms Act.

"Under the ordinance, the daughters will have ownership rights on the land owned by her father. Similarly, a wife will also be the joint owner of the land of her husband". The move is aimed to facilitate the women who are working in fields owned by their husbands or fathers especially in the hilly areas of the state. So far in Uttarakhand, the land ownership rights are transferred to men in the family which are then passed on to their sons." Traditionally in the hilly areas of Uttarakhand, men and their wives are involved in the farming on their land. However, men are largely involved in just heavy labor-intensive work like ploughing the field while about 90% farming-related works are done by their wives. Despite that they do not have any ownership of that piece of land.

2.3.2 Land Utilization

(1) Change of Land Utilization in the State

The nature and composition of land use in the hilly region differs significantly from those of plain areas due to variations in physiographic, climatic, agromatic, and other factors. The Himalayan land, as put to various uses, displays some of the unique features which are much less identified to general land use pattern of the plain areas. These are uneven in greater degree in space and magnitude. Major part of the land (63.48%) of the state is covered by the forests which is greater in comparison to many states of India. In addition, 3.46% area of land is under permanent pasture and other grazing land so is not available for cultivation. The state has 5.39% agriculture waste land which can be converted into cultivable land if efforts are made to make it usable. The area under misc. tree crops and groves has gradually increased from 6.47% (2014-15) to 6.56% (2017-18), which is not a good indicator. The comparison with Himachal Pradesh revealed that the percent share of the net sown area was slightly higher than the figure of Uttarakhand of the same year. The area cropped more than once was 8.99% in Himachal Pradesh while it lagged behind in Uttarakhand by 2.5%. The area put to cultivation more than once in Himachal Pradesh was reported to be 75.15% of the net sown area while the figure for Uttarakhand in the same year was 56.65%. The current situation of land utilization is shown on the map in Attachment 2.3.1.

Table 2.3.2 Changes in Land Use Pattern from 2014-15 to 2017-18

No	Particulars	Uttarakhand						Himachal Pradesh	
		2014-15 (ha)	% to Total	2016-17 (ha)	% to Total	2017-18 (ha)	% to Total	2016-17 (ha)	% to Total
1	Total Reported Area (Ha)	5,992,604	100.00	5,992,604	100.00	6,004,313	100.00	4,577,742	100.00
2	Area under Forest	3,799,953	63.41	3,799,953	63.41	3,811,662	63.48	1,125,386	24.58

²¹ <https://investuttarakhand.com/themes/backend/acts/ukzlar.pdf>

²² <https://timesofindia.indiatimes.com/city/dehradun/ukhand-comes-up-with-policy-for-leasing-out-agri-land/article73498493.cms>

N o	Particulars	Uttarakhand						Himachal Pradesh	
		2014-15 (ha)	% to Total	2016-17 (ha)	% to Total	2017-18 (ha)	% to Total	2016-17 (ha)	% to Total
3	Not available for Cultivation	228,200	2.82	228,091	3.81	249,520	4.16	778,998	17.02
4	Land Available for Other than Cultivation	223,792	3.73	226,845	3.79	185,836	3.09	352,407	7.70
5	Agriculture Wasteland	316,984	5.29	317,885	5.30	323,731	5.39	121,714	2.66
6	Permanent Pasture and Other Grazing Land	192,077	3.21	192,075	3.21	207,804	3.46	1,507,965	32.94
7	Area under Misc. Tree Crops and Groves, etc.	387,817	6.47	387,176	6.46	393,621	6.56	66,595	1.45
8	Current Fallow Land	57,276	0.95	61,885	1.03	73,284	1.22	55,754	1.22
9	Other Fallow Land	86,334	1.44	88,132	1.47	86,325	1.44	21,367	0.47
10	Net Sown Area	700,171	11.68	690,562	11.52	672,530	11.20	547,556	11.96
11	Area Used for More than One-time Sowing*	396,663	56.65	391,234	56.65	387,001	57.54	411,667	75.18

Source: JICA Survey Team based on the data of Chief Revenue Commissioner, Uttarakhand and Statistical Diary 2018-19 Uttarakhand, Economic and Statistical Directorate, Govt. of Uttarakhand

*Definitions of the particulars:²³

1. Reported area: Total area for which land record is available; 2. Area under forest: land legally classified as forest or administered as forest irrespective of ownership; 4. Land available for other than cultivation: Land used for any other purpose than agriculture; 5. Agriculture Waste Land: The land available for cultivation but not cultivated during the last consecutive 5 years or more including the reporting year for some reason; 6. Permanent Pasture and Other Grazing Land: Grazing land for permanent or temporal grazing. This includes village common grazing land; 8. Current Fallow Land: Area under fallow during the reporting year; 10. Net Sown Area: the total area sown once and/ or more than once in the reporting year.

*Percentage of area sown more than once is calculated out of net sown area and not from the total area.

** Statistical Abstract of Himachal Pradesh 2018-19 (https://himachalservices.nic.in/economics/pdf/StatisticalAbstract_2018_19.pdf)

(2) Agricultural Land Utilization

Out of a total geographical area of 5.35 million ha in the state, 4.6 million ha (86%) is hilly area and 0.74 million ha (14%) is plain area. Only about 14% of the geographical area is cultivable which is mainly attributed to the topography of the state. Because of its location and diverse climate, the state has certain unique advantages in further developing fruits production, off-season vegetable cultivation and cultivation of medicinal and aromatic plants. The cold climate condition can produce temperate fruits or crops at different time (off-season) and severe natural conditions such as different temperature between night and day can produce tasty crops, e.g., high brix (sugar content) of apple. In addition, the areas are at rather less contaminated location from air, soil or upper streams and have advantages for producing safe and clean crops. Similarly, the service sector, particularly tourism, offers a large potential for employment generation in both urban and rural areas. The state has about 61.1% area under forests. The share of net sown area is only about 14% as against the national average of 43.37%. The share of cultivable wasteland is about 7% which provides a huge potential for fodder trees and other plantation crops including fruits.

Agriculture is a predominant sector in the state economy, which contributes around 23.4% in state gross domestic product (GDP). The average size of landholding in the state is 0.95 ha (Marginal-0.39, Small-1.38, Medium-3.33 and Large-36.00) as against the national average of 1.57 ha. The share of small and marginal holdings is higher in Uttarakhand State as compared with the national average. The average landholding size in Himachal Pradesh was estimated to be 0.99 ha²⁴ which is slightly larger in size in comparison to Uttarakhand but both the states report significantly smaller average operational holdings. The agriculture sector in the state continues to remain heavily dependent on rainfall. The net irrigated area in the state is 3.45 lakh ha which is much less than in Himachal Pradesh reporting 114,381 ha in 2016-17 or 20.89% of the net sown area. Out of the irrigated area in Uttarakhand, 85.83% is in plains and 14% are in hills. The irrigation intensity in the state is 159% which varies between 155% in plains to 184% in the hilly region.

²³ Surveyor General of India. "Concepts and Definitions" (https://eands.dacnet.nic.in/PDF_LUS/Concepts_& Definition_s.pdf)

²⁴ Statistical Abstract of Himachal Pradesh 2018-19

Like most other hill economies, the people of Uttarakhand practice integrated systems of farming, forestry, horticulture, livestock husbandry and off-farm activities. The recorded forest area constitutes 64.79% of the total reported area, although the actual cover based on remote sensing and satellite imagery information is only 44%. The net sown area for the region is a little over 13% of the total reported area, although there are wide variations in this percentage from district to district. About 33% of the total area in Uttarakhand is either rocky/ snow-covered/ glaciated or otherwise unproductive and degraded land. About 12% of agricultural land has got irrigation and about 90% land is used for growing cereals, fodder (berseem) and some vegetables.

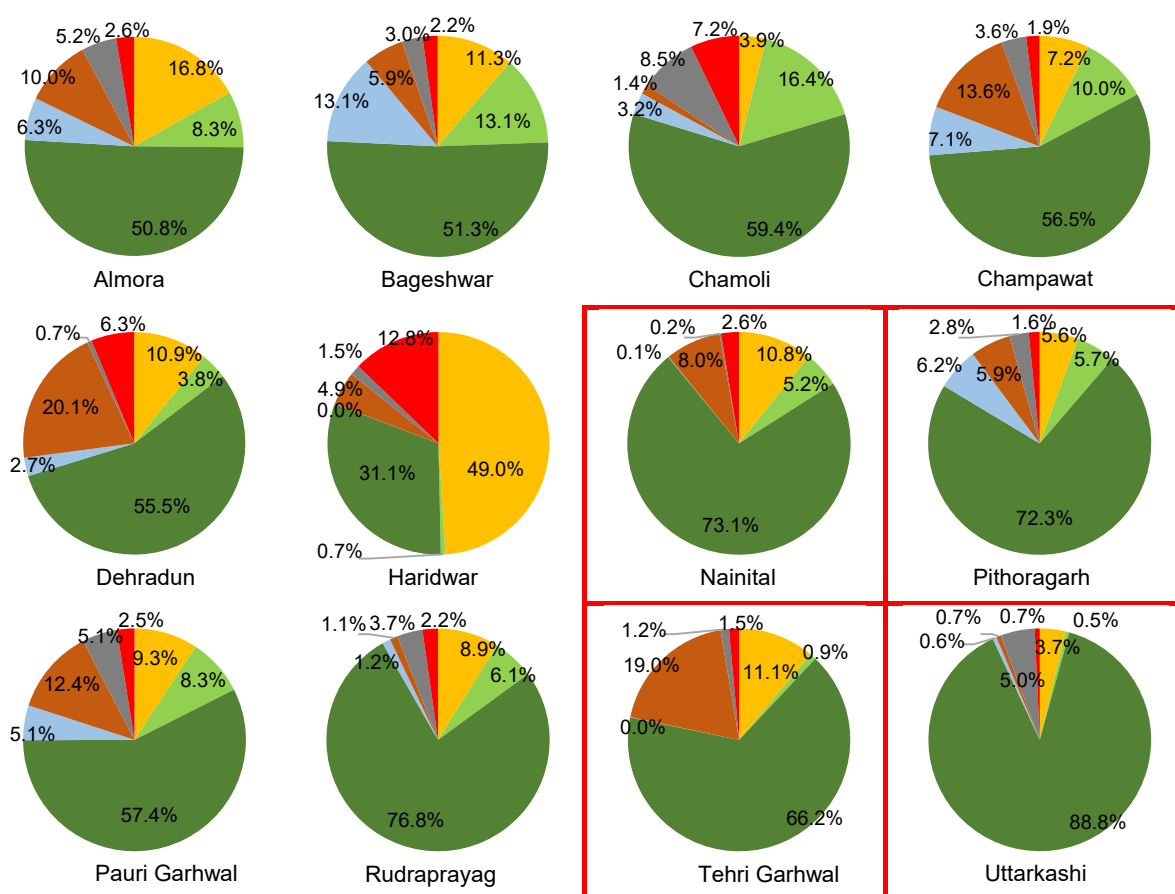
Table 2.3.3 District-wise Land Utilization in Uttarakhand (2015-16)

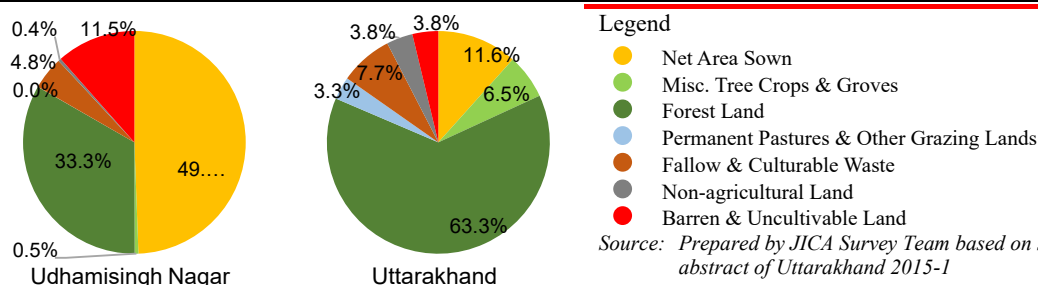
(Unit: ha)

District	Geographical Area	Reported Area	Net Area Sown	Misc. Tree Crops & Groves*	Forest Land	Permanent Pastures & Other Grazing Lands	Fallow & Culturable Waste	Non-agricultural Land	Barren & Uncultivable Land	Total
Almora	313,900	464,942	78,278	38,585	236,184	29,214	46,322	24,051	12,308	464,942
Bageshwar	224,600	207,902	24,295	28,119	110,160	28,119	12,660	6,502	4,727	214,582
Chamoli	803,000	851,764	33,433	139,574	506,100	27,122	12,192	72,226	60,937	851,584
Champawat	176,600	233,225	16,921	23,400	132,338	16,652	31,873	8,487	4,554	234,225
Dehradun	308,800	363,371	39,443	13,960	201,830	9,744	73,109	2,435	22,850	363,371
Haridwar	236,000	232,798	114,059	1,545	72,431	60	11,395	3,398	29,910	232,798
Nainital	425,100	408,005	43,951	21,265	298,236	304	32,765	967	10,463	407,951
Pauri Garhwal	532,900	669,055	62,087	55,737	385,094	33,955	83,019	34,113	17,050	671,055
Pithoragarh	709,000	746,734	41,891	42,579	540,150	45,981	43,859	20,810	11,764	747,034
Rudrapur	198,400	234,796	20,821	14,222	180,365	2,784	2,690	8,653	5,261	234,796
Tehri Garhwal	364,200	485,517	53,809	4,517	321,564	220	92,447	5,885	7,075	485,517
U.S. Nagar	254,200	281,806	139,120	1,523	93,837	48	13,376	1,178	32,424	281,506
Uttarkashi	801,600	812,689	30,251	4,467	721,664	4,548	5,426	40,401	5,932	812,689
Total	5,348,300	5,992,604	698,359	389,673	3,799,953	198,751	461,133	229,106	225,255	6,002,230

Source: Statistical abstract of Uttarakhand 2015-16

*: Not included in Net Area Sown





Source: Prepared by JICA Survey Team based on statistical abstract of Uttarakhand 2015-1

Figure 2.3.1 Land Use Pattern in Uttarakhand (2015-16)

(3) Landholdings of Farmers

1) Area of holding land

The total area of agriculture landholdings is recorded at 747,320 hectares. Out of which, 74.78% of landholding in the state is less than one ha. A total of 91.67% landholdings show existence of high percentage of small and marginal farmers.²⁵ Further, small and marginal farmers hold 65.53% of the total agriculture land. The remaining 34.47% land is with 8.33% medium and large farmers of Uttarakhand. These farmers are concentrated mainly in Udham Singh Nagar, Dehradun and Haridwar districts of Uttarakhand. In the hilly region, majority of farmers are marginal and small.

Table 2.3.4 Landholdings and Area under Different Categories of Farmers

Classification of Holding		Holding		Area	
		Nos.	% to Total	(Ha.)	% to Total
<= 1 Ha	(Marginal)	65,9064	74.78	283,442	37.93
>1 to <=2 Ha	(Small)	14,8817	16.89	206,228	27.60
>2 Ha <=4 Ha	(Semi-medium)	58,040	6.59	155,532	20.81
>4 Ha <=10 Ha	(Medium)	14,496	1.64	78,834	10.55
>10 Ha	(Large)	888	0.10	23,284	3.12
Total		881,305	100	747,320	100

Source: Agriculture Directorate/Statistical Diary 2018-19, Uttarakhand, Economic and Statistical Directorate, 2018-19

Note: <= 1 Ha : Marginal Farmers, >1 to <=2 Ha: Small farmers

2) Area Percentage in Different Altitudinal Zones

An analysis of the area available in different altitude zones reveals that one fourth of the area of Uttarakhand State lies under the altitude of below 1,000 m. This area mainly constitutes the southern plain area. Terai, and Bhabar belt, and valley areas like dun valley and open and broad valley bottoms of the mountain area. About 33% area of the state lies between the altitude of 1,000 m and 2,000 m. In this way, nearly 60% of the total geographical area lies below 2,000 m. Low hills and the mid slopes of the higher mountains occupy about 13% area of the state and the remaining 28% area is located above 3000 m. Most of this area is under permanent snow and rocky, highly influenced by peri-glacial climate.

Table 2.3.5 Percentage of Area in Different Altitudinal Zones

S. No	Altitudinal Zone	Percentage of Area (%)	Area (sq. km)
1	< 1000 m	26	13,905.58
2	1000-2000 m	33	17,649.39
3	2000-3000 m	13	6,952.79
4	>3000 m	28	14,975.24
	Total	100	53,483.00

Source: Dr. S C Kharkwal, in his book Uttarakhand Geo-Economic Profile, Chapter -3 'Physical settings', pp77

3) Change in Landholding for Farming

The district-wise details of the landholdings with specification of the size of the land provides a clear picture of marginal and small landholding and the changes that has taken up from 2010-11 to 2015-16. While the total units in all the categories of farmers based on landholdings were 912,650 in 2010-11, it decreased to 881,305 in 2015-16. Several reasons behind this decline of the operational landholdings can be detected from literature. Partly, the farmers especially in the hills are unable to make their ends

²⁵ Press Information Bureau, Government of India, Ministry of Agriculture & Farmers Welfare "Categorization of Farmers" dated 5th Feb. 2019 (<https://pib.gov.in/Pressreleaseshare.aspx?PRID=1562687>)

meet due to a number of reasons including unproductive farming practices, difficulties in coping with climate changes, and some are more attracted to urban life²⁶.

Table 2.3.6 Change in Agriculture Landholding of Farming from 2010-11 to 2015-16

District	2010-11 (Units in number)						2015-16 (Units in number)						Increase/ Decrease in % (+ -)
	Land in ha						Land in ha						
	0-1	1-2	2-4	4-10	10+	Total	0-1	1-2	2-4	4-10	10+	Total	
Almora	82,043	22,451	4,570	201	3	109,268	76,258	21,490	4,343	143	6	102,240	-6.43
Bageshwar	48,856	4,479	503	30	1	53,869	43,959	3,381	176	5	1	47,522	-11.78
Chamoli	33,525	7,486	3,220	665	19	44,915	35,607	8,186	2,828	411	17	47,049	4.75
Champawat	27,390	6,517	2,113	244	10	36,274	25,404	5,166	1,567	113	7	32,257	-11.07
Dehradun	49,354	7,550	4,450	1,455	111	62,920	39,670	7,154	4,460	1,482	116	52,882	-15.95
Haridwar	96,548	20,058	10,630	3,131	178	130,545	108,320	22,831	12,284	3,340	115	146,890	12.52
Nainital	34,234	9,637	5,069	1,556	167	50,663	32,897	9,720	4,644	1,335	137	48,733	-3.81
Pauri Garhwal	52,999	21,746	8,022	1,600	62	84,429	61,282	14,368	3,498	256	6	79,410	-5.94
Pithoragarh	70,574	7,881	1,335	55	1	79,846	66,688	6,061	897	97	1	73,744	-7.64
Rudraprayag	19,159	5,980	1,769	184	1	27,093	14,380	5,873	1,410	133	2	21,798	-19.54
Tehri Garhwal	64,922	16,449	4,480	564	18	86,433	64,174	16,847	3,839	336	8	85,204	-1.42
Udham Singh Nagar	64,537	20,213	14,804	6,793	512	106,859	61,401	20,180	14,597	6,331	462	102,971	-3.64
Uttarkashi	27,997	6,883	3,816	824	16	39,536	29,024	7,560	3,497	514	10	40,605	2.7
Total	672,138	157,330	64,781	17,302	1,099	912,650	659,064	148,817	58,040	14,496	888	881,305	-3.43

Source: Statistical diary 2018-19 Uttarakhand, Economic and Statistical Directorate, Govt. of Uttarakhand

The district-wise compilation of the land utilization pattern provides a clear picture of the area that has been covered under forest (63.48%) is spread differently in the different districts. Leaving aside Haridwar and Udham Singh Nagar districts which are termed as plain districts, all other districts have high percentages of forest cover.

The district-wise compilation of the land utilization pattern provides a clear picture of area that has been covered under the forest (63.48%) is spread differently in the different districts. Leaving aside Haridwar and Udham Singh Nagar districts which are termed as plain districts, all other districts have high percentage of forest cover. In majority of the hill districts, it is more than 50% of the total geographical area. Similarly, area under misc. shrubs, tree crops and groves is also less in these districts whereas other hill districts have high percentages of area under this cover. Tehri Garhwal has a large area under agriculture wasteland (74,172 ha) whereas Uttarkashi (2,412 ha) and Haridwar (1,623 ha) have low agriculture wasteland.

2.4 Water Resources Utilization and Irrigation System

Water is one of the most vital and abundantly available natural resources of Uttarakhand. The state is richly endowed with a hilly terrain having an enormous volume of water from the catchment areas of Bhagirathi (Ganges in Uttar Pradesh), Yamuna, Alaknanda, Mandakini, Pindar and Kali rivers. As such, the state has enormous potential of water resources in the form of glaciers and rivers but groundwater resources are limited. Availability of water resources in Uttarakhand is as follows.

2.4.1 Surface Water Resources

(1) River

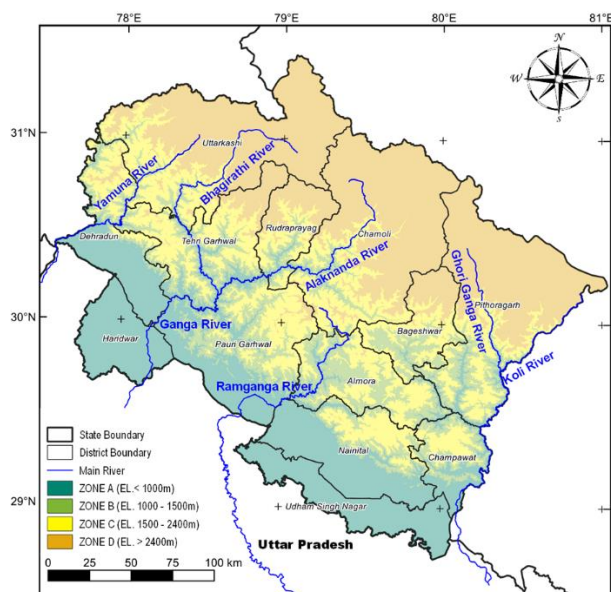
A large number of rivers originate from glaciers in Himalayan region and flow down through Uttarakhand State. The state is mostly drained by the main rivers described below and shown in Figure 2.5.1²⁷.

- **Yamuna River:** The river originates from Yamunotri. Its main tributaries are Kamola, Tons and Alghar. Tons flow along the border of Himachal Pradesh and Uttarakhand. The Yamuna River and its tributaries drain the western part of Uttarakhand, namely; parts of Dehradun and Uttarkashi districts.

²⁶ Potsdam Institute for Climate Change Impact Research and TERI (2021). Climate Change and Migration in Uttarakhand.

²⁷ Climate of Uttarakhand, India Meteorological Department

- **Bhagirathi River:** The river rises from Gangotri glaciers and joins the Alaknanda River in Deoprayag to form the main channel of the Ganga River. It means that the Ganga River geographically rises as the Bhagirathi River. The main tributaries of the Bhagirathi River are Janhavi and Bhilangana rivers. The river drains parts of Tehri Garhwal and Uttarkashi districts.
- **Alaknanda River:** It originates from the snow at the confluence of the Satopanth and Bhagirath Kharak glaciers. The river flows through Alaknanda Valley and merges with the Bhagirath River in Deoprayag. Mandakini, Nandakini and Pindar rivers are main tributaries of the Alaknanda River. This river drains the parts of Chamoli, Rudraprayag, Pauri Garhwal and Tehri Garhwal districts.
- **Ganga River:** The river starts in Deoprayag where the Bhagirathi and Alaknanda rivers merge. Tributaries which join the main channel of Ganga between Deoprayag and Hardwar are Nayar, eastern Hiyuni, western Hiyuni, Song and Suswa rivers. The main channel of the Ganga River drains the parts of Tehri Garhwal, Dehradun, Pauri Garhwal and Hardwar districts before entering the plain of Bijnor District of Uttar Pradesh.
- **Kali River:** The river is also called the Kaliganga River. It originates from the Greater Himalayas at Kalapani in Pithoragarh District. The Kali River flows along the national border between Uttarakhand of India and Nepal. It drains some parts of Pithoragarh, Almora, Bageshwar, Champawat and Udham Singh Nagar districts.
- **Ghori Ganga River:** It originates from Milam Glacier in the Munsiyari tehsil of the Pithoragarh District. The river is also fed by glaciers and streams flowing from the eastern slopes of the east wall of the Nanda Devi Sanctuary. The water from Kalabaland-Burfu Kalganga Glacier also flows into the Ghori Ganga Valley from the east.
- **Ramganga River:** The river rises from Chorarkhal dhar in Gaisain Block of Chamoli District. Main tributaries of the Ramganga River are Mandal, Palain and Sona. The Ramganga River flows through parts of Chamoli, Almora, Nainital and Pauri Garhwal districts before entering the plain (Kalagarh) of Bijnor District of Uttar Pradesh.



Source: Climate of Uttarakhand, India Meteorological Department

Figure 2.4.1 Main Rivers in Uttarakhand

(2) Lakes and Wetlands

There are a number of small and large lakes and wetlands in Uttarakhand as listed in Table 2.4.1.

Table 2.4.1 Major Lakes and Wetlands in Uttarakhand

SN	Name	Type	District	Altitude (EL. m)	Area (ha)*
1	Vasudhara Tal	Glacial	Chamoli	4,691	Large
2	Nandi Kund	Tarn	Chamoli	4,369	Large
3	Parvati Kund	Tarn	Pithoragarh	4,507	Large
4	Hardeol Kund	Tarn	Pithoragarh	4,359	Large
5	Kanasar	Tarn	Uttar kasha	4,400	Large
6	Hemkund	Tarn	Chamoli	4,204	Medium
7	Kush Kalyan Kund	Tarn	Tehri Garhwal	3,100	Medium
8	Dodi Tal	Tarn	Uttarakashi	3,077	Medium
9	Khera Tal West	Proglacial	Uttarakashi	3,450	Medium
10	Sat Tal	Tarn	Uttarakashi	3,018	Small
11	Thamri Tal	Tarn	Pithoragarh	2,776	Small
12	Khera Tal East	Proglacial	Uttarakashi	3,442	Small
13	Asan Barrage	Manmade	Dehradun	109	396
14	Sharda Barrage	Manmade	Champawat	184	275

SN	Name	Type	District	Altitude (EL. m)	Area (ha)*
15	Jhilmil Jheel	Permanent freshwater lake	Haridwar	240	148
16	Bhimgoda barrage	Manmade	Haridwar	249	106
17	Banganga Wetland	Permanent freshwater lake	Haridwar	222	90
18	Virbhadra Barrage	Manmade	Dehradun	340	72.7
19	Dakpathar barrage	Manmade	Dehradun	480	70
20	Banbasa Barrage	Manmade	Champawat	226	66
21	Tadag Tal	Natural	Almora	1,209	50.6
22	Naini Tal	Permanent freshwater lake	Nainital	1,919	48.8
23	Bhimtal	Permanent freshwater lake	Nainital	1,275	45.6
24	Sarla Tal	Manmade	Bageshwar	1,688	39
25	Nakuchia Tal	Permanent freshwater lake	Nainital	1,320	29.9

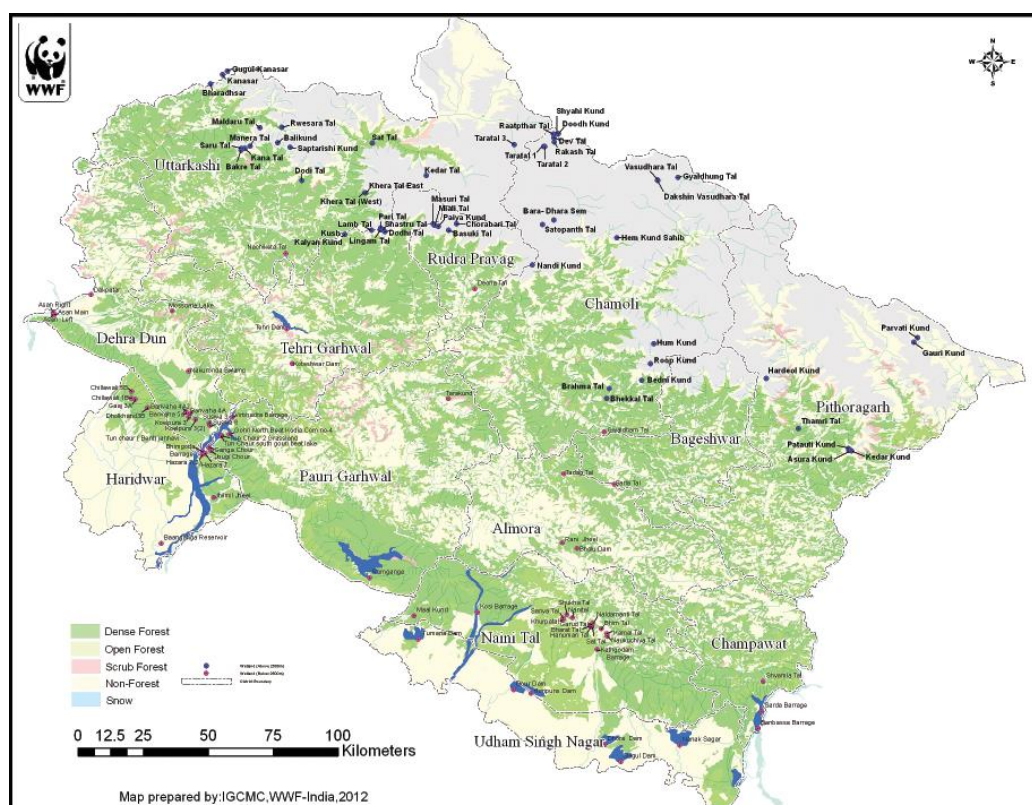
* Size of the lakes/wetlands located higher than EL. 2,500 m is not available but they are categorized by length (L);

Large: L > 300 m, Medium: 100 m < L < 300 m, Small: L < 100 m

Source: Directory of Wetlands in Uttarakhand, Forest Department, Uttarakhand

In the study done by WWF and the Forest Department of Uttarakhand in 2012, the status of 116 wetlands within an altitude range from 300 m to over 5,000 m asl²⁸ were assessed. The studied wetlands are shown in Figure 2.4.2. The study also conducted interview survey to assess the magnitude of ecosystem service, land use and threat occurring at the wetlands. The scores which represent the magnitude of a particular ecosystem service/land use/threat occurring at the wetlands were allocated through the following technique:

At least 10 informants were interviewed at each wetland site. Among these 10 informants, if 1 to 3 of them, 4 to 7 of them, or 8 to 10 of them confirmed that a particular ecosystem service/land use/threat occurred at the wetland, then a score of '1' (magnitude = low), '2' (magnitude = medium) or '3' (magnitude = high) were given, respectively.



Source: WETLANDS OF UTTARAKHAND, WWF and Forest Department of UK (2012)

Figure 2.4.2 Wetlands Surveyed in the State of Uttarakhand

²⁸ WETLANDS OF UTTARAKHAND, WWF and Forest Department of UK (2012)

Table 2.4.2 Magnitude of Ecosystem Services Being Provided by the Surveyed Wetlands

Magnitude of Ecosystem Services Being Provided by the Surveyed Wetlands																	
S.No.	Ecosystem services being provided by wetlands and their magnitude	Districts where wetland surveys were conducted															
			Al	Ba	Cha	Ch	CTR	Ddn	Hrd	Ntal	Pr	RNP	Rd	Th	USN	Utt	
1	Education	0 to 1															
		1 to 2															
		2 to 3															
2	Biodiversity	0 to 1															
		1 to 2															
		2 to 3															
3	Unspoilt environment	0 to 1															
		1 to 2															
		2 to 3															
4	Impact on terrestrial ecosystems	0 to 1															
		1 to 2															
		2 to 3															
5	Fish/wildlife habitat	0 to 1															
		1 to 2															
		2 to 3															
6	Floodwater storage	0 to 1															
		1 to 2															
		2 to 3															
7	Irrigation water	0 to 1															
		1 to 2															
		2 to 3															
8	Fishing (commercial)	0 to 1															
		1 to 2															
		2 to 3															
9	Recreation	0 to 1															
		1 to 2															
		2 to 3															
10	Drinking water supply	0 to 1															
		1 to 2															
		2 to 3															
11	Groundwater recharge	0 to 1															
		1 to 2															
		2 to 3															

Source: WETLANDS OF UTTARAKHAND, WWF and Forest Department of UK (2012)

Table 2.4.3 Magnitude of Different Land Use Options Being Provided by the Surveyed Wetlands

S.No.	Land use options being provided by wetlands and their magnitude	Districts where wetland surveys were conducted															
			Al	Ba	Cha	Ch	CTR	Ddn	Hrd	Ntal	Pr	RNP	Rd	Th	USN	Utt	
1	Research	0 to 1															
		1 to 2															
		2 to 3															
2	Tourism	0 to 1															
		1 to 2															
		2 to 3															
3	Water management	0 to 1															
		1 to 2															
		2 to 3															
4	Human habitation	0 to 1															
		1 to 2															
		2 to 3															
5	Forest	0 to 1															
		1 to 2															
		2 to 3															
6	Fishing	0 to 1															
		1 to 2															
		2 to 3															
7	Agriculture	0 to 1															
		1 to 2															
		2 to 3															

Source: WETLANDS OF UTTARAKHAND, WWF and Forest Department of UK (2012)

Table 2.4.4 Magnitude of Different Threats to the Surveyed Wetlands

S.No.	Threats to wetlands and their magnitude	Districts where wetland surveys were conducted														
			Al	Ba	Cha	Ch	CTR	Ddn	Hrd	Ntal	Pr	RNP	Rd	Th	USN	Uttr
1	Siltation	0 to 1														
		1 to 2														
		2 to 3														
2	Tree cutting	0 to 1														
		1 to 2														
		2 to 3														
3	Poaching	0 to 1														
		1 to 2														
		2 to 3														
4	Invasive species	0 to 1														
		1 to 2														
		2 to 3														
5	Boating	0 to 1														
		1 to 2														
		2 to 3														
6	Overgrazing	0 to 1														
		1 to 2														
		2 to 3														
7	Firewood collection	0 to 1														
		1 to 2														
		2 to 3														
8	Pollution	0 to 1														
		1 to 2														
		2 to 3														
9	Developmental activities	0 to 1														
		1 to 2														
		2 to 3														
10	Agricultural expansion	0 to 1														
		1 to 2														
		2 to 3														
11	Medicinal plant extraction	0 to 1														
		1 to 2														
		2 to 3														

Source: WETLANDS OF UTTARAKHAND, WWF and Forest Department of UK (2012)

2.4.2 Groundwater Resources

(1) Hydrogeography

Majority of the area in the state falls under hilly terrain, except for Udham Singh Nagar, Haridwar and parts of Dehradun District. The northern parts of the state remain under snow cover throughout the year. Drainage is controlled by major rivers like Ganga (Gangotri) and Yamuna (Yamnotri), originating from the glaciers in high Himalayan Mountain Range and their tributaries like Ramganga, Kali, Saryu, and Pindar. A variety of rock units ranging in age from Archean to Quaternary are exposed over the state. The rock units in the Himalayan Mountain regions have undergone repeated phases of deformation and metamorphism after their formation.

In the plain areas, groundwater occurs in multi-aquifer systems. Perched water bodies lying above the main water-bearing formations are frequently encountered in Bhabar Zone and Doon Valley. Contrary to this, the occurrence of groundwater in the hilly areas is limited to small, localized aquifers with limited groundwater potential. Groundwater in hilly terrains is found in the secondary porosity developed in crystalline igneous and metamorphic rocks in the form of fractures, joints and fissures. Low to moderate groundwater potential exists in parts of the state where groundwater is located in valley fill deposits of the alluvial plains and piedmont zones. The chemical quality of groundwater is generally good and the water can be safely used for drinking, and domestic and irrigation purposes.

The state is broadly subdivided into two hydro-geomorphic units, namely 1) Gangetic Alluvial Plain 2) Himalayan Mountain Belt. These two units are further classified into several hydrogeological regimes as shown in the table below.

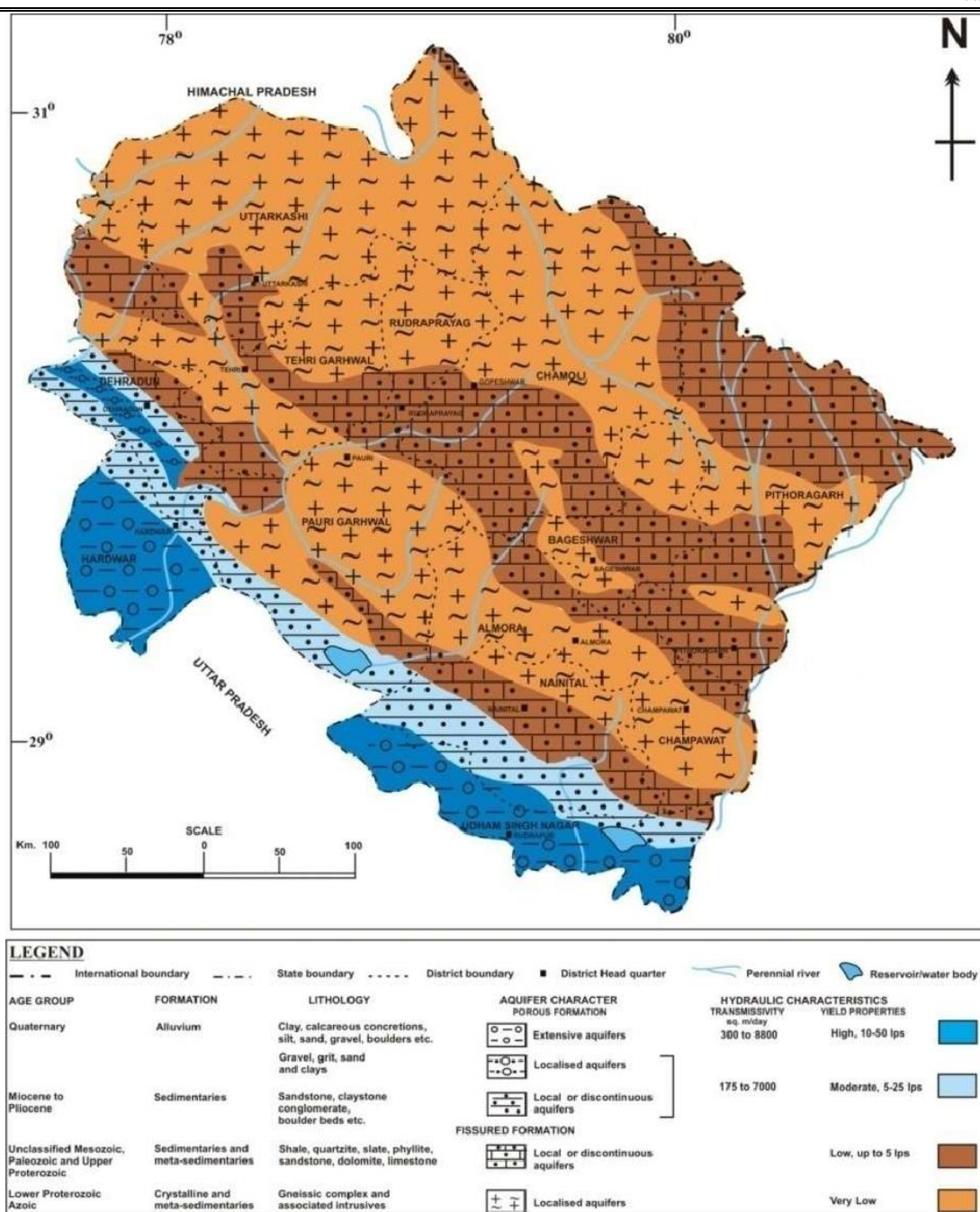
Table 2.4.5 Category of Hydro-geomorphic Unit and Hydrogeological Regimes in Uttarakhand

Hydro-geomorphic Unit	Hydrogeological Regime	Features
Gangetic Alluvial Plain	Axial Belt	Distribution: Alluvial plain Mixture of layered deposits of gravel, sand, silt and clay Overexploited due to high potential as groundwater resources and requires artificial recharge
	Tarai	Distribution: Between Axial Belt and Bhabar; separated from Bhabar by “spring line” Porous and permeable sedimentary unit consisting of mixture of gravel, sand and clay High potential aquifer with good chemical quality: 1) Unconfined aquifers down to depths of 30 meters bgl* and 2) Confined aquifers that occur at depths greater than 30 m bgl under very high hydrostatic pressure Tubewells tapping these aquifers generally exhibit free flowing conditions with hydraulic head sometimes as high as 10 m agl and discharge of 5000 lpm
	Bhabar	Distribution: Between Tarai and Outer Himalaya Consists of mixture of clastic materials with different fractions Promising groundwater resources and constructed 28 deep tubewells (deeper than 100 m bgl with discharge more than 5,000 lpm)
Himalayan Mountain Belt	Outer Himalaya (Siwalik Mountain Range)	Distribution: EL. < 1,000 m Composed of sandstone, ferruginous shale and clay, younger than other surrounding zones Constructed 11 deep tubewells (252-3,197 lpm)
	Lesser Himalaya	Distribution: At boundary of Main Boundary Thrust (MBT) and Main Central Thrust, EL. 1,000-3,000 m Metasedimentary rocks and minor plutonic intrusive (granitoids). The most important source of springs Groundwater occurrence is restricted to the weathered residuum and the highly fractured/jointed zones of the area Several hand pumps and tubewells in the river valley
	Central Himalaya	Distribution: North of MCT, EL. 5,000-8,000 m, highly inaccessible, snow-covered area Both cold water and hot water (thermal) springs exist Steep hydraulic gradient makes development of groundwater difficult
	Tethys Himalaya	Distribution: North of Central Himalayan zone Predominantly occupied by highly fossiliferous sedimentary rocks ranging in age from Precambrian to Jurassic Porous and permeable, suitable for groundwater development

* bgl: below ground level

Source: Prepared by the JICA Survey Team based on GROUNDWATER YEAR BOOK UTTARAKHAND (2019-2020)

Geological conditions as well as property of aquifer and hydraulic characteristics of Uttarakhand are described in Figure 2.4.3. The belts of each zone trend from northwest to southeast with roughly parallel with mountain ranges spanning across the state.



Source: GROUNDWATER YEAR BOOK UTTARAKHAND (2019-2020)

Figure 2.4.3 Hydrogeological Map of Uttarakhand

(2) Monitoring System

Monitoring of groundwater quality is very important as this determines the suitability of groundwater for various purposes like domestic, agricultural and industrial use, and also for deciphering the water quality trends in space and time. There are 173 monitoring stations of groundwater in Uttarakhand as of January 2020, distributed in each district as shown below:

Table 2.4.6 District-wise Status of Groundwater Monitoring System

SN	District	No. of Monitoring Stations ³⁾	Depth Range (m) ¹⁾		Discharge (lpm) ¹⁾		Quality of Groundwater ¹⁾
			Min.	Max.	Min.	Max.	
1	Almora	NA	There are no dug/open wells in use for irrigation				
2	Bageshwar	20	Possibility for large-scale exploitation is low				
3	Chamoli	Nil	No scope of groundwater availability				
4	Champawat	4	74.98	88.39	2683	3100	Overall good
5	Dehradun	46	50	200	252	3198	Overall good

SN	District	No. of Monitoring Stations ³⁾	Depth Range (m) ¹⁾		Discharge (lpm) ¹⁾		Quality of Groundwater ¹⁾
			Min.	Max.	Min.	Max.	
6	Haridwar	36	65.92	223.96	961	2300	Overall good
7	Tehri Garhwal	Nil	Groundwater availability not assessed but is low				
8	Nainital	13	62.45	301	1330	4526	Overall good
9	Rudrapur	Groundwater availability very low					
10	Pithoragarh ²⁾	No scope of development of groundwater					
11	Pauri Garhwal	1	50	200	252	3198	Overall good
12	Uttarkashi	8	Large-scale exploitation of groundwater is not possible				
13	Udhamisingh Nagar	45	74.98	88.39	2683	3100	Overall good

Sources: 1) CGWB, District Profile of Uttarakhand (http://cgwb.gov.in/District_Profile/Uttarakhand_districtprofile.html)

2) <https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031467.pdf> for Pithoragarh

3) GROUND WATER YEAR BOOK UTTARAKHAND (2019-2020)

(3) Water Quality

Analysis of hydro-chemical data also helps in evaluating the nature and extent of groundwater pollution and to ascertain the effectiveness of pollution control measures already in existence.

The chemical quality of groundwater of shallow and deep aquifers in Uttarakhand State varies widely depending on physiography, soil texture and geology of the area. The aquifers are mostly dominated by Ca-Mg-HCO₃ and Ca-HCO₃ types of groundwater. The general chemical quality reveals that most of the wells contain low dissolved mineral contents and hence, groundwater in Uttarakhand is fresh and potable. The chemical quality of groundwater with respect to electrical conductivity (EC), chloride (Cl), nitrate (NO₃) and fluoride (F) are given separately. The groundwater of Uttarakhand is dominated by Ca-Mg cations and CO₃-HCO₃ anions.

A survey on groundwater quality was conducted in May 2019, in which samples were collected from groundwater monitoring stations like dug wells, hand pumps and springs in Dehradun, Haridwar, Pauri Garhwal, Udham Singh Nagar, Nainital, Almora, Champawat and Uttarkashi districts. The result of survey is summarized below:

Table 2.4.7 Categorization of Water in Uttarakhand

No.	Class	% of Samples in this Class	Districts	Interpretation
1	C1S1	16	Almora (40%), Uttarkashi (38%), Dehradun (35%)	Low salinity and low sodium hazard
2	C2S1	69	Dehradun (58%), Uttarkashi (46%), Almora (60%), Udham Singh Nagar (89%), Nainital (94%), Haridwar (87%)	Medium salinity and low sodium hazard
3	C3S1	5	Haridwar (11%), Dehradun (2%), Udham Singh Nagar (8%)	High salinity and low sodium hazard
4	C3S2	1	Uttarkashi (15%)	High salinity and medium sodium hazard

Source: GROUNDWATER YEARBOOK UTTARAKHAND (2019-2020)

As per the U S salinity²⁹ diagram, major groundwater samples of Uttarakhand State, i.e., Dehradun, Uttarkashi, Almora, Udham Singh Nagar districts fall in the C2S1 region, which indicate their suitability for irrigation purposes on all types of soils. Groundwater in some parts of Almora, Uttarkashi and Dehradun districts fall in C1S1 types, i.e., medium salinity and low sodium hazard. Groundwaters that fall within the C1-S1 and C2-S1 region can be used for irrigation on all types of soil with little danger of the development of harmful levels of exchangeable sodium. However, C3- S1 water types of high salinity and low sodium content occurred in few parts of Haridwar, Dehradun and Udham Singh Nagar districts, and this water could only be used to irrigate certain semi-tolerant crops.

2.4.3 Glaciers³⁰

In about 10% area of its total area, the state is covered by snow, ice and glaciers, and are the perennial source of fresh water for four major river systems, namely Yamuna, Bhagirathi, Alaknanda and Kali. There are 968 glaciers covering 2,857 km² area existing in four major river basins of the state.

²⁹US salinity is a lab under US Department of Agriculture for research in agricultural water efficiency and Salinity

³⁰State Specific action plan for water sector

Approximately 10% of the glacier area of the entire Indian Himalaya is located in Uttarakhand. The most active glaciers are generally found in the regions receiving the heaviest snowfall. It is estimated that 38,221 km² of the Himalayan ranges are glaciated. There are about 9,575 glaciers with an estimated area of 37,466 km² in the Indian administrative part of the Himalaya (Raina and Srivastava, 2008; Sangewar and Shukla, 2009).

2.4.4 Traditional Water Sources

There are traditional and unique systems of water resources management in Uttarakhand since the natural environment of the area is characteristic of water. The main water sources in the state are rainfall, glaciers, rivers, streams, lakes, and groundwater. In the Kumaon Region, communities learned various ways to collect and store rainwater through a long history. Rawat and Sah (2009)³¹ documented traditional water harvesting techniques in Uttarakhand and described these as follows:

- **Naula:** created for collecting and storing water from subterranean springs
- **Dharas:** the common source of drinking water similar to a fountain
- **Simar/Gajar:** a marshy tract of land in a farm created by groundwater
- **Chuptaula:** waterholes for animals in high altitudes in general
- **Khals:** large depressions in the mountainous areas used for rainwater harvesting
- **Dhaan:** like a lake where water is collected from small and big streams

2.4.5 Government Schemes on Irrigation

The State Government of Uttarakhand has been implementing and operating several schemes for irrigation development with the purpose of providing adequate irrigation facilities to promote vegetable production in the state. Construction of Hauz (water storage tanks) and ponds for irrigation is supported by the central government through 'Pradhan Manti Krishi Sinchayee Yojna' (PMKSY). Under the scheme, funds are available for irrigation projects and watershed development.

The schemes and programs for irrigation development in the state are summarized in the following table.

Table 2.4.8 Irrigation Development Schemes in Uttarakhand

Name	Aim	Assistance	Period	Budget(Million)
Supported by the Central Government ¹				
Paramparagat Krishi Vikas Yojana (PKVY)	Model Organic Cluster Demonstrations aim at boosting/ promoting organic farming among rural youth/ farmers/ consumers/ traders by creating awareness on the latest technologies of organic farming. These are conducted at the farmer's field in clusters of 20 ha or 50 acres under PKVY	Total financial assistance available for a 20 ha or 50 acres cluster shall be a maximum of INR 10 lakhs for farmer members and INR 4.95 lakh for mobilization and PGS Certification with a subsidy ceiling of one hectare per farmer Of the total number of farmers in a cluster, a minimum of 65 percent farmers should be allocated to small and marginal category, to be fulfilled at cluster level as far as practicable, and where not possible, to be satisfied at mandal/block/ taluka or district level. At least 30% of the budget allocations need to be earmarked for women beneficiaries/ farmers by states	No of clusters -550 2015-16 Budget/ Expenditure 2016-17 Budget/ Expenditure 2017-18 Budget/ Expenditure	19629.7 19022.1 20194 16412.9 27805 0.0
PMKSY	Creation of micro irrigation fund under NABARD	Interventions to be undertaken: • Remodeling of old small irrigation schemes lying defunct • New flow irrigation schemes on community basis • Community micro-irrigation schemes • Strengthening distribution system for command area • Shallow well and borewell on individual basis Financial assistance of 100% for above mentioned community schemes, 50% for	WDC -65 Nos Central share 2014-15 2015-16 2016-17 2017-18 PDMC- OFWM 2015-16 2016-17 2017-18 2018-19	- 497.7 257 162 0 96 150 272 430 320

³¹ Rawat, A. S., & Sah, R. (2009), Traditional knowledge of water management in Kumaon Himalaya

Name	Aim	Assistance	Period	Budget(Million)
		individual or farming groups for construction of shallow wells and borewells watershed development (WDC) Per drop more crop (PDMC-OFWM)	2019-20	
		Accelerated Irrigation Benefit Program (AIBP), Surface Minor Irrigation (SMI), CAD-command area development, Restoration of water bodies (RRR)	PMKSY-AIBP, CAD, SMI and RRR 2016-17&2017-18	9340M
		AIBP Central Share c/o water channels	2015-16 2016-17 2017-18	61586.60 80015.0 32400.0
		AIBP/PMKSY	2018-19 2019-20	41766.50 15999.70
Supported by the State Government ²				
New machinery and equipment	To provide assured irrigation to farmers	Provision of new machinery in tube wells/lift schemes	2015-16 2016-17 2017-18 2018-19 2019-20	65 25 50.6 38.9 48
C/o high sprinklers	To provide assured irrigation to farmers	Providing sprinkler-based irrigation to farmers	2015-16 2016-17 2017-18 2018-19 2019-20	227 108.9 0.0 50 0.0
C/o water channels, pipelines and tanks	To provide assured irrigation to farmers	Providing water channels and tanks	2015-16 2016-17 2017-18 2018-19 2019-20	3778.5 1944.30 1071.80 2595.30 2987.90
Lump sum provision	To provide assured irrigation to farmers	Lump sum provision for irrigation facilities	2015-16 2016-17 2017-18 2018-19 2019-20	3342.80 1664.30 2706.50 1345.20 2714.50
C/o warehouses	Provide storage	Provide storage facility for grains	2015-16 2016-17 2017-18 2018-19 2019-20	829.60 190 179 488.10 1100
C/o artisan wells	To provide assured irrigation to farmers	Providing irrigation facility thru' wells	2015-16 2016-17 2017-18 2018-19 2019-20	2418.60 1660.80 1356.10 0.0 1604
Assistance for boring and equipment	To provide assured irrigation to farmers	Providing assistance to famers for tube well boring and machinery	2015-16 2016-17 2017-18 2018-19 2019-20	50 50 0.0 0.0 0.0
Strengthening ion and rehabilitation of water channels (Guls)	Maintain water channels	Repair and rehabilitation of water channels	2015-16 2016-17 2017-18 2018-19 2019-20	5288.70 4346.30 4177.30 4605.40 2944.50
Artificial recharge	Recharge of groundwater	To maintain groundwater level	2015-16 2016-17 2017-18 2018-19 2019-20	542.80 30.0 374.10 171.10 54.30

Sources: ¹ Data.gov.in/rajya sabha questions

² <https://minorirrigation.uk.gov.in/pages/display/112-budget-progress-districtwise>

Among the above schemes, PMKSY is a main program of irrigation development. Strategic action plans for irrigation development in each district during the period from 2016-17 to 2020-21 are summarized in the following table.

Table 2.4.9 Block-wise & Component-wise Abstract of Project Cost of PMKSY (2016-2021)

(Unit: INR lakh)

Name of District/Block	Name of Component					Project Management & Capacity Building	Total
	AIBP	Har khet ko pani	Per Drop More Crop	PMKSY Watershed	MGNREGA		
Nainital							
Haldwani	1,552.51	21,786.17	47.47	1545.6	0.00	477.82	25,409.27
Kotabagh	464.72	8,047.66	233.21	0.00	6.40	175.04	8,927.03
Ramnagar	242.16	7,107.54	48.24	0.00	0.00	147.96	7,545.9
Dhari	34.69	651.19	118.24	744.90	6.30	16.34	1,571.66
Ramgarh	43.60	2,774.35	142.04	653.10	8.16	59.49	3,680.74
Okhalkanda	123.65	1,848.59	1,024.32	0.00	52.00	60.97	3,109.53
Bhimtal	30.46	3,468.56	251.88	0.00	17.80	75.37	3,844.07
Betalghat	77.43	3,792.05	182.62	0.00	25.64	81.55	4,159.29
Subtotal	2,568.92	49,476.11	2,048.02	2943.60	116.30	1094.53	58,247.49
Pithoragarh							
Bin	89.07	2,095.5	530.95	89.00	114.35	No data	2,918.87
Munakot	69.18	2,664.00	601.37	1,056.08	148.00	No data	4,538.63
Kanalichina	37.89	2,574.00	663.37	259.65	110.00	No data	3,644.91
Didihat	152.40	3,288.00	676.07	7,24.72	310.00	No data	5,151.19
Dharchula	340.17	3,044.20	562.27	3,390.00	367.50	No data	7,704.14
Munsiyari	240.29	2,435.00	863.37	0.00	300.00	No data	3,838.66
Berinag	36.46	3,571.60	613.37	1,150.00	333.35	No data	5,704.78
Gangolihat	260.46	2,730.00	578.01	0.00	331.35	No data	3,899.82
Subtotal	1,225.92	22,402.3	5,088.78	6,669.45	2,014.55	-	37,401.00
Tehri Garhwal							
Bhilangna	5,309.55	2,523.22	791.75	No data	No data	No data	8,624.52
Kirtinagar	0.00	615.00	279.97	No data	No data	No data	894.97
Devpriya	0.00	100.00	404.22	No data	No data	No data	504.22
Chamba	1,121.00	455.00	525.88	No data	No data	No data	2,101.88
Partapnagar	2,629.00	502.00	317.28	No data	No data	No data	3,448.28
Thauldhar	128.00	290.00	251.36	No data	No data	No data	669.36
Jakhnidhar	292.00	117.00	225.20	No data	No data	No data	634.20
Jaunpur	0.00	460.27	290.64	No data	No data	No data	750.91
Narendranagar	0.00	0.00	259.04	No data	No data	No data	259.04
Subtotal	9,479.55	5,062.49	3,345.34	-	-	-	17,887.38
Uttarkashi							
Bhatwari	247.00	2,876.99	1,342.94	2,245.80	21.30	843.00	6,734.03
Dunda	353.06	7,198.19	984.32	825.00	71.30		9,431.87
Chinyalisaour	1,017.04	7,626.43	825.15	0.00	26.60		9,495.22
Naugoan	508.92	9,153.47	1,653.73	1,957.05	31.33		13,304.50
Purola	130.00	4,715.85	787.03	1,495.20	14.12		7,142.20
Mori	283.17	10,481.07	1,030.99	934.95	10.45		12,740.63
Subtotal	2,539.19	42,052.00	6,624.16	7,458.00	175.10	843.00	58,848.45
Total	15,813.58	118,992.90	17,106.30	17,071.05	2,305.95	1,937.53	172,384.32

Sources: District Irrigation Plans of Nainital, Pithoragarh, Tehri Garhwal and Uttarkashi

2.5 Transportation and Communication Network

Paucity of good roads and absence of well-developed transport system have been the major obstacles for the marketing of agriculture and horticulture products in the hill regions. According to FAO, an

estimated one-third of all food produced globally is lost unconsumed either at the consumers or retailer's level, or spoiled due to poor transportation and harvesting practices³².

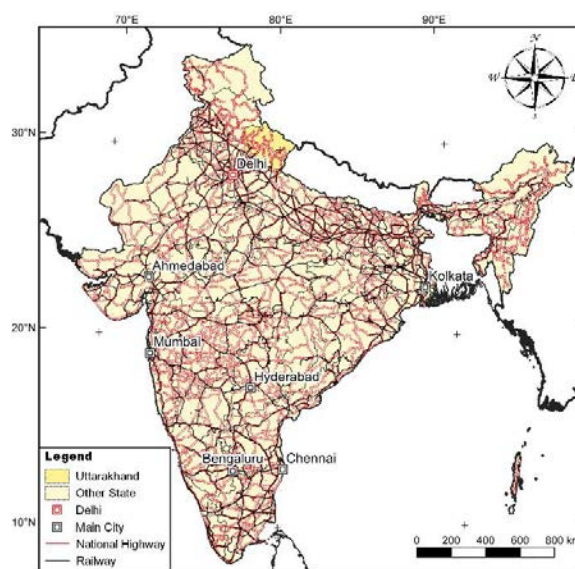
In Uttarakhand, the public transport facility is reported to be used by 83% farmers, and the remaining use their own vehicles (17%)³³. As discussed earlier, Uttarakhand markets are usually located in the plain regions of the state, therefore, roads and transportation facility are relatively better as compared with hilly terrains. Cold storage facility exists only with 9% farmers in the state. High wastages occur due to multi-layered marketing channels, lack of marketing infrastructure, fragmented cold chains, absence of sufficient cold storage and associated logistics as well as organized distribution system (GOI, 2013)³⁴. One of the biggest constraints in the horticulture sector has been the extent of postharvest losses which is about 5.8-8.0% with monetary value amounting to around 44,000 crores based on wholesale prices as of 2009³⁵.

(1) Means of Transportation in Uttarakhand

The means of transportation in Uttarakhand is varied as the terrain of different areas is different. It has a limited railway set up with various gauge widths. It has a good network of motor roads including highways, main roads, and feeder roads. Besides this, there are tracks that can only be covered by jeeps, mules, or by foot. The southern areas of the state are flat where the road coverage and options for transportation are many while the northern half of the state is mostly hilly and thus, the means of transportation are often limited.

(2) Situation of Pucca Roads and Railway Lines

In Uttarakhand, there is a good network of roads constructed by Public Works Department (PWD) (75.97%), Other departments (15.37%) include the Agriculture Marketing Board of Uttarakhand (2.14%) and local bodies (8.67%). A large area of Uttarakhand is still left which can be covered either by mules, jeep, or on foot. However, the availability of roads has improved since 2011-12. The total length of the roads was 39,461.92 km in 2011-12 which has increased to 47,292.27 km in 2018-19 with an addition of 7,830.35 km of roads. It is good to note that the rural roads have been extended to 9,409.69 km more, which is a good sign of development as this will positively affect the connectivity.



Sources :- Prepared by JICA Survey Team
- Base map and data from OpenStreetMap and OpenStreetMap Foundation

Figure 2.5.1 Traffic Connectivity in India

Table 2.5.1 Statistics of Roads and Railway Lines in Uttarakhand

S.No.	Departments	Length in km (2011-12)	Length in km (2018-19)	Changes from 2011-12 to 2018-19)
1	Roads under PWD* (Public Works Department)			
	National highways	1,357.76	2,091.34	733.58
	State highways	3,788.20	4,516.91	728.71

³² FAO (2011). Global Food Loss and Waste.

³³ <http://www.un.org/sustainabledevelopment/sustainable-consumption-production/> accessed on April 20, 2017.

³⁴ Final Report of Committee of State Ministers, In-charge of Agriculture Marketing to Promote Reforms (GOI 2013), pp.28 (<http://www.dmi.gov.in/Documents/stminpreform.pdf>)

³⁵ <http://ndpublisher.in/admin/issues/EAV61N3y.pdf> (Economic Affairs EA: 61(3): 549-559, September 2016 "Agricultural marketing system in Uttarakhand: Structure and functioning" by Deepika Joshi, Md. Ejaz Anwer, Rohit Kumar, Simmi Rana, Ranjit K Paul, Anil Kumar and Raka Saxena, from ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi, India, ICAR-Indian Agricultural Statistics Research Institute, New Delhi, India, GB Pant University of Agriculture and Technology, Pantnagar, New Delhi, India)

S.No.	Departments	Length in km (2011-12)	Length in km (2018-19)	Changes from 2011- 12 to 2018-19)
	District main roads	3,289.74	2,113.17	-1176.57
	District other roads	2,945.04	2,714.60	230.44
	Rural roads	14,543.89	23,953.58	9409.69
	Light vehicle roads	852.22	536.68	-315.54
	Total	28,800.85	35,926.28 (75.97)	7125.43
2.	Roads under local bodies			
	Motor road – Zila Panchyat	862.45	915.22	52.77
	Motor road – Nagar Palika/ Nagar Panchayat/ Nagar Nigam and others	1,947.30	3,179.59	1232.29
	Total	2,809.75	4,094.81 (8.66)	1285.06
3.	Roads of other departments			
	Irrigation	7,43.00	741.00	-2.00
	Sugar Cane	885.00	899.347	14.347
	Forest	3,257.00	3,731.48	474.48
	BRTF	1,281.32	885.35	396
	Uttarakhand Agriculture Production Marketing Board	1,685.00	10,14.00 (2.14)	-671
	Total	7,852.32	7,271.18 (15.37)	-581.14
	Total length of the roads	39,461.92(100)	47,292.27 (100)	7830.35
	Railway lines			
	Broad gauge		283.76	
	Short gauge		61.15	
			344.91	

Source: Developed by the JICA survey Team based on PWD and Relevant Departments/Statistical Diary, Uttarakhand 2011-12 and 2018-19, Economic and Statistical Directorate, Planning department, Govt. of Uttarakhand;

*In the PWD roads Pucca/Kutchra Motorable roads are also included; **Figures in Parentheses shows percentage to total

(3) Mobile Network

According to data provided by the Information Technology Development Agency, out of a total of 15,745 villages in the hill state, 434 of them did not have network service availability until May 2020. Under the Bharat net scheme, internet services in 3,738 villages of the state are upgraded³⁶. Twelve thousand villages of Uttarakhand will get internet connectivity in the second phase of the BharatNet project. The center government gave its nod to implement the BharatNet 2.0 project in Uttarakhand (February 2021)³⁷.

2.6 Farmers' Organizations

2.6.1 Types of Farmers' Organizations

In Uttarakhand, various departments and project promotes community-based organizations among the farmers. Farmers' organization having legal entity as cooperatives are registered under Uttarakhand Cooperative Society's Act 2003 and also Uttarakhand Self-reliant Cooperative Societies Act 2003, others may be registered under Autonomous Society's Act 1860 (Amendment 2019). Some are also be registered under Company's Act 2013 as Producer Company. Furthermore, for women empowerment and improving rural livelihood, Self-help Groups (SHGs) and their federations mostly among women in the rural areas have also been promoted by State Rural Livelihood Mission (SRLM) across the states. This section provides the overview of farmers' organization in the state.

(1) Primary Agriculture Cooperative Societies (PACS)

PACS are multi-purpose cooperatives having credit, savings, input supply (fertilizers, seeds, pesticides, insecticides), marketing of agriculture/ horticulture produce, consumer business and services of agriculture implements. These PACS also have got owns but they are under-utilized. These cooperatives are registered under the Uttarakhand Cooperative Societies Act 2003.

³⁶ Planning for Bharat Net Phase 2: Report on IIT Bombay BharatNet Planning Tool (2016). Indian Institute of Technology Bombay (http://bbln.nic.in/WriteReadData/LINKS/Rpt_Nw_Plg_tool6cad24a7-eea8-4adc-91ff-468d7119eeb0.pdf)

³⁷ "12000 Uttarakhand villages to get net connectivity under Bharat Net project" The Economic Times. (22 Feb 20 21). <https://economictimes.indiatimes.com/industry/telecom/telecom-news/12000-uttarakhand-villages-to-get-net-connectivity-under-bharatnet-project-2-0/articleshow/81153624.cms?from=mdr>

Table 2.6.1 Relevant Cooperative Societies in Uttarakhand for Horticulture (2020)

District / District Cooperative Bank	No. of PACS
Almora	80
Bageshwar	18
Udam Singh Nagar	32
Chamoli	47
Rudrapur	34
Dehradun	39
Nainital	50
Haridwar	43
Kotdwar (Pauri)	118
Pithoragarh	74
Champawat	22
Tehri Garhwal	78
Uttarkashi	35
Total	670

Source: Uttarakhand Cooperative Department booklet "Uttarakhand Mein Sahkarita Ke Badtey Kadam"

In addition to PACS, cooperatives named as *Bhesaj Sanghas* are organized for the medicinal and aromatic plants farmers at the district level as a federation.

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

The Department of Agriculture and Cooperation (DAC), Ministry of Agriculture, Government of India launched a pilot program for promoting member-based Farmer Producer Organizations (FPOs) during 2011-12, in partnership with state governments, which was implemented through the Small Farmers' Agribusiness Consortium (SFAC). In this initiative, approximately 250,000 farmers across the country are mobilized into 250 FPOs (each with an average membership of 1,000 farmers) under two sub-schemes of the National Vegetable Initiative for Urban Clusters (RKVY) and Program for Pulses Development for 60,000 rainfed villages. The purpose of the project is to collectivize farmers, especially small producers, to facilitate technology dissemination, improve productivity, enable improved access to inputs and services, and thus, to increase farmer incomes and strengthen their sustainable agriculture-based livelihoods. These attempts resulted in mobilizing 300,000 farmers into village-level Farmer Interest Groups (FIGs), which are being federated into registered FPOs.

In 2020, the central government also announced the formation of 10,000 FPOs between 2019/20 – 2023-24 and the provision of support up to five years of formation.³⁸ The salient features of this initiative are given in the table below.

Table 2.6.2 Main Features of FPO Scheme Announced in 2020 by the Central Government

Main Points	Outline
Main Implementing Agency	- Small Farmers Agribusiness Consortium (SFAC) - National Bank for Agricultural and Rural Development (NABARD) - National Cooperative Development Corporation (NCDC)
No. of FPOs	10,000 FPOs in total 15% of the total number of FPO shall be in the Aspirational Districts. - In the Aspirational Districts, at least one FPO in each block to be organized. - Aspirational Districts in Uttarakhand: Udham Singh Nagar and Haridwar
Unit of FPO Formation	FPOs formed on the basis of cluster of agriculture and allied sectors
Registration	FPOs must be registered under the Indian Companies Act 1956 (Amendment 2013/ Part 9 A) or State Cooperative Societies Act.
No. of Members	- Plain area: 500 members in each FPO - Hilly area: 300 members in each FPO (200 in hilly region in North East States)
Facilitation	Cluster-based Business Organizations (CBBOs) will be engaged by implementing agencies in each cluster or state.
Financial and Capacity Building Support	- Management of FPO: matching equity grant up to INR 2,000 per member with ceiling of INR 1.5 million. - Credit Guarantee Facility/ Project Loan per FPO: up to INR 20 million - Specialized training and skills development ➤ For FPOs registered under Companies Act: Bankers' Institute of Rural Development

³⁸<http://sfacindia.com/UploadFile/Statistics/Government-Order-on-FPO-Scheme.pdf>

Main Points	Outline
	(BIRD) by NABARD is the nodal agency. ➤ Laxmanrao Inamdar National Academy for Cooperative Research & Development (LINAC) Gurugram by NCDC is the nodal agency for training of FPOs registered under the Cooperative Societies Act.
Other Approach Adopted	• One district one product to be promoted for marketing, processing, and export.

Source: <http://sfacindia.com/UploadFile/Statistics/Government-Order-on-FPO-Scheme.pdf>

(3) Facilitating Agencies for FPO Formation and Operation

As briefly indicated above, several organizations have been actively facilitating FPO formation and supporting their operation. The table below summarizes the outline of such organizations.

Table 2.6.3 Facilitating Agencies for FPO Formation and Operation

Department/ Organization/ Institute	Mandate
Small Farmers' Agri-business Consortium (SFAC)	Established in 1994 as an Autonomous Society by the Ministry of Agriculture, Cooperation and Farmers' Welfare. SFAC aims at promoting sustainable growth of agriculture and agriculture-based industries. The areas of intervention include postharvest processing, marketing for both domestic and overseas markets. Not only implementing the Government of India program, it also works with farmers to form groups/ organizations and to set up agribusiness for value addition and marketing. SFAC is a nodal agency to set up e-commerce platform- National Agriculture Market (known as e-Nam) - through PPP.
National Agriculture Bank and Rural Development (NABARD)	NABARD's mission is to "promote sustainability and equitable agriculture and rural development through participative financial and non-financial interventions. NABARD runs three agriculture related schemes: Producer Organization Development Fund (PODF), Watershed Development Program, and Tribal Development Program. Out of these, PODF provides 1) loan linked grant support for promotion, capacity building, and market interventions; and 2) grant assistance for capacity building and networking activities for FPO. Registered farmers' organizations such as producer company (Registered under 581 A Part IXA of Company's Act 1956), producer cooperatives, farmer federation, PACS and others are eligible for PODF. Kisan Credit Card scheme of NABARD is also a way to improve access to agriculture credit.
Indian Farm Forestry Development Cooperative Limited (IFFDC)	Registered as a multi-state cooperative society, the IFFDC operates in 19 states and carries out farm forestry program, livelihood, and poverty alleviation program. Recently, IFFDC also expanded its operational area in watershed management, climate, and CSR-related activities and farm inputs supplies in response to the community needs.
Cooperative Department	The Cooperative Department has also been playing a key role in the development of horticulture in the state. The state has primary agriculture cooperative societies, Bhesaj Sangha (Cooperatives for MAPs) that works for the horticulture sector. In Uttarakhand, the terminology is modified and PACS are called MPACS now, which means multi-purpose Primary Agriculture Cooperative Societies – MPACS are multi-purpose cooperatives having credit, savings (mini bank), input supply (fertilizers, seeds, pesticides/insecticides), marketing of agriculture /horticulture produce, consumer business, and custom service business of agricultural implements.
National Cooperative Development Corporation (NCDC)	The National Cooperative Development Corporation (NCDC) was established by an Act of Parliament in 1963 as a statutory corporation under the Ministry of Agriculture & Farmers Welfare. It has financial schemes for processing, marketing, storage and export and import of agriculture produces and other items. Loans and grants are advanced to state governments for financing primary and secondary level cooperative societies and direct to the national level and other societies having objects extending beyond one state. NCDC also has in-house technical and managerial capabilities in the areas of cooperation, organization and methods, financial management, management information systems, sugar, oilseeds, textiles, fruits and vegetables, dairy, poultry and livestock, fishery, handlooms, civil engineering, refrigeration and preservation to help cooperatives to identify/formulate projects and successfully implement them. (Source: https://www.ncdc.in/index.jsp?page=genesis-functions=en)

Source: Compiled from various sources by the JICA Survey Team

(4) Existing FPOs in Uttarakhand

1) NABARD-supported FPOs

As per the NABARD statistics related to FPOs in Uttarakhand, a total of 83 FPOs are formed. The number of members is only reported for the 53 FPOs which comprised 16,153 members. The average membership is 305 per FPO.

2) SFAC-supported FPOs

As per SFAC data³⁹, seven FPOs are promoted and registered in Uttarakhand which are supported by SFAC. These FPOs cover 6,004 farmers (as of 31.5.2020). The average membership of SFAC-promoted FPOs is around 858.

Table 2.6.3 Details of the FPOs Promoted by SFAC in Uttarakhand

Sl. No	District	Promoting Institution	Name of the FPO	Date of Registration	Address	Produce Handled
1	Pauri Garhwal	IFFDC40	Adarsh Autonomous Cooperative	29/May/13	C/o Shri Ghanshyam Dubey, Marha Tola, Bhatgaon, Sehora Block, Tal: Pauri	Potato, Peas, Cabbage
2	Pauri Garhwal	IFFDC	Pragati Autonomous Cooperative	NA	At : Miyadi, Tal : Dhoomakot, Dist : Pauri Garhwal	Tomato, Potato, French Beans
3	Dehradun	IFFDC	Maarkhamgrand Producer Company Ltd.	17/Jun/13	42, Majra, Kudkawala, Near Maarkhamgrand, Doiwala, Tal: Dehradun	Tomato, Potato, French Beans
4	Dehradun	IFFDC	Haritranti Producer Company Ltd.	11/Jun/13	At : Sehaspur 171, PS : Sehaspur, Tal : Vikasnagar,	Potato, Okra, Peas
5	Uttarkashi	Sumati Foundation	Sumati Farmer Agriculture Swayatt Sahakari Samiti - North Jhandichaour	31/Aug/12	Sumati Farmer Agriculture Swayatt Sahakari Samiti, At : Dhanori, Tal : Badkot, Dist : Uttarkashi	Paddy
6	Pauri Garhwal	Sumati Foundation	Sumati Farmer Agriculture Swayatt Sahakari Samiti - Buakhal	30/Oct/12	At: Bobakhal, Near Government Rashan Shop, Kotdwara Road, Po- Bobakhal, Tal : Pauri, Dist : Pauri Garhwal	Wheat, Madhava, Paddy
7	Haridwar	Sumati Foundation	Sumati Farmer Agriculture Swayatt Sahakari Samiti - Dhanori	18/Mar/13	Behind National Inter College, Jaswada Road, Dhanori, Tal: Roorkee, Dist : Haridwar	Okra, Peas, French Beans, Tomato- Local, Potato, Tomato- Hybrid, Cabbage, Cauliflower, Okra, Pumpkin, Brinjal

Source: <http://sfacindia.com/PDFs/List-of-FPO%20identified-by-SFAC/List%20of%20FPOs%20in%20the%20State%20of%20Uttarakhand.pdf?var=9958908.25855>

3) NCDC-Supported FPOs

In four districts and 15 blocks, NCDC has planned to form 15 FPOs. The district-wise, block-wise list is given below. While FPOs of plain areas of Dehradun and Haridwar, FPO of barley, oil seeds, green maize, pulses, potato, and jaggery are to be promoted. In hills districts like Nainital, FPOs of apple, spices, and pulses will be promoted. In Udham Singh Nagar, FPOs of mustard, pea, and vegetables will be promoted.

Table 2.6.4 Districts and Blocks for FPO Promotion by NCDC during 2020-21

Name of District	Name of Block	Major Commodity	No. of FPOs Proposed
Dehradun	Raipur	Barley, Oil Seeds, Green Maize	1
Dehradun	Doiwala	Barley, Oil Seeds, Green Maize	1
Dehradun	Vikasnagar	Barley, Oil Seeds, Green Maize	1
Haridwar	Bahadradabad	Oilseeds, Pulses, Potato, Jaggery	1
Haridwar	Bhagwanpur	Oilseeds, Pulses, Potato, Jaggery	1

³⁹SFAC Website-<http://sfacindia.com/PDFs/List-of-FPO%20identified-by-SFAC/List%20of%20FPOs%20in%20the%20State%20of%20Uttarakhand.pdf?var=9958908.25855>

⁴⁰ IFFDC - Indian Farm Forestry Development Cooperative Ltd. (Outline of the organization is given in Table 2.6.3.)

Name of District	Name of Block	Major Commodity	No. of FPOs Proposed
Haridwar	Laksar	Oilseeds, Pulses, Potato, Jaggery	1
Nainital	Haldwani	Apple, Spices, Pulses,	1
Nainital	Bhimtal	Apple, Spices, Pulses,	1
Nainital	Kotabag	Apple, Spices, Pulses,	1
Nainital	Dhari	Apple, Spices, Pulses,	1
Udham Singh Nagar	Khatima	Mustard, Peas, Vegetables	1
Udham Singh Nagar	Jaspur	Mustard, Peas, Vegetables	1
Udham Singh Nagar	Kashipur	Mustard, Peas, Vegetables	1
Udham Singh Nagar	Gadarpur	Mustard, Peas, Vegetables	1
Udham Singh Nagar	Rudrapur	Mustard, Peas, Vegetables	1
4 Districts			15

Source: <https://www.ncdc.in/documents/whats-new/1719191120Website-Advertisement-for-CBBO-empanelment.pdf> (NCDC Website)

(5) Self-help Groups (SHGs), Producer Groups, Farmers Interest Groups and their Federations

In Uttarakhand, primary level groups in the form of SHGs are being formed not only by NABARD but also by the Department of Rural Development, Women and Child development, Watershed, Cooperatives, Agriculture and Horticulture, Forest, etc., under various programs and schemes through partner NGOs and field level organizations including PACS. The State Rural Livelihood Mission (SRLM) implemented by the Rural Development Department is one of the most important projects in terms of formations of new SHGs. Projects for women and child development such as Swayam Siddha, Mahila Dairy Project also created SHGs in various districts. The Diversified Agriculture Support Project (DASP) financed by the World Bank was another major project promoted SHGs in the state. Besides SHGs, Producer Groups, Vulnerable Producer Groups and Farmers Interest Groups (FIGs) are also formed under various projects like IFAD-ILSP, World Bank's GRAMYA - I and II (Watershed Directorate) and several other organizations like Himmothan Society (Tata Trust promoted) and various other NGOs.

1) SHGs

As mentioned above, there are various initiatives promoting formation of SHGs. Yet, no single agency is keeping track of the entire dynamics of SHGs. Therefore, in this section, figures from main actors in promoting SHGs are referred to.

(a) NABARD

As per the State Focus Paper Uttarakhand 2021-22, NABARD, cumulatively, there are 739,73 SHGs in Uttarakhand. These SHGs have saving bank accounts in nearby branches of banks and therefore, these SHGs are called saving linked⁴¹. Out of the total SHGs, 163,54 (22%) SHGs are credit-linked⁴² in the State as of 31 March 2020. This shows that majority of SHGs (78 %) do not take loans from banks but use their own funds for inter-lending⁴³. In Uttarakhand, 73,973 SHGs in total are savings linked with total savings amount of INR 1,068.953 million with various banks.⁴⁴

(b) NRLM

The NRLM is one of the big players in the formation of SHGs. Until 1st June 2021, 31,678 SHGs have been formed in all the 95 blocks of Uttarakhand. The table below provides district-wise details of the SHGs.

⁴¹ Saving linked mean the SHGs are linked with banks in terms of having their Saving Accounts

⁴² Credit linked SHGs means those SHGs that are being graded by the banks using prescribed parameters of NABARD and provided with a Cash Credit Limit (CCL) for getting loans from banks

⁴³ Inter-lending means that the SHG is using its Common Fund to lend to the members. This common fund can comprise Loans taken from Bank, SHG savings from members, Interest received, etc.

⁴⁴State Focus Paper Uttarakhand 2021-22 NABARD https://www.nabard.org/auth/writereaddata/tender/NABARD%20SMFI%202019-20_compressed.pdf

Table 2.6.5 SHGs Formed under NRLM in Uttarakhand in Different Districts

S.No.	District	Blocks covered	Total SHGs
1	Almora	11	1968
2	Bageshwar	3	745
3	Chamoli	9	2983
4	Champawat	4	1125
5	Dehradun	6	2582
6	Haridwar	6	3150
7	Nainital	8	3319
8	Pauri Garhwal	15	4133
9	Pithoragarh	8	1948
10	Rudraprayag	3	1060
11	Tehri Garhwal	9	2326
12	Udham Singh Nagar	7	4739
13	Uttarkashi	6	1600
	Total	95	31678

Source: NRLM, Ministry of Rural Development, Government of India

<https://nrlm.gov.in/shgReport.do?methodName=showDistrictShgCount&encd=35&stateName=UTTARAKHAND&reqtrack=ojP3ag6bDacgJOM018LnyspTI>

2) Joint Liability Groups (JLGs Farmer Interest Groups)

JLGs are promoted by NABARD to enable small farmers to access institutional credit extended as agriculture credit for the farmers. The group is formed by 4-10 small farmers having common interest. The loan applied by JLGs will not require collateral. There are 45,546 Joint Liability Groups (JLGs) that have been credit linked in Uttarakhand as of 31 March 2020.

3) SHG Federations and Livelihood Collectives

(a) IFAD ULIPH and ILSP

The IFAD-supported projects Uttarakhand Livelihood Improvement Project for Himalayas (ULIPH/ 2003-2012) and Integrated Livelihood Support Project (ILSP/2011 – 2021) are known for their significant contribution to support SHGs. In both these projects, 232 federations/ livelihood collectives were formed. The table below provides details of the federations and SHGs formed under ILSP. All the federations are registered under the Self-reliant Cooperative Act of Uttarakhand. In that project, 3,617 SHGs were linked with 71 federations that covered 35,397 households.

Table 2.6.6 Coverage of SHGs and Federations in Different Districts under ILSP

Division	No of Federations	No of SHGs	No of Shareholders
Almora	11	793	6168
Bageshwar	12	641	8247
Chamoli	19	801	6461
Tehri	12	733	7452
Uttarkashi	17	649	7069
Total (Fed.)	71	3617	35397

Source: Annual Report, ILSP, 2019-20

ILSP has created 161 livelihood collectives under the Self-reliant Cooperative Act 2003. The district-wise details of the livelihood collectives are given in the table below.

Table 2.6.7 Producers' Groups (PG)/ Vulnerable Producer Groups (VPGs) and Livelihood Collectives at a Glance

SN	Districts	Villages	Formed and Supported PGs/VPGs	Supported HHs	Livelihood Collectives
1	Almora	767	2,456	23,060	40
2	Bageshwar	155	762	6,708	11
3	Chamoli	151	978	7,596	13
4	Dehradun	228	718	8,024	13
5	Pauri	132	331	3,256	6
6	Pithoragarh	255	1,155	10,126	16
7	Rudraprayag	203	1,062	9,115	15
8	Tehri	174	779	7,601	11
9	Uttarkashi	70	406	3,804	6

SN	Districts	Villages	Formed and Supported PGs/VPGs	Supported HHs	Livelihood Collectives
Total		2,135	8,647	79,290	131

Source: Annual Report, ILSP, 2019-20

These federations/livelihood collectives of IFAD-ILSP undertake a variety of farm and non-farm sector activities. Horticulture sector has been covered by these federations in several ways – providing inputs to the farmers through Producer Groups (PG)/ Vulnerable Producer Groups (VPGs)⁴⁵ at the grassroots level, marketing of horticulture produce under the brand name of “Hilans” through their own outlets as well as in the *mandis* and also to various private sector companies. Several federations have started processing of fruits and spices. The project is also running 25 growth centers. Majority of the growth centers of IFAD-ILSP are agro-processing centers and related to horticulture.

(b) Gramya II

Gramya II is a World Bank-supported project implemented through the Watershed Directorate of Uttarakhand. The second phase of this project has been implemented in 509 Gram Panchayats, which is contiguous to the Gramya I-supported Gram Panchayats. The total project area covers about 263,800 hectare of land spread in 8 districts and 18 development blocks. The project created a number of FIGs, farmer federations, cooperatives, and producer companies.

(c) JICA Uttarakhand Forest Resource Management Project (UFRMP)

The UFRMP is implemented by the Forest Department in 13 forest divisions⁴⁶. The project has created 18 cluster-level federations out of 1,500 SHGs. These federations are spread out in eight different districts – Almora, Bageshwar, Chamoli, Nainital, Pithoragarh, Pauri Garhwal, Champawat and Tehri Garhwal. The project has also created a state-level federation of their cluster federations. This apex is registered under Self-reliant Cooperative Act in the name of Uttarakhand Van Sansadhan Prabhbandhan Swayatt Sehkarita.

(d) NGOs

In Uttarakhand, several NGOs are also actively promoting formation of SHGs as well as their federations. Especially in horticulture sector development, Tata Trusts initiated Himmothan Pariyojana (HMP) as one of the key actors and has created more than 50 federations of SHGs/PGs/VPGs.

2.7 Gender and Agriculture

2.7.1 Gender Situational Analysis Based on the Field Survey

The gender situation in the proposed districts were assessed based on the questionnaire survey, of which findings are reported in Attachment 5.2. and the key informant interviews as reported in Attachment 5.3. The Gender Action Plan (GAP) for the project is given in Attachment 11.1.

2.7.2 Gender Situation in Uttarakhand

(1) Gender Indicators

India's position on the Global Gender Gap Report as per World Economic Forum (WEF) in 2011, reveals that India ranks 113 on the Gender Gap Index (GGI) among 135 countries. Thereafter, India's gender situation has rather deteriorated as ranked 140th among 156 countries in 2021 report of GGI. Some of the gender indicators for India and Uttarakhand are shown in the table below and show that all the indicators for Uttarakhand are above national average.

Table 2.7.1 Demographic Indicators Related to Gender in India and Uttarakhand

Indicators	India		Uttarakhand	
	Male	Female	Male	Female
Sex ratio- * (Census 2011)	-	943	-	963
Sex ratio (NFHS-4) 2015-16	-	991	-	1,015

⁴⁵ PVGs are formed among the vulnerable families under IFAD-ILSP.

⁴⁶ The project divisions include: Alakhnanda Soil conservation, Civil Soyam (Pauri), Tehri Dam I, Narendra Nagar, Lansdowne Soil, Ramnagar Soil, Ranikhet Soil, Civil Soyam (Almora), Nainital Soil, Bageshwar, Champawat, Pithoragarh and Mussoorie Forest Division.

Child sex ratio - (Census -2011)	-	914	-	886
Child Sex ratio (NFHS-4) 2015-16	-	919	-	888
Literacy(Census 2011) %	82.14	65.46	87.4	70.01
Literacy (NFHS-4)%	85.7	68.4	90.7	76.5
Health Status (Anemia NHFS -4)%	22.7	53.2	15.5	45.2
Life expectancy (Sample Registration Survey 2013-17) Years	67.8	70.4	69	74

Source: 1. <http://censusindia.gov.in> 2. <http://niti.gov.in/content/life-expectancy>, 3. NFHS -4 (2015-16) factsheet India and Uttarakhand

Although the state indicators are better than those of India, the gap can be seen between rural and urban areas of India and Uttarakhand. Among the indicators, there is a significant gap between the urban and rural areas in terms of usage of clean fuel for cooking. In rural Uttarakhand, the access to clean fuel for cooking is 55.4% less than in comparison to urban areas in the state. As fetching fuelwood is mostly the work of women, this implies that women consume time and energy for securing household energy which could be otherwise used for economic activities and also for their well-being. Low life expectancy among women in rural Uttarakhand, which is 6.7 years of the state average for female, could be partly due to their hard work.

Table 2.7.2 Other Societal Indicators to Understand Gender Inequality

Parameters / Indicators	India - (NFHS-4, 2015-16)			Uttarakhand (NFHS-4, 2015-16)		
	Urban	Rural	Total	Urban	Rural	Total
Households using clean fuel for cooking ¹ (%)	80.6	24.0	43.8	86.6	31.2	51
Women aged 20-24 years who married before age 18 years (%)	17.5	31.5	26.8	12.2	14.7	13.8
Women aged 15-19 years who were already mothers or pregnant at the time of the survey (%)	5.0	9.2	7.9	2.2	3.2	2.8
Currently married women who usually participate in household decisions (%)	85.8	83	84	92.6	88.2	89.8

1. Electricity, LPG/natural gas, biogas

Source: National Family Health Survey 3 2005-06 and NFHS- 4, 2015-16. Ministry of Health and Family Welfare, Government of India.

The gender situation in the project districts is shown below. Female literacy rates are significantly falling behind that of men. Years of schooling among women are shorter than that of males by 2-4 years.

Table 2.7.3 Gender Indicators in the Project Districts

Indicators	Nainital		Pithoragarh		Tehri		Uttarkashi	
	M	F	M	F	M	F	M	F
Literacy 2011	91.09	78.21	93.45	72.97	89.91	61.77	89.26	62.23
Sex ratio- 2011	-	934	-	1020	-	1077	-	958
Child sex ratio -2011	-	902	-	816	-	897	-	916
Life expectancy at birth*	68.3	74.1	69.5	74.9	66.1	71.4	67.5	73.1
Years of schooling*	9.3	7.2	9.5	6.8	9.6	5.8	9.7	5.9

Source: Census of India 2011 (<https://www.indiacensus.net/states/uttarakhand/sex-ratio-2021>),

Source: * Human Development Report, Uttarakhand State Survey, 2017

(2) Workload and Gender Division of Labor

Women's work burden is often extremely heavy because of their multiple responsibilities in farming, livestock herding, water and forest management, and household and community life. The field study for Secure Himalaya Project (2016-17)⁴⁷ revealed that women in Uttarkashi and Pithoragarh have heavy work burden. Women tend to work for long hours - 15 to 17 hours a day as compared with 8 to 10 hours a day by men. Women work from early morning (5:00 am) until night (10:00 pm). During the time, women take care of household chores, childcare, collecting fuel/ fodder, water management, animal care and agriculture-related works such as ploughing with hand hoes, tilling, applying manure, weeding, watering, harvesting, threshing, winnowing, and processing the products for consumption. A similar study that was conducted by Pathak (2016) reports the disposal time of women in the hilly areas of Uttarakhand. The data shows that 14.09% of their time during the day is used for agriculture-related work and 13.69% for fuelwood collection followed by cooking (10.29%) and caring for family (9.81%).

⁴⁷ <https://www.in.undp.org/content/india/en/home/projects/securing-livelihoods-in-the-himalayas.html>

Table 2.7.4 Work and Responsibilities Performed by Women in Rural Uttarakhand

Activities Performed by Rural Women	Disposal of Time	
	Per Women per Day Hrs of Work	% Distribution of per Women per Day Work
Agriculture	2.24	14.09
Animal Husbandry	1.29	8.11
Water Fetching	0.57	3.58
Fodder Collection	1.55	9.74
Fuel and Wood Collection	2.18	13.69
Cooking	1.64	10.29
Washing Clothes	1.08	6.82
House Cleaning	0.87	5.47
Cleaning Utensils	1.11	6.98
Care of Children and Aged	1.56	9.81
Craft Work	0.11	0.68
Reading and Writing	0.13	0.82
Watching TV	0.99	6.21
Social Work	0.12	0.77
Religious Activities	0.39	2.46
Computer/ Mobile/ Social Media	0.08	6.49
Total	15.91	100

Source: Dr. Indu Pathak, *Women Participation in Decision Making and Women Drudgery in High Hilly Districts of Uttarakhand* (2016).
Sponsored by the Directorate of Economics & Statistics Govt. of Uttarakhand Dehradun, Kumaun University, Nainital

(3) Impact of Migration on Women's Workload

Rural families of Uttarakhand depend on remittance from male family members, who work in urban areas within and outside the state. Uttarakhand has recorded the highest increase in the share of urban population in comparison to the other Himalayan states of the country while its rural decadal growth rate is the lowest. According to a study conducted by Pathak (2016)⁴⁸, 310 persons from 320 families migrated for work and out of which, 73% were male. Male members of the family migrate for employment or education. Women migrate due to marriage in most cases. Out of the total migrants, around 51% migrated within district or other districts of the state and 49% emigrates to other states. Although the migrants' households receive remittance from the migrants which increase the purchasing power of their families, it is at the cost of increased work burden on the rural women as they will have to take over the work which could otherwise be done by the males.

2.7.3 Gender and Agriculture

(1) Workforce Contribution in Agriculture of Uttarakhand

The Human Development Report (2017) shows that around 85% of the total female laborers are employed in agriculture sector in rural India. It is also true especially in the hill districts of Uttarakhand. Women are the backbone of hill farming system and are engaged in all agricultural activities from tilling to sowing to harvesting and thrashing/winnowing. Apart from this, women are responsible for livestock activities such as collection of fodder, cleaning of shed, milking the cattle and preparation of milk products. The significance of women's contribution in agriculture and livestock-related activities is evident from the data from a study on women's participation in agriculture employment conducted in Uttarakhand. The data depicts that women's contribution is significantly higher in the entire farming system excluding ploughing and fertilizer application.

Table 2.7.5 Division of Work in Rural Farming System

Activity	Percentage Share (%)	
	Men	Women
A. Agriculture		
Ploughing	100	0
Land Preparation and Cold Breaking	15	85
Sowing and Transplanting	28	72
Gap Filling	0	100
Inter-culture Work	32	68
Weeding	6	94

⁴⁸ A case study, Dr. Indu Pathak, *Women Participation in Decision Making and Women Drudgery in High Hilly Districts of Uttarakhand*

Activity	Percentage Share (%)	
Irrigation	50	50
Fertilizer Application	55	45
Harvesting	29	71
Threshing and Winnowing	42	58
B. Animal Husbandry	Men	Women
Tending Cattle in Shed	5	95
Grazing	52	48
Removing Dung from Sheds	0	100
Fodder Collection	7	93
Milking	4	96

Source: Mountain Women Development Center Records 1995

An attempt was made to analyze overall contribution of women in various horticulture crop production. A case study conducted in Khurda and Ganjam districts in Odisha⁴⁹ was referred to see the crop-wise comparison. This study was conducted in 2015 with 300 women farmers in Odisha. The study shows that women contribute more to flower and vegetable cultivation. For vegetable cultivation, women play a significant role in land preparation, stubble collection, seed cleaning, treatment and sowing, transplanting, weeding and sorting/ grading.

Table 2.7.6 Women Role in Horticulture Crop Production

Activities	Contribution of Women in Various Horticulture Crops (%)			Average (%)
	Fruits	Vegetables	Flowers	
Field Preparation	40	84	52	59.0
Levelling of Land	-	38	-	38.0
Stubble Collection	-	84	-	84.0
Cleaning of Field Bunds	-	42	-	42.0
Manure Application	-	62	54	58.0
Seed Cleaning	-	84	-	84.0
Seed Treatment	-	84	-	84.0
Seed Sowing	-	80	80	80.0
Transplanting of Seedlings	-	80	-	80.0
Pit Digging	10	-	-	10.0
Planting of Fruit Trees	15	-	-	15.0
Irrigation	40	38	46	41.3
Weeding	-	84	78	81.0
Fertilizer Application	20	24	28	24.0
Crop Watch	10	22	16	16.0
Training and Pruning	5	-	-	5.0
Application of Insecticides and Pesticides	-	28	-	28.0
Harvesting	30	67	80	59.0
Cleaning and Collection	40	67	58	55.0
Sorting and Grading	40	80	62	60.7
Marketing	22	35	44	33.7

Source: Analysis of Participation of Women in Horticultural Activities 2015, by P C Tripathi, Directorate of Research for Women in Agriculture, Bhubaneswar, Orissa, India

(2) Women's Work in Apple Orchard

In Uttarakhand, many rural families in the hill districts are involved in commercial farming of apple, apricot, pears, plums, and peach. In this context, understanding gender division of labor in fruits production. In this section, a case study conducted in Himachal Pradesh, where similarities are observed in terrain and social conditions of Uttarakhand, in 2005 on apple orchard was referred to. The table shows that in apple production, women's work inputs are high in inter-culture, harvesting and post cleaning of orchards after training pruning emerged as the most female dominated task (88.6 %). Fruits preservation is entirely done by women. Against the total workdays required for apple orchard management, 52.71% was contributed by women. These tasks are considered to be unskilled, elaborative, and light work, and hence, women's onus was to perform it.

⁴⁹ Analysis of Participation of Women in Horticultural Activities 2015, by P C Tripathi, Directorate of Research for Women in Agriculture, Bhubaneswar, Orissa, India

Table 2.7.7 Female Participation in Apple Production

Various Operations for Apple Farming	Women's Work Days/ ha	Percent of Total Work Days Spent for Each Operation
Planting	43	61.4
Inter-culture (works done on soil between sowing and harvesting)	27	84.3
Plant Protection	12	42.9
a) Physical and Cultural Control	7.2	45.0
b) Chemical Control	3.7	31.0
Harvesting of Crop	53	70.7
Postharvesting	30	37.0
Training Pruning (TP)	25	25.0
Post TP Operation	31	88.6
Fruit Preservation	2	100.0
Total	223	52.71

Source: Contribution of Tribal Women in Temperate Horticulture" by B. Bala, S.D. Sharam

As far as the planting operations were concerned, laying out and purchase of nursery plants/planting material are done mainly by men while digging and filling of pits are predominant job of the women. The latter requires plenty of labor, thus women accounted for 61% of the total labor. Grading and packing of fruits is a very important operation in fruit cultivation and was generally carried out by specially trained males.

2.7.4 Access to Agriculture Credits and Information

In India, Findex 2017 (World Bank)⁵⁰ reported that 77% of women and 83% of men hold bank accounts. Yet, 65% of women account holders do not use the services. Various reasons are identified by the study conducted by Microsave Consulting (2019)⁵¹: some women simply do not have money to save in the bank account, others opened bank account without felt needs but due to peer pressure or because of the government campaign. They also lack the information on financial products and services. Many women use the account when the need arises but not on a regular basis. The same study identified that for women to use the financial services and benefit from it, women need to have a regular cash flow, the service must be convenient for them and constantly motivated to use the banking facilities.

When it comes to agriculture credit, in a case study from Odisha, women informants indicated significantly higher proportion of responses that they do not need loan while men indicated as collateral, terms and costs were the constraints for taking up the loan (IFPRI, 2021)⁵². The collateral seems to become an issue when women farmers wish to invest in agriculture. NABARD (2021)⁵³ reported that such women are lacking access to agriculture credit due to the lack of collateral and thus, unable to invest in agriculture activities. These mixed findings suggest that women are heterogeneous and thus, need to look into the need of women who are engaged in farming closely. Additional information will be collected in the project areas in the remaining survey period.

According to a study carried out in Uttarakhand on women's access to agriculture information by Ansari and Swetha (2014)⁵⁴, 88.33% of the women respondents referred to their friends and relatives most frequently. None of the respondents indicated that they receive technical information from progressive farmers and extension workers. The study reasoned that this is due to the lack of visits by the extension workers and women's limited exposures to various media and sources as their educational background was limited to primary level. Further, the survey findings also revealed that the women indicated strong tendency to share their information with friends, relatives, neighbors and needy person but never to share with the progressive farmers. It was explained in the study that the male family members mostly

⁵⁰ The World Bank (2017). The Global Findex Database. (<https://globalfindex.worldbank.org/>)

⁵¹ Micro Save Consulting (2019). The real story of women's financial inclusion in India. (https://www.microsave.net/wp-content/uploads/2020/01/191125_The-real-story-of-womens-financial-inclusion-in-India_Gender-research-report.pdf)

⁵² IFPRI (2021). Lending her name, but not having a say? (<https://southasia.ifpri.info/2021/05/31/lending-her-name-but-not-having-a-say-gender-norms-and-credit-for-agriculture-in-odisha/>)

⁵³ NABARD (2021). Achieving an Equal Future. (<https://www.nabard.org/auth/writereaddata/tender/0605214838Womens%20Day-booklet.pdf>)

⁵⁴ Ansari, Mohammad Aslam & Shweta, Sunetha. (2014). Agriculture Information Needs of Farm Women: A Study in State of North India. African Journal of Agricultural Research. 9. 1454-1460.

interact with the progressive farmers and thus, women do not have interaction with them. This suggests the need for changes in the conventional agriculture information system in the state so that the women farmers comprising of the significant proportion of the agriculture workforce can benefit from the information that can enhance their productivity and drudgery.

2.7.5 Access to Agriculture Land

According to the Agriculture Census (2015-16), 14.6% of total operational landholding is owned by women, of which 35.5% of the land holders own below 0.5 ha and 23.9% owns between 0.5 – 1.0 ha. The number of women's landholding significantly decreases as the plot size increases. As referred to in the above sections, lack of land ownership hinders access to agriculture credit due to the lack of collateral (NABARD, 2021). It also affects the women's role in decision-making. The study carried out in Bihar, Odisha, Uttar Pradesh and West Bengal by Valeria, et. al. (2018) reported that the women having land ownership have significantly higher involvement in decisions taken for agriculture-related activities. In the table below, 71.1% of women's land had a say in crop selection and 70.7% for variety selection. For the non-land title owning women's part in the decision making, the women took part in decision were nearly halved. Over 60% of women could decide on food crop and cash crop farming while the proportion of non-land title holders remained 35.5% and 19.6%, respectively.

To note, the state government is planning to review the concerned laws so that women farmers who work on the agriculture land owned by their spouses can gain rights over the land they work on. The gradual changes in women's role in agriculture may be anticipated.

Table 2.7.8 Proportion of Women who Participated in Farming Decision Making by Land Ownership

Type of Decision	No Title Holders Took Part in Decision-Making(%)	Land Title Holders Took Part in Decision-Making(%)
Crop Selection	37.0	71.1
Variety Selection	37.1	70.7
Food Crop Farming	35.0	69.4
Cash Crop Farming	19.6	60.0

Source: Valera, et. al. (2018). *Women's Land Title Ownership and Empowerment: Evidence from India*. ADB Economic Working Paper Series No. 559. (Extracted from p. 10). (<https://www.adb.org/sites/default/files/publication/453696/ewp-559-women-land-title-ownership-empowerment.pdf>)

2.8 Nutritional Status and Gender Implications in Uttarakhand

2.8.1 Status of Nutrition and Issues in India and Uttarakhand

Various reports and researches reveal the high levels of maternal and child undernutrition persisting in India despite strong constitutional, legislative policy, plan and programmatic commitments. Legislations such as the National Food Security Act 2013 mandate food and nutrition entitlements for children, pregnant and breastfeeding mothers with maternity support and the infant milk substitutes. Further, there are various government interventions working towards improving the nutritional status of the Indian population. The nodal agency for nutrition in India is POSHAN Abhiyan (formerly the National Nutrition Mission) established under the Ministry of Women and Child Development. The interventions implemented by POSHAN Abhiyan are given in the table below.

Table 2.8.1 Interventions Concerning Nutrition Undertaken by POSHAN Abhiyan

Type of Intervention	Outline of the Intervention
Ration*	Take home ration to preschool children, adolescent girls, pregnant and feeding mothers. Distribution of ration is done through <i>Anganwadi</i> (childcare center under the Women and Child Development Department).
Hydroponics Project*	In 100 AWCs (Anganwadi centers) in Pithoragarh, Nainital and Tehri to provide alternate option to grow healthy food at home. Simultaneously, 390 AWCs initiated kitchen gardening to provide green vegetables to the target population.
Village Health Sanitation and Nutrition Day*	Last Saturday of every month celebration held at AWC for health check-up and vaccination of children and pregnant women.
Mid-day Meal Scheme**	The scheme aims at enhanced enrolment, retention and attendance besides improvement of nutritional levels among children. It was launched as the National Program of Nutritional Support to Primary Education. This is implemented as a part of National Food Security Mission and by the Education Department. Primary and upper primary pupils

Type of Intervention	Outline of the Intervention
	are assisted in this scheme. During COVID-19 time, teachers have distributed MDM ration on weekly basis to each child at their home to ensure proper food intake.
Targeted Public Distribution System (TPDS)	National Food Security Mission "Targeted Public Distribution System" (TPDS) to Below Poverty Line (BPL) and Antyodaya card holders. Under this, family get minimum ration like rice and wheat; some states provide sugar and pulses every month.

Source*: Integrated Child Development Scheme, Uttarakhand State Report July 2020, under POSHAN ABHIYAN, "Sahi Poshan Desh Roshan".
Source**: Education Department of Uttarakhand; Source ***: National Food Security Mission

The following table showing the data of the National Family Health Survey (NFHS) highlights the above stated facts. The comparison of the two surveys reveals that the rate of overweight among adult men and women significantly increased between 2005-06 and 2015-16. In terms of children, the proportion of underweight children has decreased while other indicators to assess the nutritional status had shown deterioration. According to the Comprehensive National Nutritional Survey 2016-18, only 12.2% of the children (between 6-23 months old) received the balanced diet of minimum required frequency in India.

Anemia is one of the frequently observed symptoms of malnutrition in India and in Uttarakhand. It is commonly observed in children and women. As shown in the table below, the proportion of anemic children is still as high as 59.8% in Uttarakhand. Among adult women, 45.1% of non-pregnant women and 46.5% of pregnant women are anemic while adult men with anemia accounted for only 15.5%.

Table 2.8.2 Nutritional Status of People in India and Uttarakhand

Indicators	India		Uttarakhand	
	NFHS-3 (2005-06)	NFHS-4 (2015-16)	NFHS-3 (2005-06)	NFHS-4 (2015-16)
Children under 5 years who are stunted (height for age) in %	48	38.4	44.4	33.5
Children under 5 years who are wasted (weight for height) in %	19.8	21.0	18.8	19.5
Children under 5 years who are severely wasted (weight for height) %	6.4	7.5	5.3	9.0
Children under 5 years who are underweight (weight for age) in %	42.5	35.7	38.0	26.6
Women with Body Mass Index below normal (BMI<18.5 kg/m ²) %	35.5	22.9	30.0	18.4
Men with Body Mass Index below normal (BMI<18.5 kg/m ²) %	34.2	20.2	28.4	16.1
Women who are overweight or obese (BMI≥25.0 kg/m ²) in %	12.6	20.7	12.8	20.4
Men who are overweight or obese (BMI≥25.0 kg/m ²) in %	9.3	18.6	7.9	17.9
Children aged 6-59 months who are anemic (<11.0 g/dl) in %	69.4	58.4	60.7	59.8
Non-pregnant women aged 15-49 years who are anemic (<12.0 g/dl) %	55.2	53.1	54.8	45.1
Pregnant women aged 15-49 years who are anemic (<11.0 g/dl) in %	57.9	50.3	50.8	46.5
Men aged 15-49 years who are anemic (<13.0 g/dl) in %	24.2	22.7	28.7	15.5
Infant mortality rate (IMR)	57.0	41.0	42.0	40.0
Under -five mortality rate (U5MR)	74.0	50.0	57.0	47.0
Total children aged 6-23 months receiving adequate diet (%)	-	9.6	-	8.5

Source: National Family Health Survey3 2005-06 and NFHS- 4, 2015-16. Ministry of Health and Family Welfare, Government of India.

2.8.2 Causes of Malnutrition

(1) Issues in Nutrition

Although India has made great progress in the economic field with an impressive growth rate in the last several years, the nutrition scenario in the country remains grim, with negligible rates of improvement and a continuing high burden of undernutrition. The nutrition inequality gap has widened across different states and socio-economic groups. Furthermore, as per the global targets, main health issues and concerns of the nation and state are 1) Every second women of reproductive age in the country is anemic; 2) Two in every three children of age 5 years are anemic; and 3) Increasing population of obesity and consequent lifestyle diseases.

(2) Causes

1) Change in Diet among Adults

According to the Comprehensive National Nutrition Survey (CNNS)-2016-18, the decline in the share of cereals in the total consumption of food has largely been substituted by rich food items such as milk and its products, oils and fat, and miscellaneous food products (consisting of relatively unhealthy food such as fast food, processed food, and beverages). This has implications on the emerging problem of obesity in India.

2) Undernourishment of Children

As for children, there are high levels of micronutrient (vitamin A, vitamin D, vitamin B12, iodine, zinc, folate) deficiencies, often called “hidden hunger” and relates to the lack of access to food rich in micronutrients (vegetables, fruits, dairy products)⁵⁵. Since they are unaffordable for lower income families, this gap in the provision of key vitamins, iron, zinc, calcium, and iodine can have a serious negative impact on long-term development. The table below shows the micronutrient deficiency among children.

Table 2.8.3 Micronutrient Deficiency Among Children in India

Age Group of Children	Vitamin A	Vit-B12	Vit -D	Zinc	Folate
Pre-schoolers 0-4 years	18%	14%	14%	19%	23%
School age 5-9 years	22%	17%	18%	17%	28%
Adolescents 10-19 years	16%	31%	24%	32%	37%

Note: Gender-segregated data is not available.

Source: Comprehensive National Nutrition Survey (2016-18) 2019

Further CNNS-2019 shows that Vitamin A deficiency prevalence was higher among children in poorer households. Among pre-schoolers in the poorest households, vitamin A deficiency prevalence was more than double that of the richest households (27% vs. 11%). Such differences were also observed for children aged 5–9 years, with a prevalence of 28% in the poorest households, compared with 16% in the richest households. The status of anemia among children has improved yet the percentage of children under 4 and girl children between 10-19 remain as high as 41% and 40%, respectively.

Table 2.8.4 Anemia and Iron Deficiency Among Children in India and in Uttarakhand

Age Group of Children	Anemic	Iron Deficiency (low serum ferritin)	
	India	India	Uttarakhand
Pre-schoolers 0-4 years*	41%	32%	51.2%
School age 5-9 years*	24%	17%	18.4 %
Adolescents 10-19 years	28% (Female: 40%/ Male: 18%)	22% (Female: 31%/ Male: 12%)	19.6 %

**Note: Gender-segregated data is not available.*

Source: Comprehensive National Nutrition Survey (2016-18) 2019

2.8.3 Status and Issues of Nutrition in the Project Districts

(1) Overall Nutritional Status

A comparative analysis is done to analyze the overall nutrition data of the state and the four districts of the project. It is seen that in most of the categories, the project districts have higher vulnerability in terms of nutrition compared with the average of the state.

Table 2.8.5 Nutritional Parameters and Status of Uttarakhand State and Selected Districts

Criteria / Indicators	Uttarakhand	ICDS3 July 2020	Nutrition Status of Project Districts 3			
			Uttarkashi	Tehri	Nainital	Pithoragarh
Children under 5 years who are stunted (height for age) %	33.5	31.1	35.2	30.1	32.1	30.6
Children under 5 years who are wasted (weight for height) %	19.5	7.28	39.4	46.9	9.0	20.6
Children under 5 years who are underweight (weight for age) %	26.6	4.56	40.3	44.2	17.0	16.6
Children (6-59 months) <5 years who are anemic(<11.0 g/dl) %	59.8	NA	76.2	59.9	58.0	42.3
Total children aged 6-23 months receiving adequate diet(%)	8.5	NA	5.3	5.7	12	13.7
Women of reproductive age 15-49 years who are anemic (<12.0 g/dl) %	45.1	NA	52.6	44.6	38.4	34.5
Women with Body Mass Index below normal (BMI<18.5 kg/m ²) %	18.4	NA	16.9	18.1	17.2	13.5
Women who are overweight or	20.4		11.5	5.3	27.2	19.0

⁵⁵ Food and Nutritional Security Analysis 2019 (FNSA 2019)

Criteria / Indicators	Uttarakhand	ICDS3 July 2020	Nutrition Status of Project Districts 3			
			Uttarkashi	Tehri	Nainital	Pithoragarh
obese (BMI $\geq$ 25.0 kg/m ²) %						
Men who are overweight or obese (BMI $\geq$ 25.0 kg/m ²) in %	17.9		11.3	5.9	21.3	18.3
High blood pressure among women (15-49 years)	9.7		6.6	4.5	12.4	9.2
High blood pressure among men (15-49 years)	17.5		10.4	3.3	18.1	18.1
High blood sugar among women (15-49 years)	8.6		4.5	4.4	7.3	6.4
High blood sugar among men (15-49 years)	13.4		10.0	9.6	8.8	9.2

Source: 1. National Family Health Survey-4, 2015-16. Ministry of Health and Family Welfare, Government of India.

2. POSHAN (Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition) district nutrition profile a project led by the International Food Policy Research Institute (IFPRI) in India.

3. Integrated child development scheme, Uttarakhand State Report July 2020, under POSHAN ABHIYAN, "Sahi Poshan Desh Roshan".

The NFHS-4 and district-wise POSHAN profile figures in the above table shows an increased percentage of malnutrition in various forms whereas highlighted figures reflect the alarming situation with respect to children and women's health. Among the indicators, the prevalence of anemia among children below 5 years (76.2%) and women of reproductive age (52.6%) appears severe in Uttarkashi. One of the major causes of anemia is lack of iron consumption and absorption. This may be due to low iron content of foods consumed or lack in amount/quantity of consumption of iron rich foods or low absorption of iron due to vitamin-C deficiency or worm infestation. The proportion of wasted children are also seen as high in Tehri (47%) and Uttarkashi (39.4%).

(2) Food Consumption and Nutrients

The calorie intake data from the National Sample Survey Organization (NSSO) showed how, at any given point in time, the calorie intake of the poorest quartile continues to be 30 to 50% less than the calorie intake of the top quartile of the population, despite the poor needing more calories because of harder manual work. The data also showed higher reliance of the poor on cereal-based calories because of a lack of access to fruits, vegetables, and meat products.

Table 2.8.6 Recommended Dietary Allowances and Daily Per Capita Energy Intake for India and Uttarakhand

Categories	RDA (ICMR norms)* K cal	Daily Per Capita Energy Intake (Average)	RDA (ICMR Norms)* for Protein	Protein Intake (Average)	RDA (ICMR Norms)* for FAT in gm	Fat (Average)
Lowest 30% of monthly per capita consumption Expenditure class in rural area	2,155	1,811	48	47.5 gm	28	27.8
Urban area	2,090	1,745	50	47 gm	26	35.1
Overall India	2,090	2,234	49	56.5 gm	28	52.5
Uttarakhand		2,395	49	57 gm	28	52.8gm

*Note: RDA=Recommended Dietary Allowance/ ICMR=Indian Council of Medical Research)

Source: Various rounds of NSSO Consumer Expenditure Survey published by the Ministry of Statistics and Programme Implementation, Government of India.

Uttarakhand being a hilly state has an inclination to traditional food crops and vegetables which form the basis of the daily diet intake. These include use of wild plant resources in agricultural systems. Although traditional food crop and wild plants are rich in minerals, vitamins, and micro nutrients, their production in limited quantity hampers the overall health status of the natives of the hilly areas. Two case studies were referred to hereunder to understand the rural diet pattern.

(a) Case Study Survey Conducted by Better Lives Foundation (London) in 2016

The study was carried out in the northwestern part of the district Uttarkashi in the high-altitude region of the Tons Valley indicated that a large number of people across different age group in these villages suffered from vision loss. The principal cause was identified as deficiency of Vitamin A.

(b) Case Study by the Mori Swasthya Foundation and Himalayan Health Initiatives

The study captured the composition of rural diet in Uttarakhand. The staple diet of the people is potato, Rajmah (kidney beans), Chaulai (Marcha), barley (jau), rice and ragi. The enhanced production and consumption of traditional food as well as coarse grains is being emphasized so that the poor have adequate access to good quality healthy food with a nutritionally adequate diet. This includes not only energy rich food but also minerals, vitamins, micronutrients and trace elements, necessary for normal growth and development.

As above, the staple diet of the people of the hilly region is from the coarse cereals and pulses, which have limited production. The figures of per capita food production and consumption are given in the table below. The production of pulse is much less than the volume consumed in all the districts, and vegetables are deficient in Nainital.

Table 2.8.7 Per Capita Net Production and Consumption of Agriculture and Horticulture Items(gm/day) in Project Districts

No.	Districts	Cereals	Pulse	Potatoes	Edible Oil	Fruits	Vegetables
1.	ICMR* Norms	420	40	75	22	50	125
2.	Pithoragarh	486	17.6	131	2.3	159	131
3.	Nainital	820	5.6	89	10.7	79	112
4.	Tehri	484	6.8	126	1.8	100	173
5.	Uttarkashi	407	5.4	389	3.4	293	300
6.	Average consumptions gms/day**	456	41	-	23	-	121

Note*: ICMR= Indian Council for Medical Research

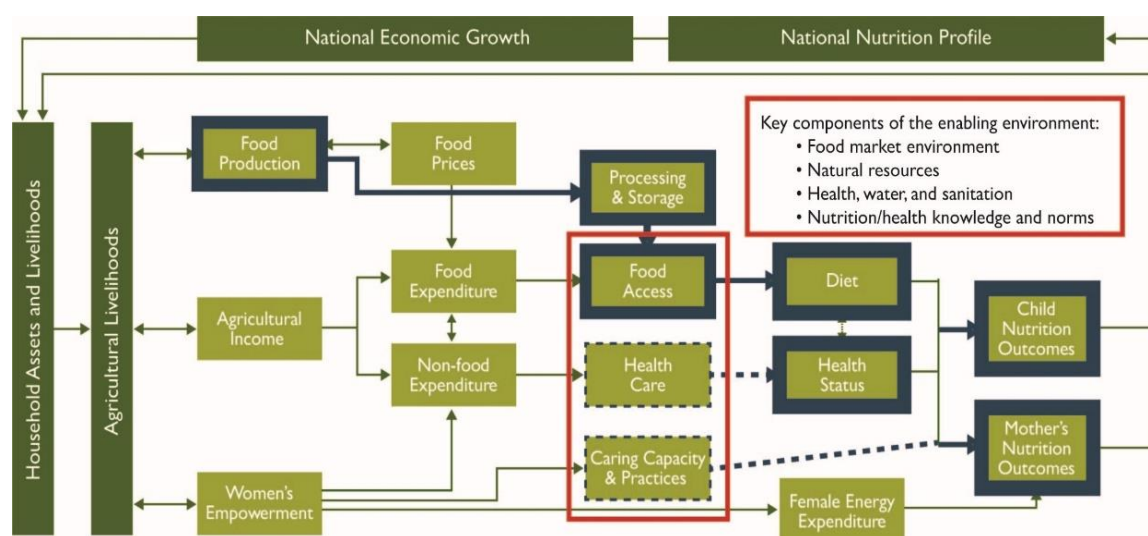
Note**: Data is based on PRA exercises of selected micro watershed by PSI (People's Science Institute, Dehradun)

Source- 1. Average for triennium ending 1999-2000, Directorate of Agriculture Uttarakhand

This deficiency can be met by enhancing the production of fruits, vegetables, mushroom and soya bean. The climatic conditions support to grow minor millets and other horticulture crops.

2.8.4 Horticulture Development and Nutrition

The figure below illustrates how the nation's economic development and nutritional profile are interlinked. Especially, food production and processing and storage direct bearing on food access, diet and nutritional status of women and children. In the place where agriculture is a major source of livelihood, agriculture income affects the food expenditure, which is linked to food access and diet. One of the advantages that the farmer has is that they can also diversify the crops that they grow, which can also be consumed at home to meet the nutritional requirement. The figure also shows that women empowerment also has an implication on household expenditures and thus, access to food and nutritional condition of the household.



Source: Adapted from "Understanding and Applying Primary Pathways and Principles". Herforth & Harris; 2014. p. 3.

Figure 2.8.1 Food Production Pathway

(1) Promoting Nutrient Rich Crops

As the Department of Agriculture recently started ‘nutricereals’ to promote millets for increasing the production of coarse cereal for balanced diet, production of horticulture crops can also be promoted. In the four project districts, the following crops can be promoted for production and also increased intake or household consumption. The table below shows the main nutrients of the horticulture crops grown in Uttarakhand.

Table 2.8.8 Horticulture Crops Grown in Project Districts and Their Nutritional Value

Crop Type	Horticulture Crops Grown in Project Districts	Main Nutrients per 100 gms
Root Crop	Carrot	Vitamins- A 835µg B5-273 mg, B4-8.8 mg B1- 0.066 mg, B2-0.058 gm, B3-0.983 mg, C-5.9 mg Minerals - K- 320 mg, Na-69 mg, P-35 gm, Ca-33 gm, Mg- 12 mg, Proteins- 0.93 gm, Energy - 41 Kcal, Carbohydrates- 9.58 gm
	Potato	Vitamins- C - 19.7 mg, B4-12.1 mg, B3 1.05 mg Minerals- K- 421 mg, P - 57 mg, Mg- 23 mg, Ca- 12 mg, Na- mg, Fe- 0.78 mg Protein- 2.02 gm Energy- 77 Kcal Carbohydrates - 17.47 mg
Leafy Vegetables (as per USDA 2018)	Spinach	Vitamins - A-469 µg, folate – 194 µg, K- 483 µg, C- 28 mg, E- 2 mg, β carotene - 5626 µg. Mineral - K- 558 mg, P- 49 mg, Ca- 99 mg, Fe- 2.71 mg, Mg- 79 mg, Na- 79 mg, Protein - 2.9 gm Energy - 23 Kcal Carbohydrates -3.6 gm
	Mustard leaves	Vitamins - B3- 7.89 gm, K- 5.4 mg, C- 3 mg, Folate – 76 µg, A-3 µg, E- 2.89 mg, Mineral - P- 841mg, K- 682 mg, Ca- 521 mg, Fe-9.9 mg, Mg- 298 mg, Na- 5 mg, Zn- 5.7 mg Protein - 24.94 gm Energy - 469 Kcal Carbohydrates - 34.94 gm
Fruits	Apple	Vitamins - C- 4.6 mg, Folate- 3µg, A- 3 µg, K- 2.2 µg, Mineral - K - 107 mg, P- 11 mg, Ca – 6 mg, Mn - 5 mg, Fe- 0.12 mg, Protein -260 gm, Lipid (FAT) – 170 gm Energy - 52 kcal Carbohydrates - 13810 mg, sugar-10390 mg
	Sweet Orange	Protein- 800 mg, Fat 300 mg, Fibre- 500 mg, Carbohydrates - 9300 mg, Minerals- 700 mg, Ca- 40 mg, P- 30 mg, Iron 0.7 mg, Vitamin - C – 50 mg, Energy 43 Kcal.
	Kiwi	Energy - 39 kcal, Protein- 610 mg, Fat 140 mg, Carbohydrates - 9810 mg, Fiber – 1800 mg, K- 257 Mg, Na- 3 mg, Ca- 24 Mg, Mg-10 mg, Vitamin - C- 61.8 mg, Vitamin A- 150 µg, β carotene - 276 µg
	Litchi	Vitamins - C- 71.5 mg, Mineral - K -171 mg, P -31 mg, Mg- 10 mg, Ca- 5 mg, Protein – 830 mg, Fat (Lipid)- 440 mg, Energy - 66 kcal Carbohydrates - 16530 mg
Cereals	Jowar (USDA database)	Calories -359 Kcal, Na-3 mg, Protein- 8400 mg, Iron - 17% of daily need, Co- 28% of daily need, Mg- 55% of daily need, Mn- 31% and P- 40% daily needs. Vitamin B6 and B3- 27 and 25% of daily need as per USDA database. Jowar is good for diabetes, manage cholesterol, weight and full in micronutrients. It improves digestion and is good for heart health and anemia.
	Bajra	Calories- 361 Kcal, Protein – 11920 mg, K- 284 mg, Sodium – 397 mg Additionally, the potassium and complex carbohydrate content in bajra flour have numerous health benefits, including weight and blood pressure management. Bajra is one of the few kinds of cereal that is entirely gluten-free, and can be used by gluten-intolerant syndromes.
	Ragi	Ragi flour is rich in energy equivalent to 354 Kcal and protein: for every 100 g provides 13 g of protein. This can prove to be an excellent protein source for vegans who rely on plant-based sources for their protein intake. Ragi 100 g contains 344 mg of calcium that is enough for fulfilling 49% of the body’s daily calcium requirements. Additionally, the (P) phosphorus and potassium content in Ragi flour works with calcium to strengthen the bones and teeth.

Crop Type	Horticulture Crops Grown in Project Districts	Main Nutrients per 100 gms
		Ragi 100 g provides 137 mg of magnesium, that fulfils 50% of the body's RDA and helps in managing heart health.
	Jhangora	An indigenous variant of barnyard millet, Jhangora grows in the high altitudes of Uttarakhand. Also called sawak or shyama ka chawal in Hindi, Jhangora is a nutritional powerhouse with high levels of protein, calcium, iron, minerals and vitamin B complex. It is also low in carbohydrates and gluten-free, making it an excellent grain for those with gluten allergies, type II diabetes, and cardiovascular diseases.

Source: JICA Survey Team

(2) Developing Processing Technologies for Better Availability and Options for Intake

Due to the seasonal availability, efforts are made to process vegetables in large quantity to extend their shelf life and to make them available during the rest of the year and in areas where they are not available. Preservation of vegetables and other horticulture products by processing not only involves the inhibition of microbial growth but also preserves their color, texture, flavor, and nutritive value. The vegetables can be processed into different forms to extend their shelf life such as dehydrated powders, grits, flakes, pulp, and puree.

The 'C' grade fruits in making various bakery products will enhance the use of fruits and nuts. In the present context, a lot of these fruits are getting wasted as marketing and transportation are difficult and not cost-effective. Agriculture universities in Uttarakhand are experimenting these with various local fruits that can be explored.

In addition, KVK Tehri Garhwal developed a recipe of iron-fortified traditional Indian sweets called *laddu*. The iron-fortified laddu is made by SHGs and sold to the local communities. This recipe can also be shared with other SHGs and also with families in the project area to supplement the iron intake.

(3) Fruits Plantations and Kitchen Garden

In the case of a farming community, the food they consume can also depend on what they grow in their own farm. Thus, plantations of wild fruits and berries high nutrient plants on roadsides and on the panchayat, van panchayat and other barren land to enhance availability of these wild fruits for monkeys and the surrounding populations. These were easily available earlier and children and women used to enjoy eating these wild fruits but these days, it is just beyond the reach, like *hissar* (rubus ellipticus), *kingod* (Indian barberry), *maalu* (camel-foot-tree/Bauhinia variegata), wild figs, *daadim* (wild pomegranate), *aadu* (peach), *kaafal* (Bay berry), mulberry, *ber* (Indian Jujube), *bamor* (Cornus capitata), mango, and guava. Furthermore, to complement the nutritional value, kitchen garden and medicinal garden kind of small initiatives along with small processing units need to be introduced so that each family can process surplus seasonal vegetables and fruits to use year around.

(4) School Gardens and Mid-day Meals

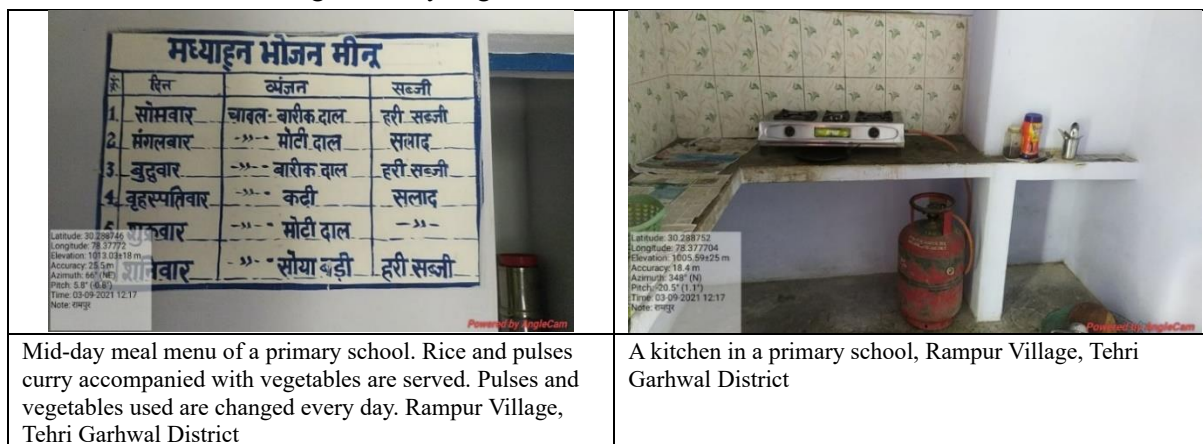
School nutrition garden has also been established by NGOs so far. One case was shared by an NGO based in Uttarakhand, AAROH, which is based in Nainital. They have established a school garden to promote agriculture while educating children on nutrition. Although not all the schools have sufficient land area to establish a garden, it would help to create awareness on the linkage between agriculture and balanced diet since early age. Engaging experienced NGOs to facilitate the process may be considered.



Source: AAROH, Nainital, Uttarakhand

Figure 2.8.2 School Garden and Children Learning from Resource Person

Mid-day meal schemes are implemented for children in the government lower (1st to 5th standard) and upper primary schools (6th to 8th standard) and other equivalent educational institutions. The mid-day meal for lower primary children is designed to provide 300 calories with 8-12 grams of protein per child per day and 700 calories and 20 grams of protein for the same in upper primary schools⁵⁶. The menu is fixed for a week. Each meal comprised curry using pulses (*daal*) and rice accompanied by vegetable dishes of salad or cooked green leafy vegetables.



Source: JICA Survey Team

Figure 2.8.3 Photographs of School Mid-day Meal Menu and School Kitchen

(5) Awareness Creation and Rations Supplied through Anganwadi

Anganwadi is an early childhood care center established under the Integrated Child Development Service under the Ministry of Women and Child Welfare. One of the interventions implemented through Anganwadi is distribution of ration to lactating mothers. The field survey revealed that the following items were distributed. However, the facilities of many Anganwadi centers were not in a good condition and awareness materials were limited. In this case, the UKIHDP decides to collaborate, adequate budget provision shall be made for the preparation of awareness materials and other inputs planned in the activity. The CBBO engaged at the district level may need to provide substantial technical inputs. The details of the information collected from the field survey is given in Attachment 5.2.3



Source: JICA Survey Team

Figure 2.8.4 Rations Distributed at Anganwadi Center in Ramnagar, Nainital

⁵⁶ UK government website on midday meal scheme (<https://www.uk.gov.in/pages/view/481-middaymealscheme>)

Chapter 3 Present Condition of Horticulture Sector in Uttarakhand

3.1 National Policies and Schemes on Horticulture Sector

3.1.1 National Policies on Horticulture Sector

The agriculture and allied sectors are the foundation of India's economic growth even at the time of pandemic. The National Institute for Transforming India (NITI Aayog) estimated a 3% growth of the sector during FY 2020-21. On the other hand, this sector and its subsector required an urgent upgradation and transformation. Thus, in 2020, three bills were passed, namely: "The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Bill", "The Farmers' (Empowerment and Protection) Agreement of Price Assurance and Farm Services Bill", and "The Essential Commodities Act (Amendment) Bill", to create an enabling environment for growth and improvement of farmers' income. These bills will help to realize effective investment, liberate trading of agriculture produces, and ensure fair payment of traded produce to the producers. These reforms in agriculture and allied sectors will enable the farmers to sell their produce where they wish to sell, whereas it was limited earlier in the Agricultural Produce Market Committee (APMC) or to the government registered buyers. It is also expected that small farmers will significantly benefit from these reforms, which enable them to receive investment from the public sector to enhance their productivity and access better market. The synopsis of the bills is given in the table below and further discussions on the implication of these laws on the horticulture supply chain development can be found in Section 3.5.

Table 3.1.1 Synopsis of the New Bills for Agriculture and Allied Sector

Bill	Main Points of the Bill	Implications
Farmers' Produce Trade and Commerce (Promotion and Facilitation) Bill, 2020	➤ The farmers can sell to the buyers of their choice, which was only limited to APMC mandis and government-registered licensees before the introduction of the bill.	➤ Reduced marketing cost ➤ Increased opportunities for farmers to identify and access better market and selling prices ➤ Improved flow of produce from surplus area to shortage area
The Farmers (Empowerment and Protection) Agreement of Price Assurance and Farm Services Bill, 2020	➤ The bill provides a basis for farmers to interact with the buyers of their choice on equal ground. ➤ It also facilitates the advance agreement of purchase at a price where both parties agreed before the harvest (contract farming).	➤ Reduced marketing cost ➤ Increased farmers' earnings
The Essential Commodities (Amendment) Bill, 2020	➤ This lifts the limits to the stock of agriculture produce excluding the essential commodities (cereals, pulses, oilseeds, edible oils, onions, and potatoes), which was imposed in the Essential Commodities Act 1955. ➤ This act allows the processors, exporters, and other value chain stakeholders as per their storage/ processing capacity and in response to the market demand.	➤ Improved food supply chain by harnessing the private sector/ foreign direct investment

Source: <https://www.ibef.org/blogs/india-s-promising-new-agricultural-policy>

3.1.2 Centrally Sponsored Schemes for Horticulture Development

The Centrally Sponsored Scheme of Horticulture Mission for North East and Himalayan State (HMNEH) is properly being implemented in the State since 2003-04 for the holistic development of horticulture sector to ensure forward and backward linkages by adopting cluster approach, covering production, postharvest management, processing, and marketing with the active participation of all stakeholders. In Uttarakhand, a single window system has been created to expedite sanction/clearance of projects under the Micro, Small and Medium Enterprises (MSME). A separate Horticulture Marketing Board has been setup to promote marketing of horticulture produce and ensure better price of produce to farmers. To promote protected cultivation especially among small and marginal farmers and in hilly

areas, *Mukhyamantri Sanrakshit Kheti Yojana* (A State Government Scheme on protective farming launched by the Chief Minister of Uttarakhand) has been launched during 2011-12 with the provision of 30% additional subsidy from the state budget up to 500 m² greenhouse per beneficiary.

The Weather Based Crop Insurance (*Pradhan Mantri Fasal Bima Yojana: PMFBY*)¹ is a central scheme administered by the Ministry of Agriculture and Farmers Welfare to provide financial safety net against the loss of yield incurred during various stages of production such as sowing/ planting/ germination, growing stage of crops, postharvest, natural disasters, and also damages caused by wild animals. The insurance covers the food grains (cereals, pulses and oil seeds) and annual horticulture and commercial crops². The farmers who have taken loan for growing such crops must be ensured while for others, it would be optional. In the case of Uttarakhand, the horticulture crops such as litchi, mango, malta, peach, tomato, potato, pea, chilli, and ginger would be covered.

The Ministry of Food Processing Industries sets its goals to promote food processing to reduce the postharvest losses and value addition, to improve shelf life, and through which, the ministry aims to improve the income of the farmers and to create surplus to export. Under the central government assistance, four Agri Export Zones and two Mega Food Parks have been established in Uttarakhand as shown in the table below.

Table 3.1.2 Salient Features of the Schemes/ Interventions under the Government of India

Establishments	Implementing Agency	Key Feature
4 Agri Export Zones	Government of India	Litchi, floriculture, herbs and medicinal plants, and basmati rice
2 Mega Food Parks	Ministry of Food Processing Industries	Patanjali Food and Herbal Park Ltd, Haridwar and Himalaya Food Park, Kashipur

Source: Food Processing Sector Profile, State Horticulture Mission, Government of Uttarakhand. (2019). (https://foodprocessingindia.gov.in/uploads/state_ut/MoFPI1614056144uttarakhand_Policy.pdf)

3.2 State Policy and Plan for Horticulture Sector

3.2.1 Establishment of University on Horticulture and Forestry

One of the important policy decisions of the Uttarakhand government was to establish the Uttarakhand University of Horticulture and Forestry (UUHF) in 2011 in Bharsar, District Pauri. Uttarakhand is the third state to set up a separate University for Horticulture and Forestry. Other states are Andhra Pradesh and Himachal Pradesh. Now, Karnataka has also set up its fourth University for Horticulture and Forestry. The Government of Uttarakhand has established Veer Chandra Singh Garhwali Uttarakhand University of Horticulture & Forestry (UUHF)³ by an Act of State Legislative Assembly on 28th April 2011 with Head Quarter at Bharsar, Pauri Garhwal.

With the establishment of UUHF, various campuses, colleges, research centers, and Krishi Vigyan Kendras (KVKs) viz., Veer Chandra Singh Garhwali College of Horticulture, Bharsar; Krishi Vigyan Kendra, Distt. Pauri Garhwal; College of Forestry & Hill Agriculture, Ranichauri; Krishi Vigyan Kendra, Distt. Tehri Garhwal; Research Centers at Kanatal and Gaja (Tehri Garhwal) of Govind Ballabh Pant University of Agriculture & Technology have been merged with UUHF. It is a state government university, and is linked with the National Agriculture Research System (NARS) and the Indian Council of Agricultural Research (ICAR).

3.2.2 The MSME Policy, 2015 Uttarakhand and its Relevance to Horticulture

The state government has formulated MSME Policy 2015 to provide incentives for setting up of industries including food processing industries, which has subsumed the Special Integrated Industrial Promotion Policy 2008 for Hilly & Remote Areas of Uttarakhand. The salient features of the fiscal incentives and concessions provided under the scheme are shown in the table below.

¹ This paragraph is based on the Pradhan Mantri Fasal Bima Yojana website of National Insurance (<https://nationalinsurance.nic.co.in/en/pradhan-mantri-fasal-bima-yojana-pmfby>) and the Operational Guideline for RWBCIS (https://agricoop.nic.in/sites/default/files/RWBCIS%20Revised%20Guidelines_3.pdf)

² Premium rates paid by the insurance company to the farmers: Food grains: Kharif 2%/: Rabi 1.5%; Annual horticulture and commercial crops: 5%.

³ <https://www.uuhf.ac.in/about-university/historical-background/>

Table 3.2.1 Fiscal Incentives under Special Integrated Industrial Promotion Policy 2008 for Hilly and Remote Areas of Uttarakhand

Schemes/ Incentives	Particular
Land development promotional scheme	Allotment of land for setting up of industrial units on priority basis with availability of general facilities like electricity, road, water supply, connecting roads, etc. Full concession on stamp duty for purchase / lease of land from industrial areas developed by the state government / private sector The process of land use change to be simplified.
Special state capital production incentive	Industries making investment in certain areas of the state shall be provided capital incentives depending on the areas- at a rate of 25% of the total investment subject to a maximum of INR 4.0 million in certain areas and at a rate of 20% of the total investment subject to a maximum of INR 2.5 million in other areas
Interest subsidy	Industries (in specified geographies) seeking loan through banks/financial institutions shall be given incentives of loans at concessional rates- of simple interest up to 6% per annum on term loan, with a ceiling of INR 500,000 per unit per annum to units in some areas and at 5% subject to a ceiling of INR 300,000 per unit per annum in other designated areas.
Power concession to new industrial units	All new industrial units (in designated areas) engaged in manufacturing and production of goods including industrial enterprises engaged in activities in the service sector shall be entitled for 100% rebate or exemption on electric bills for a period of ten years. This is not applicable to hotels, resorts, furnaces, etc. The industries based on fruit preservation, herbal and medicinal plants, and domestic produce shall be given due preference and priorities in this scheme.
Grant towards transport subsidy in hilly areas	In order to promote industrial units based on raw material produced in hilly areas, the transport subsidy at 5% of annual turnover (maximum of INR 500,000) will be provided by the state government to compensate the higher cost of transportation for units in designated areas and 3% of annual turnover (maximum of INR 300,000) for units in other designated areas.
Grants in aid for certification/ licensing	The state government will provide grant-in-aid to set up an industrial unit at 75% of expenditure with a ceiling of INR 200,000 per project towards payment of International Organization for Standardization (ISO) certification, Indian Standards Institution (ISI) mark, quality marking, Bureau of Indian Standards (BIS), and Farmers Producing Organization (FPO) license, trademark and copyright registration by the national and internationally approved agencies/ institutions.

Source: State Horticulture Mission, Government of Uttarakhand. (<https://shm.uk.gov.in/pages/display/6-state-profile>)

3.2.3 Mega Industrial and Investment Policy, 2015

The Government of Uttarakhand has promulgated the Mega Industrial and Investment Policy 2015 to promote large-scale units above INR 750 million investments. Several agencies are engaged in the implementation of the policy. The State Infrastructure and Industrial Development Corporation of Uttarakhand Limited (SIDCUL) plays a key role in industrial development of the state both in terms of policy formulation and infrastructure development. The Industries Association of Uttarakhand (IAU) is an apex body of small- and medium-scale industries of Uttarakhand and assists in the development of small- and medium-scale enterprises in the state. For promotion and growth of food processing industries in the state, the Department of Horticulture & Food Processing is the nodal agency. Beside the scheme of MSME, food processing industries are setup under HMNEH and state food processing mission.

3.2.4 Growth Centers Concept in Uttarakhand⁴

With its abundant natural resources and numerous agro-geo climatic zones, Uttarakhand has tremendous potential to turn into a hub for production and export of several local products including flowers, horticulture produce (fruits, vegetables, medicinal and aromatics, mushrooms, etc.), textiles and carpets, woolen products, and industrial infrastructure. Despite producing specialized/niche products in different parts of the state, Uttarakhand has been facing challenges in the development of MSMEs for niche products in the absence of commercial cultivation practices and standardization of the quality of its products. Without adequate credit and market linkages, or value addition and processing facilities, agribusiness and agro-value chain development remain a highly under-developed segment of the MSME sector.

As a way to address these challenges, the Government of Uttarakhand has embarked upon a Growth Center (GC) Scheme in 2018, for the establishment of growth centers in specific rural areas to promote identified economic activities and help specialized/ niche local produce and services reach the national

⁴ Growth Centers - <https://growthcenters.uk.gov.in/>

and international markets. This will help create income-generating opportunities and reduce out-migration of the youth, which is currently a major challenge for the state. The Growth Center Scheme will focus on identifying leading products and services, promotion of local products by removing the critical gaps in infrastructure, and developing specific areas by implementing the economic activities.

The cluster-based approach is built on the lines of the Micro & Small Enterprises – Cluster Development Program (MSE-CDP) of the Ministry of Micro, Small and Medium Enterprises (MSME), Government of India that seeks to link together common physical infrastructure facilities for enterprises that are producing similar/ complementary products and/or services to help them address their common challenges. The growth centers shall be established in remote parts of Uttarakhand that are witnessing high out-migration of rural youth. Export-oriented units will be set up with the support of local communities for large-scale production of several agri-products, fruits, vegetables, non-agri products, and food processing units. Such clusters will have tremendous economic potential as they are built on the state's comparative advantages, i.e., natural endowments, traditional skills, and basic entrepreneurial spirit.

The growth centers seek to empower entrepreneurs, farmers, and craftsmen/artisans to engage in product-specific value chains, upscale their products, and improve productivity through access to new designs, technology and knowledge which will enable them to successfully operate micro and small enterprises. The scheme will support the production of high-value products and diversification of existing outputs through development of fixed assets and supporting infrastructure. Rural-urban linkages will also be strengthened which will enable growth centers in and across the most-impacted/vulnerable districts to become catalysts for rural employment, and help reduce rural poverty through Self Help Groups (SHGs)/ Farmers Producing Companies (FPCs) led by public-private partnerships.

The state government would support these initiatives by plugging the gaps through infrastructure and institutional development. The program will build capacities of people, provide skills, and strengthen backward linkages by dovetailing several existing schemes through various state departments. Moreover, value addition and marketing support will be the keystones of the program. With these objectives in mind, the growth center approach aims to support the state's poverty reduction goals and promote shared prosperity through economic activities.

As per the information of MSME Department, there are 42 growth centers related to horticulture, promoted mainly by the Integrated Livelihood Support Project (ILSP) of the International Fund for Agriculture Development (IFAD), State Rural Livelihood Mission (SRLM), and Directorate of Watershed.

Table 3.2.2 List of Horticulture Related Growth Centers in Uttarakhand

No.	Name of the Scheme	Name of the Center	Implementation Agency	Products
Almora	IFAD-ILSP	Wheat Milling and Fruit Processing Growth Center – Chaukhutiya	Maa Agneri Self-reliant Cooperative Block – Chaukhutiya, Almora, Uttarakhand 263656	-
Almora	IFAD-ILSP	Spices Processing Growth Center – Dwarahat	Himdrishya Self-reliant Cooperative, Majkhali, Dwarahat, Almora Uttarakhand	Turmeric, Chilly, Coriander, Pulses
Almora	IFAD-ILSP	European Vegetables Growth Center – Lamgadha	Pragati Self-reliant Cooperative, Motiyapathal, Lamgadha, Almora, Uttarakhand	European Vegetables, Mix Jam, Apple Jam
Almora	Watershed Management Directorate	Agribusiness Growth Center Faliyat Almora	Dhaura Devi Gramya Shree Swayatt Sahkarita Sangh, Village-Faliyat, Near Thana, Danya, Almora	Seed Processing, Daliya Grinding and Packaging, Packaging of Mung Dal and Roasted Gram, Collection, Grading and Marketing of Vegetables
Almora	IFAD-ILSP	Upscaling Bakery and Agro Processing Unit Nyaya Panchayat – Hawal Bagh, Block – Hawal Bagh, Almora	Vikas Swayatt Sahkarita and Pragati Swayatt Sahkarita	-
Almora	IFAD-ILSP	Spices/Fruits and Millets Processing Growth Center Nayay	Ma Gargia Swayatt Sahkarita, Machod, Salt	-

No.	Name of the Scheme	Name of the Center	Implementation Agency	Products
		Panchayat – Machod, Block – Salt, Almora		
Almora	IFAD -ILSP	Spice Growth Center, Nyaya Panchayat Bhasot, Block – Bhikiyasen	Mahakaleshwar, Swayatt Sahkarita, Basot, Block – Bhikiyasen	-
Bageshwar	IFAD-ILSP	Fruit Processing Growth Center – Garurdh	Sanjeevani Ajivika Self-reliant Cooperative, Naya Panchayat – Lobbaj, Garur, Bageshwar, Uttarakhand 263641	Juice, Pickles
Bageshwar	USRLM	Spices and Ginger Processing Organization-Kapkot	Haryali Mahila Village Organization, Kapkot, Bageshwar, Uttarakhand 263632	-
Bageshwar	Watershed Management Directorate	Agribusiness Growth Center – Shyama Kapkot	Danpur Kisan Ekta Self-reliant Cooperative, Kapkot Bageshwar, Uttarakhand 263632	-
Bageshwar	IFAD-ILSP	Traditional Grains Processing and Aromatic Rose Processing	Bajnath Ajivika Self-reliant Cooperative, Bajnath, block- Garur, Bageshwar	-
Chamoli	IFAD-ILSP	Waste Flower Value Processing Growth Center	Maa Chandika Aajivika Self-reliant Cooperative, Vikaskhand – Pokhri, Chamoli, Uttarakhand	Recycling of Flowers, Local Vegetables
Chamoli	IFAD-ILSP	Prasad Making Growth Center, Tharali	Soldungri Aajivika Self-reliant Cooperative, Dungri, Tharali Chamoli, Uttarakhand	Burans (Rhododendron) Juice, Pickles
Chamoli	IFAD-ILSP	Fruit and Flower Processing Growth Center, Tharali	Maa Rajeshvari Aajivika Self-reliant Cooperative, Tharali, Chamoli, Uttarakhand	Value Addition Fruits
Chamoli	IFAD-ILSP	Fruit Processing Growth Center – Hawalbagh	Nagdhara Aajivika Self-reliant Cooperative, Uttarakhand, Vikaskhand-Pokhri – Chamoli	Grading of Fruits
Chamoli	IFAD-ILSP	Aromatic Rose Processing Growth Center	Maa Bhagvati Aajivika Self-reliant Cooperative, Nyaay Panchayat Lolti, Vikaskhand, Tharali, Chamoli, Uttarakhand	Rose Nursey
Chamoli	KVIB	Honey and Honey Products	-	-
Dehradun	IFAD-ILSP	European Vegetable Growth Center – Kalsi	Visayalkhat Aajivika Self-reliant Cooperative, Kalsi, Dehradun – 248001	European Vegetables-Tomato, Capsicum
Dehradun	Watershed Management Directorate	Agribusiness Growth Center-Punha	Ath Village Fruit and Vegetable Production Self-reliant Cooperative Punha, Pokhari, Chakrata, Dehradun Uttarakhand 248124	-
Dehradun	Watershed Management Directorate	Agribusiness Growth Center –Thano Raipur	Mal Koti Self-reliant Cooperative, Thano Raipur, Dehradun, Uttarakhand 248008	-
Pauri Garhwal	IFAD-ILSP	Fruit and Spice Perservation Growth Center – Vikaskhand	Buransh Aajivika Self-reliant Cooperative, Vikaskhand, Kaljhikhal, Pauri	Spices Processing
Pauri Garhwal	USRLM	Fruit and Spice Processing Growth Center – Pauri	Navdurga CLF, Duggarda, Pauri Garhwal, Uttarakhand 246127	-
Pauri Garhwal	USRLM	Mushroom Growth Center – Faraswadikot Pauri	Faraswadikot, Pauri, Uttarakhand	-
Pauri Garhwal	Watershed Management Directorate	Agribusiness Growth Center – Simarakhal Pauri	Chaundkot Navjyoti Swayatt Sahakarita, Simarakhal, Pauri Garhwal	Chilli Powder, Chilli Sabut, Chaulai, Turmeric Powder, Garlic, Jhangora, Jakhiya, Gahat Dal, Badri Cow Ghee, Kala Bhatt, Mandua Atta, Rayans Dal, Urd Dal, Soyabean, Till
Pauri Garhwal	Watershed	Agribusiness Growth	Teelurautei Swayatt Sahakarita,	Chilli Powder, Chilli

No.	Name of the Scheme	Name of the Center	Implementation Agency	Products
	Management Directorate	Center – Amotha Guth, Patisain	Amotha Guth Patisain, Pauri Garhwal	Sabut, Chaulai, Turmeric Powder, Jhangora, Jakhiya, Gahat Dal, Badri Cow Ghee, Kala Bhatt, Mandua Atta, Rayans Dal, Urd Dal, Soyabean, Till, Handmade Sleeper, Amla Pickle, Garlic Pickle, Mix Pickle, Button Mushroom, Mango Pickle, Mushroom Pickle, Dheengri Mushroom, Chilli Pickle, Fancy Candle and Bags
Pithoragarh	IFAD-ILSP	Aromatic Rose Growth Center-Pithoragarh	Mahadev Aajivika Self-reliant Cooperative, Vind Pithoragarh	Rose Nursey
Pithoragarh		Fruit Processing Growth Center – Kanalichina	Dhwaj Livelihood Self-reliant Cooperative Development Block Pithoragarh Kanalichina, Pithoragarh, Uttarakhand 262541	Juices, Pickles
Pithoragarh	Watershed Management Directorate	Agribusiness Growth Center – Nachni	Triveni Sangam Swayatt Sahkarita Sangh, Munsiyari Pithoragarh Uttarakhand	Juice: Malta, Amla, Orange, Burance Pickles: Mango, Amla, Lemon Spices: Turmeric powder, Bay leaves Flowers: Lilium, Guldavari, Genda Vegetables: Capsicum, Cucumber, Bottle Ground, Chilli, Brinjal
Rudraprayag	IFAD-ILSP	Prasad Making Growth Center – Jakholi	Lata Baba Aajivika Self-reliant Cooperative, Block Jakholi Rudraprayag, Uttarakhand	Spices Processing
Rudraprayag	IFAD -ILSP	Bee Keeping Honey Procesing Growth Center	Uccha Dungi Self-reliant Cooperative, Block Augustmuni, Rudraprayag, Uttarakhand	-
Tehri Garhwal	IFAD-ILSP	Prasad Making and Fruit Processing Growth Center – Jaunpur	Maa Surkanda Aajivika Self-reliant Cooperative, Sakalana Development Block Jaunpur, Tehri, Uttarakhand	Red Rice, Pickles, Dhoop, Manduwa Aata, Burans Juice, Amaranthus
Tehri Garhwal	IFAD-ILSP	Prasad Making and Fruit Processing Growth Center – Kotigad	Utsaah Aajivika Self-reliant Cooperative, Kotigad Development Block Chamba, Tehri Garhwal	Pickles, Finger Millet, Phadi Salt, Honey, Rajma
Tehri Garhwal	USRLM	Spices and Ginger Processing Growth Center – Narendra Nagar	Kanjipuri CLF, Narendra Nagar, Tehri, Uttarakhand 249175	-
Tehri Garhwal	Watershed Management Directorate	Agribusiness Growth Center – Thatud	Rural Farmers Self-reliant Cooperative, Khyarsi Thatud Jaunpur, Tehri Garhwal, Uttarakhand 249180	-
Udham Singh Nagar	USRLM	Govindpur Masala Growth Center – Gadarpur	Udhaan Mahila Cluster Organization, Gadarpur, Udham Singh Nagar Uttarakhand 263152	-
Uttarkashi	IFAD-ILSP	Prasad Making and Fruit Processing Growth Center	Maa Jagdama Aajivika Self-reliant Cooperative, Block Bhatwari Uttarkashi, Uttarakhand	-
Uttarkashi	IFAD-ILSP	Aromatic Rose Based Processing Growth Center	Ganga Maiya Aajivika Self-reliant Cooperative, Block Bhatwari Uttarkashi, Uttarakhand	-
Champawat	USRLM	Honey and Spices Growth Center – Shyamaltaal	Growth Center: Shyamaltaal, Champawat, Uttarakhand 262523	-

No.	Name of the Scheme	Name of the Center	Implementation Agency	Products
Nainital	USRLM	Prasad Making Growth Center-Nainital	Astha Village Organization, Kotabagh, Nainital Uttarakhand 263159	-
Nainital	USRLM	Food Processing Growth Center, Ramgarh, Nainital	-	-
Nainital	USRLM	Organic Produce Based Growth Center, Kotabagh, Nainital	-	-
Nainital	KVIB	Honey Growth Center, Kaladungi, Nainital	-	-

Source: MSME Department, Uttarakhand, Growth Center Website. <https://growthcenters.uk.gov.in> and List released by MSME Department on Growth Centers

3.2.5 Cluster Development Policy on Horticulture Crops in Uttarakhand⁵

In the state, based on geographical location and climate, a total of 1,050 clusters are identified that include 6, 563 villages. Out of the total clusters, 384 (36.57%) clusters are for fruits, 437 (41.62 %) for vegetables, 179 (17.05%) for spices, and 50 (4.76%) for horticulture. In the present context, 34,824 ha of land is identified under the selected clusters.

Table 3.2.3 Details of Clusters with Number of Villages and Area under Different Horticulture Crops

District	Fruits			Vegetables			Spices			Flowers			Total		
	No. of Clusters	No. of Villages	Area (ha)	No. of Clusters	No. of Villages	Area (ha)	No. of Clusters	No. of Villages	Area (ha)	No. of Clusters	No. of Villages	Area (ha)	No. of Clusters	No. of Villages	Area (ha)
U. S. Nagar	70	670	352	55	576	393	29	332	332	3	14	12	157	1,592	1,089
Nainital	14	128	290	10	107	211	9	87	163	1	7	29	34	329	693
Almora	13	155	351	9	103	228	4	43	200	1	10	50	27	311	829
Bageshwar	38	145	775	48	155	711	41	165	396	0	0	0	127	465	1,882
Pithoragarh	19	159	4,329	27	155	2,552	9	101	708	10	96	317	65	511	7,606
Champawat	26	78	559	25	95	808	3	18	154	6	17	310	60	208	1,831
Haridwar	18	140	5,014	5	34	610	4	40	292	3	23	23	30	237	5,939
Dehradun	26	167	588	59	158	592	6	70	123	3	15	23	94	410	1,326
Tehri Garhwal	35	191	582	33	381	275	32	408	240	0	0	0	100	980	1,097
Pauri	26	176	461	24	169	797	20	139	166	10	79	247	80	563	1,671
Chamoli	8	53	376	10	56	546	2	15	236	1	7	49	21	131	1,207
Rudrapur	10	56	520	10	63	282	12	35	164	11	28	50	43	182	1,016
Uttarkashi	81	307	4,816	122	255	3,443	8	82	246	1	0	133	212	644	8,638
Total	384	2425	19,013	437	2307	11,448	179	1535	3420	50	296	1243	1050	6,563	34,824

Source: Economic Survey 2020-21 Uttarakhand. Pp. 85-86.

3.2.6 Horticulture Missions in Uttarakhand

(1) Mission for Integrated Development of Horticulture (MIDH)⁶

The Mission for Integrated Development of Horticulture (MIDH) is a centrally sponsored scheme for the holistic growth of the horticulture sector covering fruits, vegetables, root and tuber crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew, cocoa, and bamboo. Under MIDH, the Government of India (GOI) contributes 60% of the total outlay for developmental programs in all the states except in North Eastern and Himalayas' states, while 40% share is contributed by the state governments. In the case of North Eastern State and Himalayan State, GOI, contributes 90%. (<https://hortnet.gov.in/>) The schemes are as shown below.

- National Horticulture Mission (NHM) is one of the sub-schemes of the Mission for Integrated Development of Horticulture (MIDH) which is being implemented by the State Horticulture Missions (SHM) in selected districts of 18 states and 6 union territories.

⁵ Source: Economic Survey 2020-21 Uttarakhand

⁶ HORTNET, Ministry of Agriculture and Farmers Welfare, Government of India <https://hortnet.gov.in/>

- Horticulture Mission for North East & Himalayan States (HMNEH) is one of the sub-schemes of the MIDH, which is being implemented by the SHM in the North Eastern State and Himalayan State.
- National Horticulture Board (NHB) is implementing various schemes under the MIDH in all states and union territories. (Source: <https://midh.gov.in/>)

(2) Horticulture Mission for North East and Himalayan States (HMNEH)

Before 2014-15, the mission was being implemented through the four mini missions, i.e., Mini Mission-I (Research), Mini Mission-II (Production & Productivity Improvement), Mini Mission-III (Postharvest Management & Marketing), and Mini Mission-IV (Processing & Value addition). During 2014-15 with a view to promote holistic development of the horticulture sector in the country, the Department of Agriculture and Corporation, Ministry of Agriculture, Government of India, has approved a Mission for Integrated Development of Horticulture (MIDH) by subsuming ongoing schemes of the National Horticulture Mission (NHM), Horticulture Mission for North East and Himalayan States (HMNEH), National Bamboo Mission (NBM), National Horticulture Board (NHB), Coconut Development Board (CDB), and Central Institute for Horticulture (CIH), Nagaland.

The HMNEH continues to be implemented in the State of Uttarakhand with revised cost norms and pattern of assistance during the remaining period of the 12th Five-year Plan. All the four mini missions of HMNEH now have been clubbed in the scheme.

1) Mission Objectives

- Promote holistic growth of horticulture sector, including bamboo and coconut through area based regionally differentiated strategies, which includes research, technology promotion, extension, postharvest management, processing and marketing, in consonance with comparative advantage of each state/region and its diverse agro-climatic features;
- Encourage aggregation of farmers into farmer groups like Farmers Interest Groups (FIGs)/FPOs and FPCs to bring economy of scale and scope.
- Enhance horticulture production, augment farmers, income and strengthen nutritional security;
- Improve productivity by way of quality germplasm, planting material and water use efficiency through micro irrigation; and
- Support skills development and create employment generation opportunities for the rural youth in horticulture and postharvest management, especially in the cold chain sector.

2) Mission Strategies

To achieve above objectives, the mission will adopt the following strategies:

- i. Adopt an end-to-end holistic approach covering pre-production, production, postharvest management, processing, and marketing to assure appropriate returns to growers/producers;
- ii. Promote research and development (R&D) technologies for cultivation, production, postharvest management, and processing with special focus on cold chain infrastructure for extending the shelf life of perishables;
- iii. Improve productivity by way of quality through:
 - Diversification, from traditional crops to plantations, orchards, vineyards, flowers, vegetable gardens, and bamboo plantations.
 - Extension of appropriate technology to farmers for high-tech horticulture including protected cultivation and precision farming.
 - Increase of acreage of orchards and plantation crops including bamboo and coconut, particularly in states where total area under horticulture is less than 50% of the agricultural area.
- iv. Improve postharvest management, processing for value addition and marketing infrastructure.

- v. Adopt a coordinated approach and promote partnership, convergence and synergy among R&D, processing and marketing agencies in public as well as private sectors, at the national, regional, state, and sub-state levels;
- vi. Promote FPOs and their tie up with Market Aggregators (MAs) and financial institutions (FIs) to support and adequate returns to farmers.
- vii. Support capacity-building and Human Resource Development (HRD) at all levels, including, change in syllabus and curriculum of graduation courses at the colleges, universities, Industrial Training Institutes (ITIs), polytechnics, as appropriate.

3) Mission Structure

To oversee the implementation of HMNEH in the State Level Executive Committee(s) (SLEC) under the Chairmanship of Agricultural Production Commissioner (APC) or Principal Secretary Horticulture/Agriculture/Environment & Forests, (in the absence of APC) having representatives from other concerned departments of the state government including forests, the State Agricultural Universities (SAU), Institutes under Indian Council of Agricultural Research (ICAR), Growers' Associations/FPOs, etc., will be set up. The central government will nominate its representative to the SLEC. The State Mission Director, HMNEH will be the member secretary of the SLEC. At the operational level, state governments will have freedom to establish the State Horticulture Mission (SHM) as a suitable autonomous agency, to be registered under the Societies Registration Act for implementing mission programs at the state and district levels. The Panchayati Raj Institutions (PRI) existing in the state will be involved in the implementation of the program.

4) Status of HMNEH

The activity wise physical progress of the HMNEH is reported in the table below. The data is showing a constant growth in the area expansion of vegetable, spices, flowers, and water resource creation. As for the fruits, area expansion appears stagnant. Under greenhouse, mulching is adopted in 3 million ha, which is nearly double the area of what was achieved in FY 2016-17. Although the state's focal area in horticulture/ agriculture sector is organic farming, the interventions on organic farming under HMNEH were not continued after FY 2016-17. There is a component on training of officials and farmers conducted outside of the state in FY 2016-17, FY 2018-19, and FY 2019-20.

Table 3.2.4 Physical Progress of HMNEH between FY 2016-17 and FY 2020-21

Sl. No.	Components	FY 2016-17	FY2017-18	FY2018-19	FY2019-20	FY2020-21
A. Area Expansion of Horticulture Crops (Ha)						
1	Vegetables (ha)	900	1,278	1,897	1,252	1,520
2	Spices (ha)	525	600	850	1,025	1,759
3	Flowers (ha)	697	600	841	792	1,449
4	Fruits Rejuvenation (ha)	125	109	195	200	367
5	Fruits (ha)	50	100	150		150
B. Creation of Water Resource (Nos.)		135	350	430	233	481
C. Greenhouse and General Purpose Polyhouses			105	164	70	126
D. Greenhouse (Sqm)						
1	Shade Nets (Sqm)	100,000	127,662	94,800	100,000	155,000
2	Anti-hail Nets (Sqm)	2,000	16,130	12,000	8,000	14,000
3	Mulching (ha)	160,000	465,000	1,106,750	2,200,000	3,000,000
4	Organic Farming	125	200	263	400	345
E. Promotion of Organic Farming (Ha)						
1	Vermi Compost Unit (Nos)	40				
2	HDPE Vermibed	300				
3	Pollination Support through Honey Bee					
F. Beehives / Equipment (Nos.)						
1	Bee Colonies (Nos.)	625	1,750	1,500	2,500	7,000
2	Human Resource Development (HRD)	625	1,750	1,500	2,500	7,000
G. Training of Officials and Farmers (Outside State)		1,000		3,700	3,700	
H. Horticulture Mechanization (Nos.)		100		100		
I. On-farm Handling Unit (Nos.)		162	324	385	222	

Source: UKDHFP

(3) Other Interventions Taken by the Department of Horticulture & Food Processing, Uttarakhand

1) Technical Interventions

The Department of Horticulture & Food Processing, Uttarakhand, has been adopting various technologies in different schemes for enhancement of production and productivity and quality of fruit, vegetable, spices, and flowers by adopting cluster approach, which include setting up of nurseries, tissue culture labs and distributions of planting materials, vegetable seed production, area expansion, rejuvenation of old and senile orchards, creation of community and individual water sources, protected cultivation, Integrated Nutrient Management (INM)/ Integrated Pest Management (IPM), organic farming, pollination support through bee keeping, promotion of mushroom cultivation, mechanization, training of farmers and officials, awareness campaign, postharvest management and marketing and food processing. The Postharvest Management (PHM) components include on-farm handling units, cold storages, Controlled Atmosphere (CA) storages, pre-cooling units, ripening chambers, primary processing / value addition units, refrigerated vans, under marketing component rural markets, wholesale and terminal markets, functional infrastructure for collection, sorting, grading packing, establishment of horticulture produce based on new processing units, modernization, and upgradation of existing units are taken up.

- The state government has launched several new schemes viz. Apple Mission for Cultivation of Ultra High-density Apple, Walnut Mission, Small Nurseries, Production of Off-season Vegetables, Vermi Compost Units, etc.
- To reduce postharvest losses projects for INR 16.5 crore submitted to the National Bank for Agricultural and Rural Development (NABARD) under the Rural Infrastructure Development Fund (RIDF).
- Center of Excellence on Temperate Fruits for INR 5.00 crore is being setup under HMNEH by UUHF, Bharsar.
- Two Centers of Excellence on Walnut are being set up in Chaubatia, Ranikhet, and Magra, Tehri Garhwal.
- Farmers are being provided free service regarding crop specific agro-techniques including disease/pest, market and weather information daily through SMS on mobile by Reuters Market Light Company.

(4) Future Strategy

The following strategies are mandated by the Uttarakhand Department of Horticulture and Food Processing (UKDHFP) to further develop the horticulture sector in the state. Information source is <https://shm.uk.gov.in/pages/display/6-state-profile>.

- Double income of farmers by 2022.
- Convergence with HMNEH, Rashtriya Krishi Vikas Yojana (RKVY), Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MNERGA), Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) (Watershed development programs, minor irrigation for creation of water sources, per drop more crop and other intervention components).
- Enhance productivity by rejuvenating senile orchards.
- Organize Farmers FIGs at the village level, federations (Farmer Producer Organization/Company-FPO/FPC) at the cluster/district level and FPOs will ensure procurement of inputs from self-producing agencies like planting material, seeds, fertilizers, pesticides, machines and tools, packaging material, etc.), arrangement for marketing, setting up of small and medium processing units, etc.
- Promote organic farming.
- Promote horticulture mechanization to reduce drudgery
- Safety-net to Farmers: Market intervention scheme and weather-based crop insurance scheme.

- Promote contract/Corporate farming –by involving retail houses.
- Establishment of farmer-consumer markets/*Apni* Mandi (farmers’ own market in Hindi) in Urban locations.
- Primary processing of commodities (pack house, collection, sorting, grading, pre-cooling, etc.) at the farm gate level.
- Development of PHM infrastructure, integrated pack house, cold rooms/cold storages, CA storage for temperate fruits, ref vans, ripening chambers, etc., to reduce postharvest losses.
- Set up of pulp units for mango, litchi, tomato and juice plants for apple and Individual Quick Freezing (IQF) units for fruits vegetables.
- Branding of different produce of Uttarakhand.

3.2.7 Ongoing Externally-aided Project

Several externally aided projects have been implemented in Uttarakhand. The table below provides the salient features of those which have implemented horticulture related interventions.

Table 3.2.5 Ongoing Externally-aided Project

No.	Name of the Project	Implementing Agency	Funding Agency	Project Period	Key Activities
1	Uttarakhand Forest Resource Management Project (UFRMP)	Uttarakhand Forest Department	JICA	Five Years (2017 - 2022)	Ecological restoration Improving livelihood of the people Creating income opportunities Ensuring community development activities Disaster management has also been added in the project
2 -	Uttarakhand Decentralized Watershed Development Project (Phase II - Gramya)	Watershed Management Directorate, Uttarakhand	The World Bank	Seven Years (2014 - 2021)	Supporting sustainable natural resource management through treating watersheds comprehensively at the micro-watershed level Increasing productivity on arable lands through providing extension services Increasing rural incomes through enhancing agribusiness development for target farmers and alternative livelihoods for vulnerable households Providing response to an eligible crisis or emergency in the target micro-watersheds as needed The project is based on joint relationship among three entities: -Village communities and GPs; -WMD; and -NGOs and other service providers.
3	Technical Support to Rural Development Department in the implementation of USRLM	Uttarakhand State Rural Livelihood Mission (USRLM)	UNDP (Uttarakhand)		USRLM focuses on agenda of inclusion of the poorest of the poor through transformation of the groups of rural women into empowered, self-reliant community organizations consisting of four stages of development, i.e.; (i) Social mobilization, community institution and capacity building; (ii) Financial inclusion; (iii) Livelihood promotion/skill building; and (iv) Convergence as clearly defined in the NRLM scheme document
	Technical Support to DSDE in the implementation of World Bank Funded Project on Workforce	Department of Skill Development and Employment (DSDE)		Five Years (2018-2023)	Improving the quality and relevance of training at priority Industrial Training Institutes (ITIs) and of increasing the number of labor-market-relevant workers through short-term training in Uttarakhand

No.	Name of the Project	Implementing Agency	Funding Agency	Project Period	Key Activities
	Generation				
	Strengthening of CPPGG in HR Mobilization and Capacity Building by UNDP	Department of Planning in the State Government, United Nations Development Programme (UNDP)		Four Years (2018-2022)	Emphasis on transformative change and development impact at scale UNDP has initiated active support to many state governments in mainstreaming SDGs within their schemes and programs
	UNDP Support in Electronic Vaccine Intelligence Network (eVIN) Program in Uttarakhand	Government of India, UNDP, Ministry of Health and Family Welfare		Five Years (2017-2022)	Streamline and regularize the vaccine flow network by ensuring data-driven and efficient management of the immunization supply chain Ensure equity in easy and timely availability of vaccines to all children
	Value Chain Study/Growth Centers	Government of India, UNDP			Rural Business Incubators will mentor and provide handholding support to community institutions created by Rural Development Department of Uttarakhand
4	Secure Himalayas (Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems)	The Government of India and United Nations Development Program	UNDP	Six Years (2017-2023)	• Conservation of key biodiversity areas and their effective management to secure long-term ecosystem resilience, habitat connectivity and conservation of snow leopard and other endangered species and their habitats • Securing sustainable community livelihoods and natural resource management in high range Himalayan ecosystems • Enhancing enforcement, monitoring and cooperation to reduce wildlife crime and related threats • Knowledge, advocacy, communication and information systems established
5	Integrated Cooperative Development Project (ICDP)	NCDC	National Cooperative Development Corporation (NCDC)	4-5 Years	Development of Primary Agricultural Credit Societies as multi-purpose self-reliant entities Development of allied sector cooperatives Development of viable functional linkages among cooperatives
	Yuva Sahakar - Cooperative Enterprise Support and Innovation Scheme	Ministry of Agriculture & Farmers Welfare		Five Years (Started since 2018)	
6	Integrated Livelihood Support Project (ILSP)	Department of Rural Development, Uttarakhand	IFAD	Eight Years (2013-2021)	To enable rural households to take up sustainable livelihood opportunities integrated with the wider economy The project has four components: Food Security and Livelihood Enhancement Participatory Watershed Development Livelihood Financing Project Management

Source: Compiled by the JICA Survey Team based on the information from the websites and reports of the projects

Among the above projects, the IFAD project has covered wide geographical areas in the state. The Government of Uttarakhand is in preparation of another phase of the project, namely, the Rural Enterprise Acceleration project (REAP). This project will emphasize on the development of stronger value chains to facilitate micro-agribusiness as well as non-farm business in the selected subsectors and establish market-driven sustainable production system. REAP will work on establishing and

strengthening sustainable clusters and enterprises through value chain development, forward linkages, and access to markets, technology and financial services to uplift the livelihoods of the vulnerable households. REAP will be implemented in all 95 blocks in Uttarakhand. Blocks covered under all the IFAD projects including REAP are given in Attachment 3.2.1.

3.2.8 Financial Status of Horticulture Sector in the State

(1) Uttarakhand State Plan 2021-22 as Outcome / Performance Budget⁷

Uttarakhand State has prepared a plan for the year 2021-22 in the area of horticulture development. The following are key highlights of the Outcome Performance Budget. This Outcome Performance Budget includes – financing under the National Horticulture Board/ Agricultural and Processed Food Products Export Development Authority (APEDA), NABARD support on Horticulture, Chief Minister Integrated Horticulture Development Scheme, Central Government Schemes - National Horticulture Mission, PM Agriculture Irrigation Scheme – Per Drop Crop Component, Micro Food Processing Enterprises Scheme (PM FME Scheme), Externally-funded Projects, District Sector Project, Uttarakhand Tea Development Board, Herbal Sector Support under State Plan, MAP (Bhesaj Development) plans through Cooperative Sector, District Sector Support for MAPs (Bhesaj Federations) Sericulture Development. The Plan also gives Sustainable Development Goals (SDG) indicators and expected outputs. Some of the key components of the Outcome Performance Budget are given in the table below.

(2) Budget for Horticulture Sector

Uttarakhand being a special category states, the state budget is assisted by the central government. According to the budget at a glance for 2020-2021, 56.4% of the total state budget are derived from grants from the central government for various sectors. In the case of the budget allocated for the horticulture development, 98.7% accounts for the grants from the central government.

In the table below, the annual budget and expenditure of UKDHFP between FY 2018-19 and FY 2020-21 is given. In the reporting period, the growth of budget allocation to the district sector hiked in FY 2020-2021. This budget is released to the District Magistrate (DM) by the state government and its expenditure and progress of the activities undertaken with this budget will be monitored by DM of each district. The activities proposed under this District Sector budget will be implemented by the Chief Horticulture Officer (CHO)/ District Horticulture Officer (DHO) who will report the progress to the DM and UKDHFP.

State sector budget is administered by the Director Horticulture for the implementation of State Scheme. For the implementation of the state scheme, the budget is released to CHO/ DHO. This has segment of the budget has shown marginal increase during the reporting period. The central sector budget is allotted for implementation of the central government scheme such as HMNEH/ MIDH, PMKSY, PMFME, etc. All these central schemes were supported by the central government for its budget of 90% and state government provides the remaining 10% share.

Table 3.2.6 Summary Annual Budget and Expenditure of the UKDHFP between FY 2018-19 and FY 2020-21

(Million INR)

Sectors	2018-2019		2019-2020		2020-2021	
	Total Available Budget	Total Budget Expenditure	Total Available Budget	Total Budget Expenditure	Total Available Budget	Total Budget Expenditure
District Sector	75.226	75.226	116.84	116.84	449.54	449.54
State Sector	1681.071	1681.071	1,745.67	1,745.67	2,143.02	2,143.02
Central Sector	703.802	703.802	506.41	506.41	820.00	820.00
Total	2460.099	2460.099	2,368.92	2,368.92	3,412.56	3,412.56

Source: Budget 2020-2021. Department of Budget, Government of Uttarakhand

⁷ https://budget.uk.gov.in/files/_2021-22.pdf

(3) Economic Performance of the Horticulture Sector

As per the Economic Survey of Uttarakhand 2020-21⁸, in 2019-20, 0.181 million ha land was utilized for the cultivation of fruit produce of 0.677 million MT. In the state, pear production is at the top, peach is on second position, and then comes apple. A total of 0.296 million-hectare area is under horticulture producing around 1.79 million MT of horticulture produce. Around 0.450 million farmers are associated with horticulture. Out of the total farmers, 88% farmers are small and marginal. In the state, the annual business of horticulture is at the extent of INR 32,500 million and in total local produce of agriculture sector, horticulture share is 30% (including food processing) of the total.

The Horticulture Department is trying to protect the interest of fruit growers. The Horticulture Department is being declared a Minimum Support Price (MSP) for the various fruits produced by them, such as C-grade apple, malta, pahari lemon / galgal, and pear. As a result, the possibility of fruit growers getting better prices from the traders and other 11 business establishments have increased than before. Appropriate provisions have been made in the budget for the development of horticulture, such as Per Drop More Crop, National Horticulture Mission, Integrated Horticulture Scheme, Mission Apple and Horticulture Insurance Scheme. Under Horticulture Department a provision of INR 55.3 million has been made for the operation of Honourable Prime Minister Micro Food Enterprise Up Gradation Scheme for processing of fruits⁹.

3.2.9 Horticulture Sector and COVID-19

The following are some of the initiatives that the Horticulture Department has initiated during coronavirus disease 2019 (COVID-19):

(1) Quarantine Facility for Imported Horticulture Crops before coming in Uttarakhand¹⁰

In order to prevent the spread of any diseases from imported crops to other native plants, the Government of Uttarakhand has taken an initiative to quarantine the imported plants. The objective of the facility made was to prevent the spread of the disease from imported crops to native plants. The Uttarakhand government has worked to establish a quarantine facility in the spread over 20 acres for keeping imported high-value horticulture crops. The district magistrates (DMs) of Dehradun, Haridwar, Nainital and Udham Singh Nagar were informed through the minister for agriculture and horticulture to look for a plot of land, where the post-entry quarantine facility can be built.

(2) Efforts to Retain Migrants who have returned to Uttarakhand

The Government of Uttarakhand is taking several steps to retain migrants who returned to the state after a nationwide lockdown was imposed to curb the spread of COVID-19. A total of 59,360 migrants returned to ten districts - excluding Dehradun, Haridwar and Udham Singh Nagar according to an interim report released by the state's Rural Development and Migration Commission on April 23, 2020. The government then decided to conduct an online survey to understand their socio-economic status. The government looks at this as an opportunity to retain its youth by apprising them of the schemes and gainfully employing them.

Seventy percent of those who have returned, however, were unwilling to work under the Mahatma Gandhi National Employment Guarantee Act according to the report, that said only 30% can be categorized under the minimum income group. Thirty-three percent of the migrants visited their families living in villages at least twice a year, the report said. Most of the migrants were employed in the hospitality sector as drivers or electricians. Most of the migrants, with an average age of 30 to 40 years ventured to other districts within Uttarakhand, across the country and in some cases, abroad, in the search for employment and higher education. The state government has drawn up an action plan to better engage with these blue-collared migrants and revive the state's rural economy. "One of the many

⁸ Economic Survey, 2020-21 (Part -1), Planning Department, Directorate of Economics and Statistics, Government of Uttarakhand (<https://des.uk.gov.in/pages/display/163-economic-survey--2020-21>) (Report in Hindi)

⁹ Source: Budget Estimates of Financial Year 2021-22 - CM Budget Speech https://budget.uk.gov.in/files/budget_bhasan.pdf

¹⁰ <https://www.hindustantimes.com/dehradun/in-a-first-quarantine-facility-for-imported-horticulture-crops-to-come-up-in-uttarakhand/story-puj4cgp0Ad5b20jZy17LiN.html> : Hindustan Times, Dehradun | By Suparna Roy Updated on 6th Sep. 2020

suggestions proposed by the Migration Commission is to focus on key sectors like horticulture, dairy, animal husbandry, goat rearing, eco-tourism, homestays, and other micro-enterprises,”¹¹.

An analytical paper¹² ‘Containing COVID-19 impacts on Indian agriculture’ covers the scenario of COVID-19, immediate challenges that COVID-19 has posed to the farm sector and mitigation measures to ensure a sustainable food system in the post-crisis period.

Action Taken by the Government - Also followed by the Uttarakhand Government

- Immediately after the nationwide lockdown was announced, the Indian Finance Minister declared an INR 1.7 trillion package, mostly to protect the vulnerable sections (including farmers) from any adverse impacts of the COVID-19 pandemic. The announcement, among a slew of benefits, contained advance release of INR 2,000 to bank accounts of farmers as income support under PM-KISAN scheme.
- The government also raised the wage rate for workers engaged under the NREGS, the world’s largest wage guarantee scheme.
- Under the special scheme to take care of the vulnerable population, Pradhan Mantri Garib Kalyan Yojana (Prime Minister’s scheme for welfare of the poor), has been announced.
- Additional grain allotments to registered beneficiaries were also announced for the next three months.
- Cash and food assistance to persons engaged in the informal sector, mostly migrant laborers, have also been announced for which a separate Prime Minister Citizen Assistance and Relief in Emergency Situations (PM-CARES) fund has been created.
- The Indian Council of Agricultural Research (ICAR) has issued state-wise guidelines for farmers to be followed during the lockdown period. The advisory mentions specific practices during harvest and threshing of various rabi (winter sown) crops as well as postharvest, storage and marketing of the farm produce.
- The Reserve Bank of India (RBI) has also announced specific measures that address the “burden of debt servicing” due to the COVID-19 pandemic. Agricultural term and crop loans have been granted a moratorium of three months (until May 31) by banking institutions with 3% concession on the interest rate of crop loans up to INR 300,000 for borrowers with good repayment behavior.

Immediate Challenges

- Any severe disruption to the supply of perishable fruits and vegetables, dairy products, fish, etc., having mobilized to meet the increasing demand from a bulging middle class as well as urban and rural consumers, may create irreparable damage to all actors in the supply chain.
- The migration of workers from few parts to their native places has also triggered panic buttons, as they are crucial for both harvesting operations and postharvest handling of produce in storage and marketing centers. The Union Home Ministry, in a very significant move, has notified to exclude movement of farmers, farm laborers, and harvesting and sowing-related machines from the purview of lockdown.
- Making the food grains, fruits and vegetables, and other essential items available to consumers, both in rural and urban areas, was the most critical challenge for government machinery during the lockdown period.
- Smooth functioning of the supply chain, with adequate safety measures for the people involved, is of paramount importance. Transportation of public distribution system (PDS) items to last mile delivery agents, by both rail and road, has to be ensured by respective government agencies. Distribution of the commodities to vulnerable population, while maintaining prescribed guidelines and protocol, particularly of social distancing, must be effectively monitored.

¹¹ Source: <https://www.downtoearth.org.in/news/economy/covid-19-uttarakhand-wants-to-retain-returning-citizens-70737>

¹² A paper by Dr Arabinda Kumar Padhee, Director, Country Relations and Business Affairs - New Delhi, ICRISAT; and Dr Peter Carberry, Director General, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

- As weather has been very erratic over past few months in many parts, harvested produce must also be protected from such risks.

Mitigation Measures

- People living on agriculture and allied activities, mostly those losing their income from informal employment at this lockdown period, have to be provided with alternative avenues (cash transfers) till the economy bounces back (when this health crisis is successfully overcome).
- To sustain the demand for agricultural commodities, investments in key logistics must be enhanced. Moreover, e-commerce and delivery companies and start-ups need to be encouraged with suitable policies and incentives.
- The small and medium enterprises, running with raw materials from the agriculture and allied sector or otherwise, also need special attention so that the rural economy does not collapse.
- To obviate the immediate concerns of scarcity of farm labor, policies must facilitate easy availability of machinery through state entities, Farmer Producer Organizations (FPOs) or custom hiring centers (CHCs) with suitable incentives.
- It is also suggested to explore leveraging NREGS funds to pay part of the farm labor (with farmers paying the balance wage amount) to lessen the monetary burden on the farmer, while ensuring wage employment to the landless laborers and workers.
- To answer queries relating to the announced measures of government and addressing grievances of farmers, besides providing advisories on farm operations; availability of agri-inputs, dedicated toll-free helplines/call centers (in local/vernacular languages) must be established by the government.
- Agri-inputs – seeds, fertilizers, agro-chemicals, etc. – have to be pre-positioned for easy availability. Private sector must play a significant role with necessary policy support.
- Relaxation of the norms by Agricultural Produce Market Committees (APMCs) allowing farmers to sell their produce beyond the designated mandis will certainly ease the burdens of farmers. State governments must gear up their machineries for smooth procurement operations of farmers' marketable surpluses at minimum support price (MSP) or through other price support schemes.
- It will be thus very appropriate to focus attention on the agriculture sector as a growth engine and also to bring resilience in food (and nutrition) security. At this critical stage, where climate change is already adversely impacting the agriculture sector, productive investments, including research and innovation, would be very purposeful.
- Structural reforms such as land leasing, contract farming, private agricultural markets, etc., have long been advocated to bring enhanced investments into the agriculture sector in order to push its growth. However, there has not been uniform implementation of these legislations by the State governments and so the full potential of the sector is unrealized. These reforms need significant political will. Concerns of a slowdown in the zeal of states, post-COVID-19 scenario, could be tackled with suitable incentive mechanisms by the Federal Government to the states.
- India's agricultural exports are valued at USD 38 billion in 2018-19 and can rise up further with conducive policies. Development of export-supportive infrastructure and logistics would need investments and support of the private sector, that will be in the long-term interests of farmers in boosting their income.
- Good news is that the Government of India has now increased its focus on nutrition (besides food)-security and raising farmers' income (rather than enhancing farm productivity). Changing the consumer behavior with suitable programs and incentives is already in the agenda. For all these to happen, the existing landscape of policy incentives that favor the two big staples of wheat and rice has to change. Designing agricultural policies, post-COVID-19 scenario, must include these imperatives for a food systems transformation in India.
- The impact of COVID-19 on agricultural markets reveals that the market arrivals declined significantly from March 2020 to August 2020. As this period is dominated by the arrival of Rabi crops (especially wheat), wheat arrivals declined drastically compared with the previous year's

monthly arrivals. Highest decline in wheat was observed in April 2020. Arrivals of most of the pulses declined during the period, prominent decline was noted in arrivals of Bengal gram. Vegetable arrivals were most affected during the lockdown; the arrivals of major vegetables declined up to 60%. Arrivals of onion and potato also declined drastically. Market arrivals of food grains and oilseeds have increased in May and June, while they continue to be low for vegetables in the lean season. http://www.ncap.res.in/agri_lock.pdf

(3) COVID-19 and Horticulture Sector¹³

In this section, literature review was attempted to capture the implication of COVID-19 in the horticulture sector. The problems in vegetable, fruits, and flowers value chains were identified and solutions were suggested through a study of ICAR.

Table 3.2.7 Problems and Recommendations for Horticulture Sector under COVID-19

Horticulture Crops	Problems	Recommendations
Fruits	Reduction in proportion of processing and value addition. New planting was drastically reduced due to non-availability of planting material. · Delay in harvesting and market arrivals of banana and grapes was hampered. · Grape exports to the European Union region were affected due to delay in obtaining pesticide test reports. · Inadequate labor availability affected application of plant protection measures as witnessed by farmers in the case of Apple scab. · Negative effect on the nursery business due to labor shortage issues.	Deficient payment scheme for horticultural crops in line of Haryana government should be promoted. To avoid price distortion in value chains, price ceiling must be followed. · Encouraging and incentivizing agri-entrepreneurs for setting up processing activities and cold chains. Encouraging development of varieties of fruits and vegetables that are suitable for processing. · Strengthening farm advisory services at the district/ block level. Collective pre-cooling, cooling and storage facilities should be promoted to reduce postharvest losses.
Vegetable	Due to labor unavailability, harvesting of current season crops like cauliflower, cabbage, tomato, and onion was adversely affected. · Disruption in supply chain and decline in exports of vegetables. Demand reduction (60-80%) in Delhi's Azadpur Mandi. · Reduction in wholesale prices of vegetables (- 25%). Tomato arrivals and prices were low in major APMC markets of Maharashtra and Himachal Pradesh. Increase in retail prices 30-40% in UP, Delhi and Mumbai for tomato, spinach, beans and capsicum. · Unorganized potato processing was badly affected, which is about 50-60% of potato processing in India. Shortage in market arrivals (27.74-60.30% in potato). Potato prices were however higher during March 2020 over March 2019 due to supply constraints. · Onion arrival and prices severely reduced during lockdown Phase 1 but improved afterwards.	Setting up kisan bazaars for direct marketing of vegetables. · Training and technology transfer to farmers for learning good and safe production practices. · More efforts should be made to boost agri-processing activities and upscaling value chains of vegetables. · Enhanced technical and financial support to FPOs for maintaining procurement and marketing operations. More use of ICT to link consumers and producers.
Flower	Flower sale is severely affected due to closure of religious places, social functions, events, etc. · Prices losses and export disruptions have financial losses in loose flowers INR 202.89 to INR 335.62 crores and INR 10.75 to INR 17.07 crores for cut flowers.	Promotion of mechanized practices in flower plantation to reduce drudgery. · For enhancing the shelf life of flowers, solar power air cooler cart can be promoted. · Processing plants should be established in adequate numbers for upscaling extraction of essential oil, dyes and pigments, making poultry feed, etc., in the form of integrated flori-marts.

Source: ICAR-National Institute of Agricultural Economics and Policy Research, COVID-19 LOCKDOWN AND INDIAN AGRICULTURE: OPTIONS TO REDUCE THE IMPACT (An Analytical Paper 2020) http://www.ncap.res.in/agri_lock.pdf

¹³ ICAR-National Institute of Agricultural Economics and Policy Research, COVID-19 LOCKDOWN AND INDIAN AGRICULTURE: OPTIONS TO REDUCE THE IMPACT (An Analytical Paper 2020) http://www.ncap.res.in/agri_lock.pdf

3.2.10 Subsectors of Horticulture

(1) Aromatic and Medicinal plants

As per the presentation on Uttarakhand on economic growth¹⁴ – “Between 2015-16 and 2019-20, the Gross State Domestic Product (GSDP) expanded at a CAGR (CAGR) of 9.39% to reach INR 2.54 trillion (USD 35.99 billion). The main growth drivers in the economy have been identified as hill agriculture with emphasis on horticulture including aromatic and medicinal plants (promoted by AYUSH) and tourism to improve productivity and create sustainable livelihood, especially for people in the higher reaches of the state.

The MSME sector is cross-cutting across all other sectors, due to its employment generation potential, and is hence, extremely important in the growth strategy of the state.

Simultaneous efforts to develop two other sectors—renewable energy in the form of small hydro-power and expansion of information technology (IT) to all parts of the state economy—will make the growth plan sustainable and strengthen its fundamentals.

According to the Department for Promotion of Industry and Internal Trade (DPIIT), cumulative Foreign Direct Investment (FDI) inflow stood at about USD 710 million from April 2000 and June 2020. Between October 2019 and December 2020, FDI inflows in Uttarakhand stood at USD 17.67 million. As of May 2020, 11 Industrial Entrepreneurs Memorandums (IEMs) worth INR 288 crores (USD 39.10 million) have been filed in Uttarakhand.

The list of government schemes implemented for horticulture subsectors is given in Attachment 3.2.2.

3.3 Administrative Set-up and Other Related Organization for Horticulture Development

3.3.1 Mandates of Departments/Organizations/ Institutes Concerning Horticulture Development

Horticulture development requires concerted efforts of various departments and organizations/institutions. The Agriculture Department is not the only department concerned but also KVK, MSME Department, Department of Industry, Irrigation Department, Cooperative Department, UKAPMB. The details of Irrigation Department, Industry Department and UKAPMB are dealt with in other sections and thus, the mandates of other concerned departments are reviewed hereunder and their key interventions are given in Attachment 3.3.1.

Table 3.3.1 Mandates of Department/ Organizations/ Institutes concerning Horticulture Development

Department/ Organization/ Institute	Mandate
Agriculture Department	Mandate of Agriculture Department: To increase agricultural production and productivity through coordination in agriculture and other allied departments through improved seeds and latest technologies, soil health and management, integrated pest and pest management, development of irrigation facilities, modern agricultural machinery and farmers through organic farming increase the income of farmers https://agriculture.uk.gov.in/files/Draft_for_public_comment_citizen_charter.pdf
Krishi Vigyan Kendras (KVKs)	Krishi Vigyan Kendras are integral part of the National Agricultural Research System (NARS), aims at assessment of location specific technology modules in agriculture and allied enterprises, through technology assessment, refinement and demonstrations. The KVK scheme is 100% financed by Government of India and the KVKs are sanctioned to Agricultural Universities, ICAR institutes, related government departments and non-government organizations (NGOs) working in agriculture. Supported by the Central Government through the Ministry of Agriculture and Farmers Welfare, KVKs are functioning as Knowledge and Resource Center of agricultural technology supporting initiatives of public, private, and voluntary sector for improving the agricultural economy of the district and are linking the NARS with extension system and farmers. Mandate of KVKs: The mandate of KVK is Technology Assessment and Demonstration for its Application and Capacity Development. The Mandate of KVK includes: Organize short- and long-term trainings in agriculture and allied enterprises for farmers, rural youth and unemployed women with emphasis on “Learning by doing” for update their knowledge and skills in modern agricultural technologies. Trainings of extension personnel to orient them in the frontier areas of technology development

¹⁴ <https://www.ibef.org/states/uttarakhand-presentation>

Department/ Organization/ Institute	Mandate
	On-farm testing in farmers' field for identifying technologies suitable for location specific Organize frontline demonstrations (FLDs) to establish production potential of technologies on the farmer's fields. Work as Knowledge and Resource Center for improving overall agricultural economy in the operational area of the district. Production of quality seeds and planting materials for distribution among the farmers.
Agricultural Technology Management Agency (ATMA)	The Scheme 'Support to State Extension Programs for Extension Reforms (ATMA)' a component of Centrally Sponsored Scheme "Sub-Mission on Agriculture Extension (SMAE) under Krishonnati Yojana is under implementation in 684 districts of 29 states and 3 UTs of the country. The scheme promotes decentralized farmer-driven and farmer-accountable extension system through an institutional arrangement for technology dissemination in the form of an Agricultural Technology Management Agency (ATMA) at the district level. Under the scheme grants-in-aid is released to states governments with an objective to support their efforts of revitalization of the extension system and making available the latest agricultural technologies in different thematic areas to increase agricultural production through extension activities viz. Farmers Training, Demonstrations, Exposure Visits, Kisan Mela, Mobilization of Farmers Groups and Setting up of Farm Schools. Through these activities, latest agriculture technologies are disseminated to farmers of the country.
Uttarakhand Horticulture Marketing Board (UKHMB)	The government order was issued in 2012 to establish UKHMB under UKDHFP and its operation commenced in 2015. UKHMB receives its budgetary support from UKDHFP on an annual basis. UKHMB is currently in the process of registering as an autonomous society. Its mandate is to provide technical and knowledge support for production, planting material production, storage and marketing, branding and brand promotion, R&D for improved planting materials, etc. UKHMB also issues and administers Minimum Support Price for apple, pear, hill lemon, and malta orange, however, it is still at the early stage of its operation. UKHMB is headed by the Chief Executive Officer which office is assumed by the Director of Horticulture as dual charge. Out of 11 staff members, 5 positions are administrative and clerical. Technical positions are 1 Marketing Manager (vacant), 2 Assistant Marketing Officers (2 positions filled) and 2 marketing assistant (2 vacant). It is noted that UKHMB has been renamed as Uttarakhand Horticulture Board (UHB) since December 2020.
Department of Industries	The Department of Industries is not directly concerned of developing backward linkages of the horticulture sector. This is to be done by the UKDHFP. The department is mandated to promote all kinds of industries and private investment to the state. Thus, if the food processing industries approach the department through its single window system, the department will provide necessary support for the industries to establish its units in the state.
MSME Department (Directorate of industries)	The MSME Department (Directorate of industries) is the state level office responsible for implementing the policies and programs for industrial development in the State. The main aim of Directorate of Industries is to provide a comprehensive framework to enable a facilitating, investor friendly environment for ensuring rapid and sustainable industrial development in Uttarakhand and through this to generate additional employment opportunities and to bring about a significant increase in the State Domestic Product, eventually widening the resource base of the State. The roles of the Directorate are to: Encourage investment in Manufacturing and Services Sector; Encourage Entrepreneurship; Encourage competitiveness in MSME sector; Directorate of Industries works through DIC's at the district level; 'Single Window System' and 'Udyog Mitra' two important facilitative mechanisms are being operated by the Directorate of Industries. MSME Department works in the districts through District Industries Centers (DICs). DICs are Nerve Center of Entrepreneurship; Information Centers; Counselling Centers; Single Window Contact & Facilitation Centers; Entrepreneur Memorandum (EM/Udyog Adhar) under MSME Act is to be filed in respective DICs. (Source: https://doiuk.org/mysite/aboutus) MSME Department follows the MSME policy that started in 2015. As per the policy, districts like Pithoragarh and Uttarkashi, Chamoli, Rudrapur and Bageshwar come under Category 'A' for financial promotion and subsidy assistance. Hilly region of Almora, Pauri Garhwal, Tehri Garhwal, Nainital and Dehradun comes under Category B. Plain areas of Nainital District and Dehradun come under 'C' category. https://doiuk.org/upload/1282316483.pdf
Cooperative Department	Cooperative Department has also been playing a key role in the development of horticulture in the state. The state has Primary Agriculture Cooperative Societies, Bhesaj Sangha (Cooperatives for MAPs) that works for the horticulture sector. In Uttarakhand, the terminology is modified and PACS are called MPACS now, which means multi-purpose Primary Agriculture Cooperative Societies – MPACS are multi-purpose cooperatives having credit, savings (Mini Bank), input supply (fertilizers, seeds, pesticides/ insecticides), marketing of agriculture /horticulture produce, consumer business and custom service business of agriculture implements.
National Cooperative Development Corporation (NCDC)	The National Cooperative Development Corporation (NCDC) was established by an Act of Parliament in 1963 as a statutory corporation under the Ministry of Agriculture & Farmers Welfare. It has financial schemes for processing, marketing, storage and export and import of agriculture produces and other items. Loans and grants are advanced to state governments for financing primary and secondary level cooperative societies and direct to the national level and other societies having objects extending beyond one state. NCDC also has in-house technical and managerial capabilities in the areas of cooperation, organization and methods, financial management, management information systems, sugar, oilseeds, textiles, fruits and vegetables, dairy, poultry and livestock, fishery, handlooms, civil engineering, refrigeration and preservation

Department/ Organization/ Institute	Mandate
	to help cooperatives to identify/formulate projects and successfully implement them. (Source: https://www.ncdc.in/index.jsp?page=genesis-functions=en)
International Center for Integrated Mountain Development (ICIMOD)	ICIMOD is an intergovernmental knowledge and learning center that develops and shares research, information, and innovations to empower people in the eight regional member countries of the HKH – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. ICIMOD serves the region through information and knowledge generation and sharing to find innovative solutions to critical mountain problems. In Uttarakhand, ICIMOD works with GB Pant University, Wildlife Institute of India, Center for Himalayan Environment Association (CHEA) for research, knowledge dissemination, and capacity development. ICIMOD has also conducted value chain studies of malta oranges, bay leaf, nettle plant fibers, etc.
Uttarakhand Organic Commodity Board	Uttarakhand Organic Commodity Board was established in 2003 as an autonomous society. It works to make the state as “the organic capital of India” and provides training for farmers and extension workers from various departments, and NGOs. It also administers organic certification system and provides support for marketing.
State Medicinal Plant Board Uttarakhand	The State Medicinal Plant Board was established in 2001 to act as a nodal agency for coordination and implementation of National Medicinal Plants Board Programs in the state. It aims at strengthening infrastructure, extension, market, and R&D facilities for development of medicinal plant sector and promotes MAP cultivation and product development, establishing conservation areas and knowledge management. There are 42,000 registered farmers who are cultivating 38 prioritized medicinal and aromatic plants.

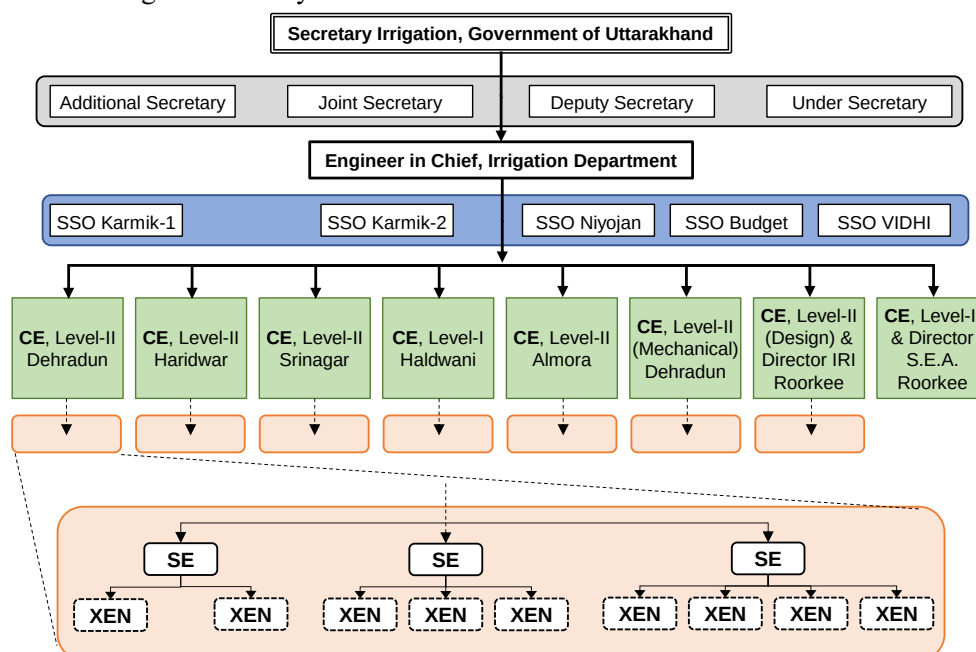
Source: Compiled from information provided by the concerned departments on their web sites.

3.3.2 Irrigation-related Organization

(1) Irrigation Department

1) Organogram

The Irrigation Department of Uttarakhand is headed by the Secretary Irrigation and consists of engineers, such as Engineer in Chief, Chief Engineer (CE), Superintending Engineer (SE), Executive Engineer (XEN), Assistant Engineer (AE), and Junior Engineer. Organogram of the department and list of engineers at the higher hierarchy in each zone are shown below.



Note: Nos. of SE and XEN vary among agencies under CE

Source: Prepared by the JICA Survey Team based on Uttarakhandirrigation.com

Figure 3.3.1 Organizational Chart of Irrigation Department Uttarakhand

Table 3.3.2 Number of Engineers in Each Zone

Zone	Chief Engineer	Superintending Engineer	Executive Engineer	Total
Almora	1	2	12	15
Dehradun	2	7	24	33
Haldwani	1	3	9	13
Haridwar	1	3	9	13
Roorkee	2	5	13	20
Srinagar	1	2	12	15
Total	8	22	79	109

Note: Assistant Engineers under Executive Engineer and Junior Engineers under Assistant Engineers are not listed in this table.

Source: Uttarakhandirrigation.com

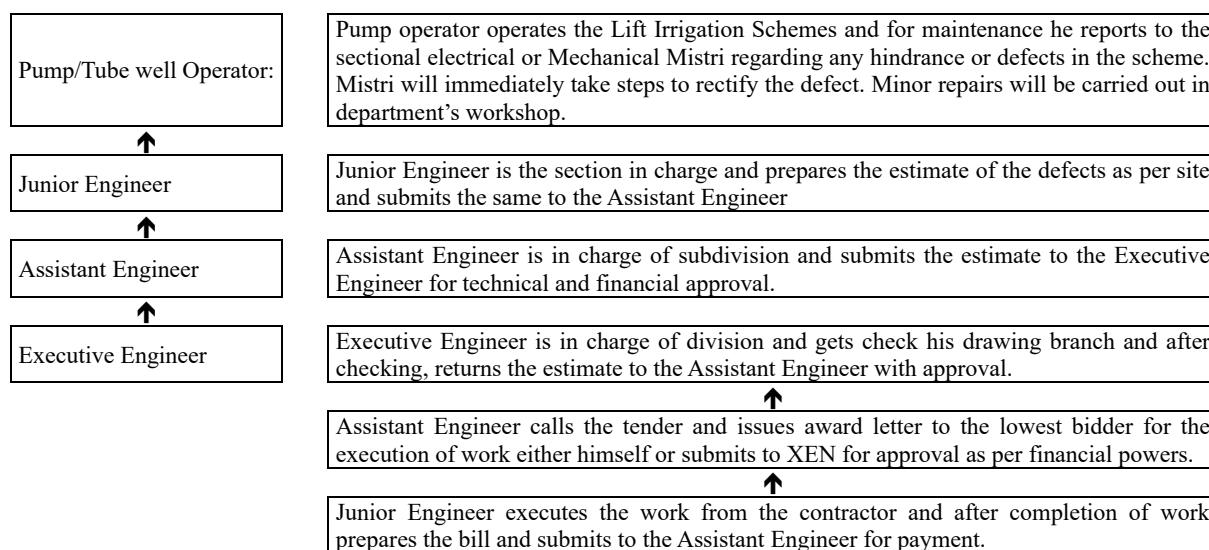
2) Jurisdiction of Services of Irrigation Department¹⁵

Main activities of the Irrigation Department are mentioned below:

- Investigation, planning, and design of water resources and hydropower development projects
- Hydraulic modelling, geotechnical investigations, material testing, etc.
- Fabrication of hydromechanical equipment
- Imparting training to engineers

The Irrigation Department is involved in projects of major and medium irrigation (CCA threshold is over 2,000 ha), flood management, and hydropower development. In addition, the department is responsible for irrigation schemes, strengthening and rehabilitation of water channels, construction of buildings, housing colonies, and minor works on road construction.

In terms of flow irrigation schemes, irrigation related structures are constructed by the department and are handed over to the Water User Associations (WUAs) after construction for operation and maintenance (O&M). On the other hand, lift irrigation scheme with pump or tube well is basically maintained by the department based on the protocol shown below:



Source: Uttarakhandirrigation.com

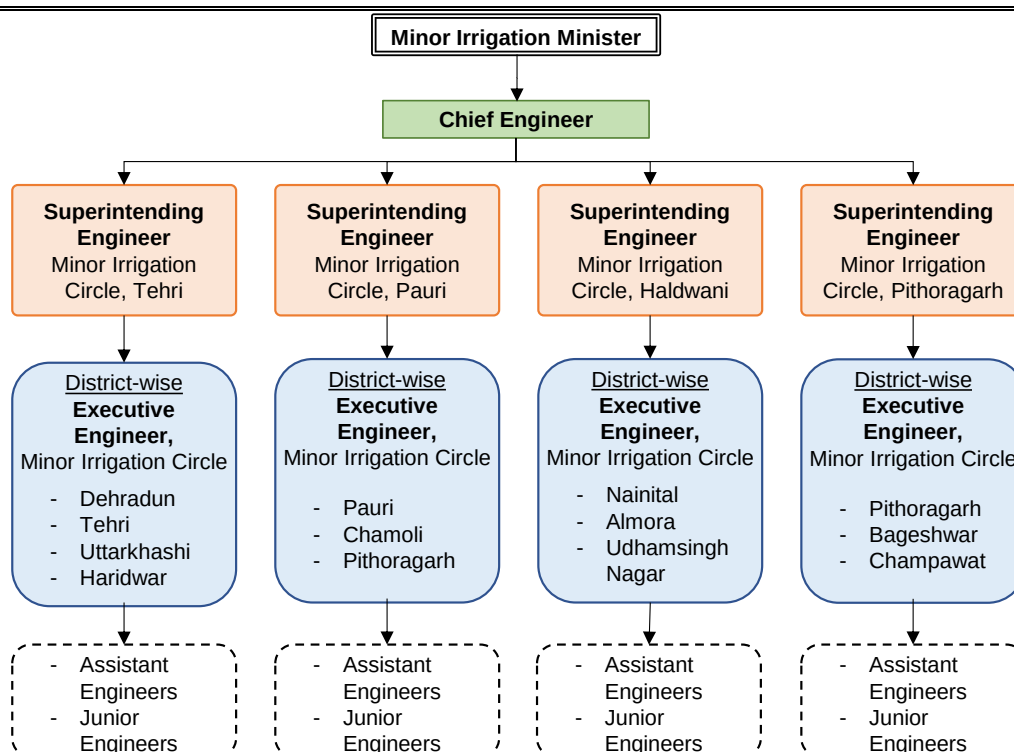
Figure 3.3.2 O&M Protocol of Lift Irrigation Scheme

(2) Minor Irrigation Department

1) Organogram

The Minor Irrigation Department of Uttarakhand is headed by the Minor Irrigation Minister and consists of engineers similar to the Irrigation Department. Organogram of the department is described as follows.

¹⁵ Uttarakhandirrigation.com



Note: Assistant Engineers: 38 nos. and Junior Engineer: 145 nos. in total in Uttarakhand
Source: <https://minorirrigation.uk.gov.in/pages/display/3-department-structure>

Figure 3.3.3 Organizational Chart of Minor Irrigation Department Uttarakhand

2) Objectives

The minor irrigation scheme (CCA threshold is 2,000 ha and below) aims to provide adequate irrigation to the field cultivated by small and marginal farmers. Water for the minor irrigation is supplied from water harvesting facilities in the state. The main benefit of the minor irrigation is stated below:

- Minor irrigation schemes can be executed in a short time.
- Farmers can use the facility immediately.
- Because of low investment more schemes can be executed.
- Local people and farmers get employment.
- Farmers can manage these schemes themselves through WUA.
- These schemes help improving intensity/density of irrigation.

The Minor Irrigation Department plans, designs, and constructs the related facilities of minor irrigation to assure the above benefits.

3.4 Horticulture Production

3.4.1 District-wise Agro-ecological Zones

Geographically, Uttarakhand has been divided into two divisions, namely: Gharwal and Kumaon. Garhwal (Northwest portion) consists of seven districts (Uttarkashi, Chamoli, Tehri, Pauri, Dehradun, Haridwar, and Rudraprayag), while Kumaon (Southeast portion) comprises six districts (Almora, Nainital, Pithoragarh, Champawat, Bageshwar, and Udham Singh Nagar), with a total of 13 districts. Uttarakhand has diverse climate and vegetation, which vary greatly with elevation from the sub-tropical humid climate of the Terai Region to the tundra-like climate of the Great Himalaya ridges.

Agro-ecological Zones (AEZs) of Uttarakhand, India was created based on land use/land cover, slope, soil texture, temperature, and length of growing period (LGP, FAO, Report on the agro-ecological zones project). The land use/land cover map having six classes, i.e., forest, agricultural land, built-up land, barren land, water body, and snow bound region¹⁶. Terai and Bhabar Region of Uttarakhand comprising

¹⁶ Indian Journal of Agricultural Sciences 89 (11): 1792–6, November 2019/Article Agro-ecological Zonation of Uttarakhand using Geo-spatial Techniques HIMANI BISHT1, SHWETA GAUTUM2, HARSHVARDHAN PURANIK and A S NAIN

Nainital, Haridwar and Udham Singh Nagar, which contributes maximum share of its cereal production. The table below provides the salient features of the agro-ecological zones of Uttarakhand.

Table 3.4.1 Temporal Distribution of AEZ and Major Crops Growing Season

Agro-Ecological Zones (AEZ)	Main Cropping Season			Major Crops Grown	
	Temporal Season	Period of Crop Establishment	Period of Harvesting	Cereals	Cash Crops
Valley Region (Altitude <1000 m) ACZ - A	Rabi	Oct. – Nov.	Mar - May	Wheat, barley, gram, masur (lentil) and mustard	Lemon, elephant citrus, ginger, garlic and green leaves
	Kharif	Apr. - May	Sep - Oct	Rice and maize	Onion, tomato, cucumber, pumpkin, beans and all green leaves
Mid-altitudes (Altitude 1000-1600 m) ACZ - B	Rabi	Nov. – Dec.	Apr - May	Wheat, barley, gram, masur (lentil) and mustard	Lemon, elephant citrus, mandarin, orange, ginger, garlic and green leaves
	Kharif	May – Jun.	Oct - Nov	Rice, manduwa, koni, jhangora, kulthi, bhatt, urd, tur, naurangi, rajma, sawa, and cheena	Potato, cucumber, pumpkin, beans, pears, peach, nut fruits, and all green leaves
Highlands (Altitude >1600 m) ACZ - C&D	Rabi	Nov. – Dec.	Apr - May	Wheat, barley, rai and mustard	Lemon, elephant citrus, mandarin, orange, ginger, garlic, arbi and green leaves
	Kharif	May – Jun.	Oct - Nov	Rice, jhangora, kodo, phaphra, chaulai, ogal, kauni, sawa, urd, bhatt, naurangi, tur, uva	Potato, cucumber, pumpkin, beans, eggplants, chili, pears, peach, almond and nut fruits

Source: IFAD -ILSP, Unpublished report “Study /Assessment of Organic Crops Production Value Chains and Marketing Situation in Uttarakhand” – A study done by Dr. Manik Lal Bose for IFAD -ILSP, July 2015
Crops: Cheena (*Panicum miliaceum*); Kauni (*Fagopyum esculentum*); Uva (*Hoycleum himalayense*)

Agroecological zoning in these regions of the state has widespread applications in land use planning; design of appropriate agricultural adaptations strategies, and reducing vulnerability to climate change. GIS and remote sensing are very powerful tools and techniques for capturing, storing, integrating and analyzing all input data used for agroecological zonation. However, there is a future need of more availability of climatic database for better planning and management of natural resources especially for higher altitude regions of the state, which are more vulnerable to climatic variability and change.

3.4.2 Current Position of Uttarakhand on Horticulture Produce

Under the agro-ecological situation in Uttarakhand as abovementioned, Uttarakhand has shown its presence in specific agricultural production in the entire country India compared with other states.

State-wise and crop-wise area and production of horticulture produces with ranking of each state including Uttarakhand are shown below. The horticulture produces, which are positioning at higher ranks in India are mainly fruits like apple, peach, plum, pear, and walnut. It can be proposed that Uttarakhand has opportunity and possibility to enhance agriculture and marketing of these crops in the supply chain. Details of current positioning are shown in Attachment 3.4.1.

Table 3.4.2 State-wise Summary of Area, Production and Productivity of Horticulture Crops in 2017-18

(Area: ha, Production: MT, Productivity: MT/ha)

States	Fruits			Vegetables		
	Area	Production (Rank)	Productivity (Rank)	Area	Production (Rank)	Productivity (Rank)
Andhra Pradesh	650.5	15215.9 (1)	23.39 (1)	243	6908.3 (11)	28.43 (1)
Arunachal Pradesh	48.1	125.7 (27)	2.61 (27)	2.6	16.6 (28)	6.38 (26)
Assam	147.3	2123.6 (13)	14.42 (11)	300.2	3292.9 (15)	10.97 (21)
Bihar	296.6	5117.1 (8)	17.25 (7)	824.6	15863.2 (4)	19.24 (12)
Chhatisgarh	229.7	2666.2 (10)	11.61 (14)	499.4	7003.2 (10)	14.02 (17)
Gujarat	422.4	8996 (4)	21.3 (3)	613.1	12254.3 (6)	19.99 (7)
Haryana	64	793.4 (18)	12.4 (13)	447	7151.7 (9)	16 (16)
Himachal Pradesh	230.9	565.3 (21)	2.45 (28)	89.3	1811.8 (18)	20.29 (5)
Jammu & Kashmir	327.4	2355.2 (12)	7.19 (21)	56.3	1226 (20)	21.78 (4)

	Fruits			Vegetables		
Jharkhand	104.3	1081.7 (17)	10.37 (16)	289.2	3475.2 (14)	12.02 (20)
Karnataka	431.6	7133.9 (6)	16.53 (8)	483.2	8394.1 (8)	17.37 (13)
Kerala	309.5	2045.7 (14)	6.61 (23)	110.8	2516.5 (17)	22.71 (3)
Madhya Pradesh	354.1	7416.9 (5)	20.95 (5)	889.7	17545.5 (3)	19.72 (10)
Maharashtra	753.2	11728.7 (2)	15.57 (9)	726.2	12306.7 (5)	16.95 (15)
Manipur	47.6	455.6 (23)	9.57 (20)	45.3	342.1 (25)	7.55 (25)
Meghalaya	32.8	316.5 (26)	9.65 (18)	49.1	519.7 (24)	10.58 (22)
Mizoram	63.2	340.5 (25)	5.39 (24)	36.2	171 (27)	4.72 (28)
Nagaland	39.5	380.5 (24)	9.63 (19)	46.2	561.6 (23)	12.16 (19)
Odisha	340.5	2402.3 (11)	7.06 (22)	639.7	8766.8 (7)	13.7 (18)
Punjab	90.6	1908.8 (16)	21.07 (4)	244.4	4919.7 (13)	20.13 (6)
Rajasthan	57.2	762 (19)	13.32 (12)	163.2	1674 (19)	10.26 (23)
Sikkim	19.4	54.9 (28)	2.83 (26)	38.4	229.1 (26)	5.97 (27)
Tamil Nadu	291.4	5680.5 (7)	19.49 (6)	241	6396 (12)	26.54 (2)
Telangana	167.1	1939.4 (15)	11.61 (14)	139.3	2753.8 (16)	19.77 (9)
Tripura	53.8	547.5 (22)	10.18 (17)	45.9	795.7 (22)	17.34 (14)
Uttar Pradesh	476.6	10539.8 (3)	22.11 (2)	1457.2	28316.4 (1)	19.43 (11)
Uttarakhand	178.7	669.9 (20)	3.75 (25)	100.1	989.4 (21)	9.88 (24)
West Bengal	261	3850.6 (9)	14.75 (10)	1400.3	27695.3 (2)	19.78 (8)
Others	17.3	143.4	-	38.2	497.7	-
All India Total	6,506.20	97,357.50	-	10,259.10	184,394.30	-

	Spices			Flowers		
States	Area	Production (Rank)	Productivity (Rank)	Area	Production (Rank)	Productivity (Rank)
Andhra Pradesh	246.4	1099.8 (3)	4.46 (8)	25.7	429 (2)	16.69 (3)
Arunachal Pradesh	11.4	68.7 (18)	6.03 (3)	0	0 (24)	0 (23)
Assam	101.6	302 (9)	2.97 (12)	5.1	33.9 (10)	6.65 (10)
Bihar	8.3	10.5 (25)	1.27 (22)	0.5	5.5 (19)	11 (6)
Chhatisgarh	11.4	9 (26)	0.79 (25)	13.2	47.5 (8)	3.6 (16)
Gujarat	567	980.4 (4)	1.73 (20)	20.4	152.2 (5)	7.46 (8)
Haryana	17.1	77.8 (17)	4.55 (7)	5.5	56.7 (7)	10.31 (7)
Himachal Pradesh	8.6	24.9 (23)	2.9 (13)	0.6	12.3 (16)	20.5 (2)
Jammu & Kashmir	5.1	1 (27)	0.2 (27)	49.6	29.7 (11)	0.6 (22)
Jharkhand	0	0 (28)	0 (28)	0.8	4.5 (20)	5.63 (11)
Karnataka	245.5	499.7 (6)	2.04 (19)	31.4	231 (4)	7.36 (9)
Kerala	167.7	204.7 (11)	1.22 (24)	38.2	0.1 (23)	0 (23)
Madhya Pradesh	540.8	1191.8 (1)	2.2 (16)	19.8	245.5 (3)	12.4 (5)
Maharashtra	34.4	370.7 (7)	10.78 (1)	5.5	29.1 (12)	5.29 (12)
Manipur	10.5	23.1 (24)	2.2 (16)	0.2	0.5 (22)	2.5 (18)
Meghalaya	18.7	92 (16)	4.92 (5)	0	0 (24)	0 (23)
Mizoram	27.7	100.9 (14)	3.64 (9)	0.2	0 (24)	0 (23)
Nagaland	9.9	64.8 (20)	6.55 (2)	0.1	0 (24)	0 (23)
Odisha	146.6	202 (12)	1.38 (21)	6.6	24.9 (13)	3.77 (15)
Punjab	31.3	98.9 (15)	3.16 (10)	2.1	10.7 (17)	5.1 (13)
Rajasthan	918.9	1144.4 (2)	1.25 (23)	3.5	7.1 (18)	2.03 (20)
Sikkim	32.3	66.6 (19)	2.06 (18)	0.2	16.5 (15)	82.5 (1)
Tamil Nadu	57	171 (13)	3 (11)	34.2	482.5 (1)	14.11 (4)
Telangana	130.3	663 (5)	5.09 (4)	3.7	17.9 (14)	4.84 (14)
Tripura	6.6	32.4 (22)	4.91 (6)	0	0 (24)	0 (23)
Uttar Pradesh	386.9	248.7 (10)	0.64 (26)	21.2	46.4 (9)	2.19 (19)
Uttarakhand	14.6	36.6 (21)	2.51 (15)	1.5	2.5 (21)	1.67 (21)
West Bengal	119.6	334.4 (8)	2.8 (14)	26.8	74.9 (6)	2.79 (17)
Others	2	4.1	-	7.3	1.2	-
All India Total	3,877.90	8,123.90	-	324.00	1,962.00	-

Source: Horticulture Statistics at a Glance 2018

Table 3.4.3 Positioning of Uttarakhand on Main Horticulture Produces

(Area: ha, Production: MT, Productivity: MT/ha)

Category	Crop	States	Area	Production (Rank)	Productivity (Rank)
Fruits	Apple	Jammu & Kashmir	158.15	1808.33 (1)	11.43 (1)
		Himachal Pradesh	112.63	446.57 (2)	3.96 (3)
		Uttarakhand	25.32	58.66 (3)	2.32 (4)
	Walnut	Jammu & Kashmir	85.62	275.45 (1)	3.22 (1)
		Uttarakhand	17.56	21.17 (2)	1.21 (2)
		Himachal Pradesh	4.44	2.46 (3)	0.55 (3)
	Pear*	Jammu & Kashmir	no data	94.42 (1)	-
		Uttarakhand	no data	78.78 (2)	-

Category	Crop	States	Area	Production (Rank)	Productivity (Rank)
		Punjab	no data	66.05 (3)	-
	Plum*	Uttarakhand	no data	36.16 (1)	-
		Himachal Pradesh	no data	20.52 (2)	-
		Jammu & Kashmir	no data	8.15 (3)	-
Vegetables	Tomato	Andhra Pradesh	61.67	2744.32 (1)	44.50 (1)
		Uttarakhand	9.2	103.85 (18)	11.29 (22)
	Potato	Uttar Pradesh	614.78	15,555.53 (1)	25.3 (6)
		Uttarakhand	26.31	362.16 (12)	13.77 (18)
	Peas	Uttar Pradesh	221	2511.38 (1)	11.36 (7)
		Uttarakhand	13.09	93.4 (9)	7.14 (16)
Spices	Garlic	Rajasthan	112.89	582.08 (1)	5.16 (11)
		Uttarakhand	1.49	2.17 (17)	1.46 (18)
	Ginger	Assam	18.79	167.39 (1)	8.90 (8)
		Uttarakhand	1.81	19.07 (14)	10.53 (6)
	Turmeric	Telangana	50.15	294.56 (1)	5.87 (8)
		Uttarakhand	0.98	1.74 (21)	1.78 (21)

Source: *National Horticulture Board 2015-2016¹⁷. Other crops data from Horticulture Statistics at a Glance 2018.

Note: 1) Rankings of fruits have been mentioned only upper rank states in Horticulture Statistics at a Glance 2018.

2) Regarding vegetables and spices, two states which are No. 1 rank of production and Uttarakhand are shown in the table.

3) Horticulture and Floriculture Sector Profile issued by Sector Horticulture Mission, Uttarakhand 2018 has shown that productivity of spices is positioning at 1st rank in India, production of pear is 1st in India, while production of walnut is 2nd in India. The state- and crop-wise rankings might be changed due to variation of statistic data and year, although the reference data source is not identified in the profile. <https://investuttarakhand.com/themes/backend/uploads/IP-UK-Horticulture%20Sector%20Profile-2018-09-10.pdf>, P.12

3.4.3 Production of Fruits

(1) General

In Uttarakhand, the major tree fruits grown include apple, pear, peach, plum, apricot, walnut, lemon, citrus variety, mango, litchi, aonla, and guava. The total area under fruit cultivation in the year 2019-20 has been 181,485.55 ha and the total production of all the fruits combined together was 677,369.75 MT.

In the state of Uttarakhand, with altitude gradient varying from 250 meters above sea level to 7,187 meters above sea level, combination of geographical features determines the climatic condition favorable for many fruit crops, consequently, nearly all types of fruits ranging from tropical to temperate fruits can be grown easily. Fruit plants can be grown successfully even in dry land provided that agroclimatic and soil conditions are right. The climatic conditions of the region are suitable for plantations like apple, walnut, apricot, litchi, etc. The fruit plantations can serve dual purpose of maintaining forest cover and at the same time provide employment and economic benefits to farmers.

Various topographic and agro-climatic conditions are congenial for different kind of fruits cultivation at different altitudes, e.g., apples, peaches, plums, apricots, walnuts, pecans, and cherry are grown successfully between altitudes of 2,000 – 3,000 meters, while almonds, kiwis, etc., at 1,000 – 2,000 meters. In areas below 1,000 meters and in fields of Terai and Bhabar, mango, litchis, jackfruits, aonla (Indian gooseberry), and papaya can be easily grown. The areas of expansion should be taken up in strategic locations in accordance with the topography, agro-climatic zone, and soil conditions.¹⁸

(2) District-wise and Crop-wise Analysis in Uttarakhand

District-wise analysis of various fruits in Uttarakhand is shown in Table 3.4.4 below. The analysis is on the area taken up in fruit crops in year 2019-20, production and productivity of each vegetable. In



Source: Photo by DHO Uttarkashi, in June 2021

Figure 3.4.1 High Density Apple Farm at 1,700 m asl. on the Terrace Farm with Supplied Hail Net by UKHFPD, Uttarkashi District

¹⁷ http://agriexchange.apeda.gov.in/India%20Production/India_Productions.aspx?cat=fruit&hscode=1054.

http://agriexchange.apeda.gov.in/india%20production/India_Productions.aspx?cat=fruit&hscode=1057

¹⁸ Uttarakhand State Perspective and Strategic plan 2009-2027, Watershed Management Directorate

addition, average increase rate is calculated to identify the production status in each district with comparison between data of 2019-20 and 2012-13.

Many districts have shown the trend of no change or slight decline / increment production area, production and unit yield from 2012-13 to 2019-20. Average increase percentage is at the range from -5% to +5% for several fruits in more than half of the districts.

However, Uttarkashi shows more increase in production volume compared with the other districts especially for apple, pear, and peach. Nainital also shows increase in production on peach, litchi, and aonla (Indian gooseberry), even though production area is decreased or slightly increased. It might be assumed that productivity of some fruits has been increased for eight years due to improvement or introduction of horticultural material, equipment or technique.



Source: Photo by DHO Pithoragarh, in June 2021

Figure 3.4.2 Sweet Orange Orchard on the Terrace (left) / High Density Apple with Supported Hail Net with Progressive Farmer (right), Berinag Block (1,500 m asl.), Pithoragarh, Uttarakhand

Table 3.4.4 District-wise Area, Production and Productivity of Fruits in Uttarakhand in 2019-20

1) Garhwal Division

District	Dehradun			Pauri			Tehri			Chamoli		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Apple	4,956.34	7,807.50	1.58	1,166.99	2,980.80	2.55	3,857.20	1,984.30	0.51	1,286.44	2,891.76	2.25
Ave.% increase	0%	-6%	-7%	3%	2%	-1%	1%	1%	1%	-16%	-26%	-11%
Pear	1,421.76	2,157.00	1.52	1,280.01	2,819.81	2.20	1,825.00	4,936.63	2.71	274.77	1,366.69	4.97
Ave.% increase	0%	-11%	-12%	2%	-2%	-3%	0%	1%	0%	-16%	-22%	-7%
Peach	514.62	805.00	1.56	977.88	990.29	1.01	227.90	926.65	4.07	397.02	1,169.13	2.94
Ave.% increase	1%	-12%	-13%	2%	1%	-1%	2%	2%	0%	-11%	-21%	-11%
Plum	996.22	1,482.50	1.49	992.20	1,466.55	1.48	1,201.30	2,687.90	2.24	140.18	313.03	2.23
Ave.% increase	0%	-9%	-10%	1%	-2%	-3%	0%	1%	0%	-12%	-24%	-14%
Apricot	1,189.48	1,757.00	1.48	1,167.00	1,290.74	1.11	1,507.70	1,214.36	0.81	96.99	393.56	4.06
Ave.% increase	1%	-7%	-8%	1%	-3%	-4%	0%	0%	0%	-19%	-25%	-7%
Walnut	2,777.06	4,099.00	1.48	2,149.24	1,467.16	0.68	4,824.35	1,179.91	0.24	622.02	931.15	1.50
Ave.% increase	0%	4%	4%	0%	-3%	-3%	0%	0%	0%	-9%	-22%	-14%
Citrus varieties	2,701.20	3,952.00	1.46	2,886.84	6,632.74	2.30	1,613.95	2,910.50	1.80	824.27	3,763.02	4.57
Ave.% increase	0%	-9%	-9%	3%	3%	0%	1%	2%	1%	-25%	-29%	-6%
Mango	6,365.10	10,287.00	1.62	3,253.24	8,161.53	2.51	3,610.15	10,265.04	2.84	226.99	485.38	2.14
Ave.% increase	0%	-8%	-8%	1%	4%	3%	1%	1%	1%	-21%	-29%	-10%
Litchi	3,903.42	6,602.20	1.69	264.13	340.54	1.29	44.68	12.37	0.28	8.99	7.81	0.87
Ave.% increase	0%	-3%	-4%	8%	-1%	-8%	3%	8%	5%	-	-	-
Aonla	188.68	253.00	1.34	133.93	252.51	1.89	86.10	265.00	3.08	122.50	76.35	0.62
Ave.% increase	4%	-2%	-6%	12%	1%	-10%	6%	6%	0%	20%	-14%	-28%
Guava	205.22	279.00	1.36	97.64	344.21	3.53	134.10	375.70	2.80	147.58	543.46	3.68
Ave.% increase	3%	-5%	-8%	16%	3%	-11%	4%	4%	0%	-3%	-11%	-8%
Other Fruits	2,170.00	3,079.10	1.42	7,278.42	8,991.38	1.24	2,154.60	2,150.77	1.00	188.48	890.08	4.72
Ave.% increase	1%	-3%	-4%	0%	3%	3%	1%	1%	0%	-16%	-19%	-4%
Total	27,389.10	42,560.30	1.55	21,647.52	35,738.26	1.65	21,087.03	28,909.13	1.37	4,336.23	12,831.42	2.96

District	Rudrapur			Uttarkashi			Haridwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Apple	422.10	215.25	0.51	9,225.08	20,191.50	2.19	-	-	-
Ave.% increase	1%	2%	1%	2%	27%	25%	-	-	-
Pear	214.00	230.10	1.08	1,645.32	4,170.00	2.53	142.50	1,354.00	9.50
Ave.% increase	2%	2%	0%	1%	27%	25%	3%	-2%	-4%
Peach	186.50	178.50	0.96	372.45	1,609.03	4.32	173.00	705.00	4.08

District	Rudrapur			Uttarkashi			Haridwar		
Ave.% increase	1%	2%	1%	4%	29%	24%	2%	0%	-2%
Plum	137.00	142.00	1.04	757.43	1,062.71	1.40	-	-	-
Ave.% increase	2%	1%	-1%	1%	18%	18%	-	-	-
Apricot	54.00	76.50	1.42	172.50	1,161.40	6.73	-	-	-
Ave.% increase	3%	3%	1%	2%	5%	2%	-	-	-
Walnut	327.50	63.75	0.19	1,454.34	1,156.75	0.80	-	-	-
Ave.% increase	3%	5%	3%	1%	18%	17%	-	-	-
Citrus Varieties	816.20	821.00	1.01	348.24	981.29	2.82	1,460.00	5,632.50	3.86
Ave.% increase	1%	1%	0%	2%	7%	5%	1%	0%	-1%
Mango	475.50	237.75	0.50	234.68	443.48	1.89	5,631.00	26,278.00	4.67
Ave.% increase	2%	4%	2%	1%	7%	6%	0%	1%	0%
Litchi	39.50	9.00	0.23	19.53	9.24	0.47	1,695.60	4,698.40	2.77
Ave.% increase	6%	17%	11%	-	-	-	1%	2%	1%
Aonla	11.80	9.80	0.83	NA	NA	-	156.50	456.90	2.92
Ave.% increase	-	-	-	-	-	-	-	-	-
Guava	27.00	33.00	1.22	49.90	298.17	5.98	609.00	4,446.30	7.30
Ave.% increase	-	-	-	-	-	-	-	-	-
Other Fruits	630.00	533.00	0.85	1,419.83	3,400.43	2.39	6,156.00	60,565.00	9.84
Ave.% increase	0%	1%	0%	1%	6%	4%	0%	-2%	-2%
Total	3,341.10	2,549.65	0.76	15,699.30	34,484.00	2.20	16,023.60	104,136.10	6.50

Source: UKDHFP

Note: Average % increase is a geometric mean to calculate average increase rate per year from 2012 to 2020.

2) Kumaon Division and the State of Uttarakhand

District	Nainital			Udham Singh Nagar			Almora			Bageshwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Apple	1,244.67	8,550.00	6.87	-	-	-	1,578.00	14,080.00	8.92	99.07	14.20	0.14
Ave.% increase	-23%	-17%	8%	-	-	-	0%	0%	0%	-7%	-33%	-28%
Pear	614.24	9,141.50	14.88	68.00	568.23	8.36	3,328.00	35,794.00	10.76	528.82	1,172.17	2.22
Ave.% increase	-15%	-12%	4%	-2%	-4%	-1%	0%	0%	0%	-2%	-19%	-17%
Peach	1,830.00	26,430.00	14.44	-	-	-	1,672.00	20,568.00	12.30	251.96	547.97	2.17
Ave.% increase	-5%	11%	16%	-	-	-	0%	0%	0%	5%	1%	-3%
Plum	596.75	6,295.00	10.55	-	-	-	2,618.00	20,564.00	7.85	101.10	153.43	1.52
Ave.% increase	-7%	5%	12%	-	-	-	0%	0%	0%	-2%	-4%	-2%
Apricot	394.00	2,926.00	7.43	-	-	-	2,299.00	17,902.00	7.79	82.39	72.12	0.88
Ave.% increase	-10%	1%	12%	-	-	-	0%	0%	0%	-11%	-1%	12%
Walnut	120.25	309.77	2.58	-	-	-	2,824.00	8,498.00	3.01	407.19	956.23	2.35
Ave.% increase	-25%	-9%	22%	-	-	-	0%	0%	0%	0%	25%	24%
Citrus Varieties	499.00	3,490.00	6.99	244.90	1,797.27	7.34	4,371.00	33,726.00	7.72	666.82	4,264.42	6.40
Ave.% increase	-20%	-14%	7%	2%	0%	-1%	0%	0%	0%	-5%	-3%	1%
Mango	2,642.00	32,758.50	12.40	4,193.00	35,202.87	8.40	4,674.00	23,826.00	5.10	1,011.80	3,757.05	3.71
Ave.% increase	-11%	8%	22%	1%	1%	0%	0%	0%	0%	8%	8%	0%
Litchi	1,838.00	9,275.00	5.05	1,576.50	2,313.26	1.47	280.00	94.00	0.34	30.77	25.88	0.84
Ave.% increase	6%	16%	9%	2%	4%	2%	0%	3%	3%	5%	1%	-4%
Aonla	84.45	584.50	6.92	50.00	260.01	5.20	12.00	3.00	0.25	16.98	57.95	3.41
Ave.% increase	5%	42%	35%	5%	76%	68%	22%	-	-	6%	-2%	-8%
Guava	480.75	2,447.00	5.09	1,469.00	10,556.39	7.19	57.00	141.00	2.47	124.01	431.97	3.48
Ave.% increase	40%	42%	1%	5%	3%	-1%	6%	3%	-3%	12%	1%	-10%
Other Fruits	668.50	6,900.00	10.32	439.00	3,474.92	7.92	601.00	1,651.00	2.75	376.73	1,290.54	3.43
Ave.% increase	-3%	2%	5%	2%	1%	-1%	0%	0%	0%	-6%	-13%	-8%
Total	11,012.61	109,107.27	9.91	8,040.40	54,172.95	6.74	24,314.00	176,847.00	7.27	3,697.64	12,743.93	3.45

District	Pithoragarh			Champanat			Total (Uttarakhand)		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Apple	1,620.50	3,043.20	1.88	329.00	331.00	1.01	25,785.39	62,089.51	2.41
Ave.% increase	0%	3%	3%	-9%	-9%	-1%	-4%	-5%	-2%
Pear	1,256.60	12,577.05	10.01	635.00	1,828.00	2.88	13,234.02	78,115.18	5.90
Ave.% increase	0%	0%	0%	-6%	-7%	-1%	-2%	-4%	-2%
Peach	1,134.10	3,932.00	3.47	519.00	940.00	1.81	8,256.43	58,801.57	7.12
Ave.% increase	2%	9%	7%	-4%	-6%	-1%	-1%	3%	4%
Plum	952.56	1,661.60	1.74	535.00	618.00	1.16	9,027.74	36,446.72	4.04
Ave.% increase	1%	5%	4%	-7%	-9%	-2%	-1%	0%	1%
Apricot	789.26	1,149.57	1.46	342.00	377.00	1.10	8,094.32	28,320.25	3.50
Ave.% increase	1%	4%	4%	-9%	-10%	-1%	-2%	-2%	0%
Walnut	1,942.00	1,644.30	0.85	281.00	64.00	0.23	17,728.95	20,370.02	1.15

District	Pithoragarh			Champawat			Total (Uttarakhand)		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Ave.% increase	0%	17%	16%	-14%	-12%	1%	-1%	-1%	0%
Citrus Varieties	3,408.30	19,642.00	5.76	1,899.00	3,565.00	1.88	21,739.72	91,177.74	4.19
Ave.% increase	0%	3%	3%	-2%	-3%	-1%	-4%	-6%	-2%
Mango	2,901.00	2,787.90	0.96	1,696.00	2,302.00	1.36	36,914.46	156,792.50	4.25
Ave.% increase	0%	3%	3%	-4%	-2%	2%	-1%	1%	2%
Litchi	565.50	713.63	1.26	430.00	539.00	1.25	10,696.62	24,640.33	2.30
Ave.% increase	1%	8%	6%	-3%	-3%	0%	2%	4%	2%
Aonla	563.00	242.20	0.43	-	-	-	1,425.94	2,461.22	1.73
Ave.% increase	21%	3%	-15%	-	-	-	15%	10%	-4%
Guava	197.00	309.30	1.57	504.00	966.00	1.92	4,102.20	21,171.50	5.16
Ave.% increase	2%	5%	2%	-	-	-	12%	9%	-3%
Other Fruits	1,267.20	1,889.00	1.49	1,130.00	2,168.00	1.92	24,479.76	96,983.22	3.96
Ave.% increase	0%	2%	1%	-7%	-8%	-1%	-1%	-2%	-1%
Total	16,597.02	49,591.75	2.99	8,300.00	13,698.00	1.65	181,485.55	677,369.76	3.73

Source: UKDHFP

Note: Average % increase is a geometric mean to calculate average increase rate per year from 2012 to 2020.

(3) Fruit Tree Production in Uttarakhand

1) Quality of Fruit Seedlings

The quality of fruit seedling in the state would be limited based on the estimation as seen in the reported photos (figure at the right side). The apple seedling would be grafted but the variety name of rootstock and scion of the seedlings are not reported. Each variety has its own features, these not only include sweetness or size of the fruits but also growth strength, blooming, or fruiting timing. Farmers should know such features of the variety for proper cultivation in order for them to be able to expect rich harvest. It would take more than five years to start harvesting fruits for market after transplanting. Usual seedling size is more than two meters with three years of raising in the nursery. In addition, information for other fruits and vegetables are requested to UKDHFP for cluster planning. Seedling quality or applying seedling transplantation method is one of the essential factors for getting quality and quantity harvest.



Source: ILSP, photo taken in February 2021

Figure 3.4.3 Supplied Apple Seedling under ILSP, Chamoli, Uttarakhand

2) Existing Seedling Production

Under UKDHFP, 93 nurseries have been established. The current production capacity is given in the table below. The data shows that only 33.73% of the area on an average is used for production of planting materials. Except Haridwar and U.S. Nagar, nurseries are not operating to its full potential. The government nurseries had been established between 1950 and 1970. Most of the nurseries have been operational for nearly 50 years or more, thus, the facilities could be either outdated or dilapidated depending on how well maintenance work had been carried out. According to the district officials, water shortage in the nursery is also one of the reasons for underutilization of the nursery area. A complete list of nurseries under UKDHFP is given in Attachment 3.4.2. Further details from UKDHFP are awaited.

Table 3.4.5 Uttarakhand Government Nursery Details

District	No. of Nurseries	Total Area of the Nursery (in ha)	Area Under Use (in ha)	% Share of Area under Use to Total Area
Almora	11	302.1	32.4	10.72
Bageshwer	2	30.05	11.95	39.77
Chamoli	12	77.57	17.84	23.00
Champawat	6	44.14	26.42	59.86
Dehradun	8	55.85	23.38	41.86
Haridwar	1	5.13	4.63	90.25
Nainital	9	184.91	84.51	45.70
Pauri	9	39.3	3.3	8.40

District	No. of Nurseries	Total Area of the Nursery (in ha)	Area Under Use (in ha)	% Share of Area under Use to Total Area
Pithoragarh	15	116.5	70.19	60.25
Rudarpur	3	10.25	5.2	50.73
Tehri	6	70.56	25.24	35.77
U.S. Nagar	4	44.77	35.02	78.22
Uttarkashi	7	73.4	15.6	21.25
Total	93	1054.53	355.68	33.73

Source: UKDHFP

Also, UKDHFP reported the current seedling production number at each state nursery for the four target districts of Nainital, Pithoragarh, Tehri, and Uttarkashi. In addition, the seedling numbers with scion and rootstock variety would be requested. Also, mother trees information with size and features of the variety, e.g., fruits size, sweetness, color, etc., seedling propagation methods (cutting, grafted, etc.), raising period of seedling, number of skilled labor /engineers are needed. These information are essential for planning horticulture cluster for market.

3.4.4 Production of Vegetables

(1) General

As abovementioned in Chapter 2, there is a geographical variety in the state of Uttarakhand, from plain to mountainous regions. Particularly, the Terai Region is unique where varieties of fruits, flowers, and vegetables grow possibly. Uttarakhand has about 13% of its geographic area under cultivation out of which about 80% of the land does not have assured irrigation facilities thus making agriculture crops, especially vegetables, totally dependent on vagaries of nature.

(2) District-wise and Crop-wise Analysis in Uttarakhand

District-wise analysis of various vegetables in Uttarakhand is shown in Table 3.4.6 below. The analysis is on the area taken up in vegetables for year 2019-20, production and productivity. In addition, average increase rate is calculated to identify the production status in each district by comparing data of 2019-20 and 2012-13.

Average increase rate of vegetables in Uttarakhand shows different situation among the districts. In Dehradun, Chamoli and Bageshwar, many vegetables declined more than 10% of the production area, production and productivity. Pauri, Uttarkashi, and Haridwar showed 10% to 30% increase of area and production in most vegetables. While in other districts, the change from 2012 to 2020 is quite small as for all aspects of production in the table, which is the same picture for “Total (Uttarakhand)” in the table.



Source: ILSP, photo taken in February 2021

Figure 3.4.4 Harvested Not Graded Potato, Jaunpur District, Tehri, Uttarakhand

Table 3.4.6 District-wise Area, Production and Productivity of Vegetables in Uttarakhand in 2019-20

1) Garhwal Division

District	Dehradun			Pauri			Tehri			Chamoli		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Pea	1,786.00	10,226.00	5.73	395.30	2,531.86	6.40	2,246.20	21,319.05	9.49	277.97	1,119.75	4.03
Ave. % increase	1%	2%	0%	3%	3%	12%	0%	1%	0%	-5%	-13%	-2%
Radish	348.70	3,930.00	11.27	607.00	8,401.60	13.84	456.60	2,229.55	4.88	405.54	3,771.22	9.30
Ave. % increase	1%	2%	-1%	2%	14%	0%	1%	1%	0%	2%	0%	-4%
French Bean	1,099.00	6,253.00	5.69	491.50	3,116.35	6.34	699.30	5,335.05	7.63	209.13	883.99	4.23
Ave. % increase	1%	0%	-11%	2%	2%	7%	1%	1%	0%	-4%	-9%	-14%
Cabbage	691.00	3,532.50	5.11	334.02	3,395.54	10.17	701.25	6,924.20	9.87	414.29	1,315.68	3.18
Ave. % increase	1%	-10%	0%	3%	10%	8%	1%	1%	0%	1%	-14%	-9%
Cauliflower	903.50	16,705.00	18.49	194.30	1,910.79	9.83	178.89	564.05	3.15	77.10	377.19	4.89
Ave. % increase	1%	1%	-	5%	13%	-	2%	2%	-	-14%	-22%	-
Pumpkin	-	-	-	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	-10%	-	-	6%	-	-	0%	-	-	-4%

District	Dehradun			Pauri			Tehri			Chamoli		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Onion	524.50	2,963.00	5.65	527.50	7,156.50	13.57	831.60	7,389.71	8.89	152.46	830.85	5.45
Ave. % increase	2%	-8%	-6%	2%	8%	1%	-1%	-1%	0%	-12%	-16%	-1%
Capsicum	114.00	639.00	5.61	227.55	1,163.96	5.12	320.09	1,434.40	4.48	16.78	72.95	4.35
Ave. % increase	3%	-2%	-3%	4%	5%	0%	2%	2%	0%	-24%	-25%	1%
Okra	792.00	4,529.00	5.72	258.50	1,529.30	5.92	292.49	1,602.85	5.48	90.65	465.92	5.14
Ave. % increase	1%	-2%	-15%	4%	4%	5%	0%	0%	0%	-10%	-9%	-9%
Tomato	1,245.00	7,073.00	5.68	425.50	5,723.50	13.45	767.40	3,755.40	4.89	78.60	399.03	5.08
Ave. % increase	1%	-14%	0%	3%	8%	53%	1%	1%	0%	-18%	-25%	-9%
Brinjal	426.00	4,789.00	11.24	203.20	3,159.90	15.55	158.10	622.99	3.94	240.21	1,418.06	5.90
Ave. % increase	1%	1%	-15%	-24%	17%	0%	3%	3%	-8%	1%	-8%	3%
Other Vegetables	4,003.10	13,757.50	3.44	1,335.40	8,660.85	6.49	1,641.75	12,957.40	7.89	182.09	1,677.59	9.21
Ave. % increase	9%	-7%	-	1%	2%	-	1%	-7%	-	-5%	-2%	-
European Vegetables	-	-	-	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	-8%	-	-	2%	-	-	0%	-	-	-3%
Potato	2,681.00	15,604.00	5.82	1,058.50	15,779.50	14.91	2,534.57	49,209.87	19.42	562.85	6,162.45	10.95
Ave. % increase	1%	-8%	-7%	1%	3%	7%	0%	0%	-1%	-21%	-23%	-6%
Total	146,13.80	90,001.00	6.16	6,058.27	62,529.65	10.32	10,828.24	113,344.52	10.47	2707.67	18,494.68	6.83

District	Rudrapur			Uttarkashi			Haridwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Pea	199.00	271.00	1.36	1,447.25	5,101.88	3.53	459.00	9,300.00	20.26
Ave. % increase	2%	2%	-1%	9%	1%	-19%	2%	11%	4%
Radish	93.00	479.00	5.15	620.12	1,824.41	2.94	187.00	3,986.50	21.32
Ave. % increase	3%	1%	1%	21%	-2%	-17%	2%	7%	4%
French Bean	90.50	291.50	3.22	715.85	1,452.27	2.03	141.00	2,833.00	20.09
Ave. % increase	2%	3%	-3%	25%	3%	-14%	2%	7%	2%
Cabbage	156.50	603.75	3.86	639.90	3,439.85	5.38	651.00	13,539.50	20.80
Ave. % increase	4%	1%	-5%	30%	12%	-12%	1%	3%	5%
Cauliflower	47.50	76.00	1.60	366.35	1,623.64	4.43	487.00	10,142.50	20.83
Ave. % increase	9%	4%	-	44%	27%	-	2%	7%	-
Pumpkin	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	-1%	-	-	-14%	-	-	-1%
Onion	72.00	233.00	3.24	343.00	2,068.29	6.03	292.00	6,094.00	20.87
Ave. % increase	3%	2%	3%	27%	9%	-16%	2%	1%	8%
Capsicum	29.14	24.60	0.84	405.74	1,052.30	2.59	161.00	3,208.50	19.93
Ave. % increase	8%	11%	1%	37%	15%	-15%	4%	11%	5%
Okra	82.00	158.00	1.93	504.25	1,282.17	2.54	239.00	4,871.50	20.38
Ave. % increase	4%	4%	-1%	26%	7%	-7%	2%	7%	7%
Tomato	118.50	176.50	1.49	1,429.47	12,343.33	8.63	787.00	16,770.50	21.31
Ave. % increase	3%	2%	3%	11%	3%	-8%	1%	8%	8%
Brinjal	39.00	124.00	3.18	322.25	1,587.19	4.93	349.00	7,184.50	20.59
Ave. % increase	-1%	3%	-1%	30%	19%	-18%	3%	11%	6%
Other Vegetables	266.50	906.00	3.40	2,979.48	13,526.98	4.54	652.00	13,396.50	20.55
Ave. % increase	2%	0%	-	21%	-1%	-	0%	6%	-
European Vegetables	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	3%	-	-	-6%	-	-	1%
Potato	715.00	9,360.00	13.09	3,927.02	30,144.09	7.68	1,686.00	35,355.00	20.97
Ave. % increase	1%	4%	1%	9%	2%	-11%	1%	1%	4%
Total	1,908.64	12,703.35	6.66	13,700.68	75,446.40	5.51	6,091.00	126,682.00	20.80

Source: UKDHFP

Note: Average % increase is a geometric mean to calculate average increase rate per year from 2012 to 2020.

2) Kumaon Division and the State of Uttarakhand

District	Nainital			Udham Singh Nagar			Almora			Bageshwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Pea	1,449.50	9,553.00	6.59	3,710.00	30,648.30	8.26	663.00	3,612.00	5.45	222.07	801.31	3.61
Ave. % increase	-4%	-2%	-8%	4%	4%	0%	1%	0%	0%	9%	-2%	-6%
Radish	105.20	1,385.00	13.17	249.00	4,549.75	18.27	858.00	15,968.00	18.61	299.87	1,739.00	5.80
Ave. % increase	-15%	-21%	-3%	2%	2%	-1%	1%	0%	0%	0%	-6%	-21%
French Bean	503.60	3,609.00	7.17	162.00	1,053.00	6.50	609.00	4,753.00	7.80	95.89	96.10	1.00
Ave. % increase	6%	3%	-4%	2%	1%	-1%	0%	1%	-2%	-7%	-26%	0%
Cabbage	985.00	12,335.25	12.52	443.00	7,531.00	17.00	296.00	3,702.00	12.51	164.14	1,451.84	8.85

District	Nainital			Udham Singh Nagar			Almora			Bageshwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Ave. % increase	0%	-4%	1%	1%	0%	-1%	2%	0%	-2%	2%	1%	-1%
Cauliflower	299.00	2,028.10	6.78	336.00	5,712.00	17.00	272.00	2,367.00	8.70	77.97	576.05	7.39
Ave. % increase	4%	6%	-	1%	0%	-	2%	0%	-	-3%	-4%	-
Pumpkin	-	-	-	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	12%	-	-	0%	-	-	-1%	-	-	-6%
Onion	389.01	5,314.50	13.66	358.00	4,952.00	13.83	278.00	1,617.00	5.82	188.92	1,290.09	6.83
Ave. % increase	13%	26%	4%	1%	1%	0%	2%	0%	0%	3%	-3%	-2%
Capsicum	197.00	1,195.50	6.07	194.00	776.00	4.00	445.00	1,288.00	2.89	71.79	280.36	3.91
Ave. % increase	-2%	1%	-4%	1%	1%	0%	1%	1%	-1%	-3%	-5%	-27%
Okra	73.15	554.50	7.58	551.00	4,628.40	8.40	167.00	1,412.00	8.46	84.97	84.74	1.00
Ave. % increase	-16%	-20%	4%	1%	1%	0%	1%	0%	-1%	1%	-26%	1%
Tomato	1,578.01	21,669.50	13.73	1,009.00	20,180.00	20.00	348.00	5,089.00	14.62	82.97	478.84	5.77
Ave. % increase	-4%	0%	-8%	1%	1%	34%	2%	0%	-1%	-3%	-2%	-4%
Brinjal	48.20	361.10	7.49	406.00	7,105.00	17.50	114.00	984.00	8.63	72.77	550.66	7.57
Ave. % increase	-19%	-25%	2%	1%	35%	1%	2%	1%	3%	1%	-3%	-14%
Other Vegetables	285.60	2,488.00	8.71	936.00	10,670.40	11.40	575.00	4,312.00	7.50	211.77	519.06	2.45
Ave. % increase	-25%	-24%	-	2%	2%	-	0%	2%	-	-13%	-25%	-
European Vegetables	-	-	-	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	-6%	-	-	1%	-	-	0%	-	-	-13%
Potato	1,845.50	26,596.00	14.41	2,820.00	62,604.00	22.20	2,472.00	54,421.00	22.01	3,510.09	5,647.55	1.61
Ave. % increase	-4%	-10%	-1%	1%	1%	0%	0%	0%	0%	30%	13%	-13%
Total	7758.77	87089.45	11.22	11174.00	160409.85	14.36	7097.00	99525.00	14.02	5083.22	13515.60	2.66

District	Pithoragarh			Champawat			Total (Uttarakhand)		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Pea	195.10	2,020.52	10.36	447.00	1,341.00	3.00	13,497.39	97,845.67	7.25
Ave. % increase	3%	10%	2%	-2%	-2%	0%	1%	2%	-1%
Radish	821.82	10,301.62	12.54	236.00	2,284.00	9.68	5,287.85	60,849.65	11.51
Ave. % increase	1%	3%	1%	-1%	-1%	-1%	2%	1%	-1%
French Bean	868.25	9,950.03	11.46	455.00	1,276.80	2.81	6,140.02	40,903.09	6.66
Ave. % increase	0%	1%	2%	-2%	-2%	-2%	2%	1%	-2%
Cabbage	683.15	9,331.57	13.66	409.00	2,131.00	5.21	6,568.25	69,233.68	10.54
Ave. % increase	1%	3%	3%	-3%	-5%	-5%	2%	0%	0%
Cauliflower	82.45	876.63	10.63	45.00	334.00	7.42	3,367.06	43,292.95	12.86
Ave. % increase	11%	14%	-	-4%	-9%	-	3%	2%	-
Pumpkin	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	2%	-	-	-3%	-	-	0%
Onion	422.83	4,961.15	11.73	80.00	599.00	7.49	4,459.82	45,469.09	10.20
Ave. % increase	1%	3%	1%	-2%	-4%	0%	2%	2%	1%
Capsicum	391.05	4,658.45	11.91	234.00	691.00	2.95	2,807.14	16,485.02	5.87
Ave. % increase	3%	4%	0%	-3%	-3%	-1%	2%	3%	-2%
Okra	428.35	4,793.78	11.19	160.00	881.00	5.51	3,723.36	26,793.16	7.20
Ave. % increase	3%	3%	2%	-1%	-2%	-1%	2%	0%	-1%
Tomato	883.30	10,473.75	11.86	608.00	6,250.00	10.28	9,360.75	110,382.35	11.79
Ave. % increase	2%	4%	1%	-3%	-4%	-7%	1%	0%	9%
Brinjal	196.95	3,107.02	15.78	144.00	1,227.00	8.52	2,719.68	32,220.42	11.85
Ave. % increase	3%	4%	-1%	-2%	-8%	-1%	-4%	5%	-6%
Other Vegetables	719.38	15,019.63	20.88	372.00	4,271.00	11.48	14,160.07	102,162.91	7.21
Ave. % increase	4%	3%	-	-2%	-3%	-	2%	-3%	-
European Vegetables	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	0%	-	-	-7%	-	-	-3%
Potato	1,848.85	46,063.00	24.91	1,108.00	11,695.00	10.56	26,769.38	368,641.46	13.77
Ave. % increase	1%	1%	1%	-11%	-17%	-5%	1%	-3%	-2%
Total	7541.48	121557.15	16.12	4298.00	32980.80	7.67	98860.77	1014279.45	10.26

Source: UKDHFP

Note: Average % increase is a geometric mean to calculate average increase rate per year from 2012 to 2020.

3.4.5 Production of Spices

District-wise analysis of various spices in Uttarakhand is shown in Table 3.4.7 below. The analysis is on the area taken up in the spices in year 2019-20, production and productivity. In addition, average increase rate is calculated to identify the production status in each district by comparison between data of 2019-20 and 2012-13.

Spices production has shown the trend of increase in production area and amount in about half of districts in Uttarakhand. Out of these districts, Nainital Pithoragarh and Tehri's productivity of spices has shown no change since production area and amount increased at similar level. It might be assumed that production material, equipment, and technique to improve yield have not been changed from 2012.



Source: Photo by DHO Bin Block, July 2021

Figure 3.4.5 Cultivation of Traditional Garlic and Ginger on Terrace Farms with Owner Farmers, Bin Block, Pithoragarh District, Uttarakhand

Table 3.4.7 District-wise Area, Production and Productivity of Spices in Uttarakhand in 2019-20

1) Garhwal Division

District	Dehradun			Pauri			Tehri			Chamoli		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Turmeric	111.20	900.00	8.09	156.23	1,785.15	11.43	121.74	559.20	4.59	161.85	698.40	4.32
Ave. % increase	2%	2%	0%	9%	15%	5%	6%	5%	-1%	6%	-6%	-11%
Chilli	192.95	500.00	2.59	179.70	851.30	4.74	266.43	467.08	1.75	114.19	376.33	3.30
Ave. % increase	2%	2%	0%	5%	22%	16%	9%	8%	0%	1%	13%	12%
Coriander	111.56	311.00	2.79	156.30	763.13	4.88	113.67	177.77	1.56	69.99	174.40	2.49
Ave. % increase	3%	3%	0%	3%	8%	4%	27%	26%	-1%	2%	2%	1%
Garlic	161.10	1,523.00	9.45	138.65	859.23	6.20	164.59	551.93	3.35	100.86	474.07	4.70
Ave. % increase	2%	2%	0%	6%	18%	11%	2%	2%	0%	-5%	-10%	-5%
Ginger	530.10	6,066.30	11.44	235.10	1,460.88	6.21	1,489.97	14,872.00	9.98	79.20	860.90	10.87
Ave. % increase	1%	1%	0%	3%	4%	0%	-4%	1%	5%	-13%	-13%	0%
Fenugreek (Methi) Seed	82.96	426.00	5.14	35.02	157.89	4.51	3.98	2.34	0.59	17.14	20.50	1.20
Ave. % increase	3%	3%	0%	0%	23%	23%	-	-	-	2%	2%	0%
Black Cardamom	-	-	-	10.75	10.65	0.99	3.21	4.80	1.50	0.66	1.82	2.76
Ave. % increase	-	-	-	27%	22%	-4%	-1%	-6%	-5%	-35%	-5%	46%
Other Spices	-	-	-	-	-	-	3.96	6.92	1.75	27.18	152.20	5.60
Ave. % increase	-	-	-	-100%	-100%	-	-	-	-	-1%	22%	24%
Total	1,189.87	9,726.30	-	911.75	5,888.23	-	2,167.55	16,642.04	25.08	571.07	2,758.62	35.23

District	Rudrapur			Uttarkashi			Haridwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Turmeric	53.00	222.00	4.19	145.30	359.50	2.47	120.50	1,205.00	10.00
Ave. % increase	4%	2%	-2%	22%	-2%	-20%	1%	6%	5%
Chilli	218.00	227.25	1.04	330.92	646.66	1.95	282.00	2,256.00	8.00
Ave. % increase	1%	1%	-1%	18%	7%	-10%	1%	-1%	-2%
Coriander	35.80	50.25	1.40	307.31	553.15	1.80	102.00	816.00	8.00
Ave. % increase	4%	6%	3%	65%	33%	-19%	3%	0%	-2%
Garlic	79.50	179.25	2.25	356.46	723.27	2.03	176.00	1,509.00	8.57
Ave. % increase	4%	1%	-3%	39%	11%	-20%	5%	2%	-3%
Ginger	199.50	1,660.00	8.32	549.33	2,754.03	5.01	354.00	3,095.80	8.75
Ave. % increase	2%	1%	-1%	23%	11%	-10%	2%	2%	0%
Fenugreek (Methi) Seed	5.95	7.20	1.21	107.91	354.02	3.28	94.00	793.00	8.44
Ave. % increase	-	-	-	38%	34%	-3%	2%	0%	-2%
Black Cardamom	8.75	9.30	1.06	-	-	-	-	-	-
Ave. % increase	3%	4%	1%	-100%	-100%	-	-100%	-100%	-

District	Rudrapur			Uttarkashi			Haridwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Other Spices	11.00	9.95	0.90	95.80	222.25	2.32	151.00	1,208.00	8.00
Ave. % increase	1%	-3%	-4%	18%	12%	-6%	9%	24%	13%
Total	611.50	2,365.20	20.39	1,893.03	5,612.88	-	1,279.50	10,882.80	-

Source: UKDHFP

Note: Average % increase is a geometric mean to calculate average increase rate per year from 2012 to 2020.

2) Kumaon Division and the State of Uttarakhand

District	Nainital			Udham Singh Nagar			Almora			Bageshwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Turmeric	291.30	2,806.50	9.63	197.00	2,011.37	10.21	140.00	897.00	6.41	150.19	1,832.03	12.20
Ave. % increase	38%	37%	0%	8%	7%	0%	3%	2%	-1%	2%	12%	9%
Chilli	381.00	1,550.00	4.07	200.00	1,030.00	5.15	436.00	1,169.00	2.68	46.17	101.20	2.19
Ave. % increase	14%	10%	-4%	2%	1%	0%	1%	1%	0%	-5%	-1%	4%
Coriander	138.50	386.50	2.79	178.50	214.20	1.20	108.00	336.00	3.11	30.11	53.42	1.77
Ave. % increase	20%	20%	-1%	1%	2%	1%	2%	3%	0%	-9%	-8%	1%
Garlic	185.00	1,110.20	6.00	205.00	1,875.77	9.15	184.00	1,040.00	5.65	67.09	302.85	4.51
Ave. % increase	21%	12%	-7%	4%	3%	-1%	2%	1%	-1%	-5%	-3%	3%
Ginger	367.01	2,836.51	7.73	281.50	4,029.70	14.32	327.00	5,389.00	16.48	115.08	1,097.08	9.53
Ave. % increase	11%	0%	-9%	2%	2%	0%	2%	1%	-2%	-3%	-2%	2%
Fenugreek (Methi) Seed	-	-	-	112.00	784.00	7.00	92.00	609.00	6.62	22.67	26.23	1.16
Ave. % increase	-100%	-100%	-	2%	1%	-1%	1%	1%	0%	-2%	-12%	-10%
Black Cardamom	-	-	-	-	-	-	15.00	14.00	0.93	5.34	1.46	0.27
Ave. % increase	-100%	-100%	-	-	-	-	-1%	-9%	-8%	1%	-22%	-22%
Other Spices	80.50	211.40	2.63	44.50	200.25	4.50	35.00	137.00	3.91	12.89	132.52	10.28
Ave. % increase	20%	11%	-7%	7%	7%	0%	2%	2%	0%	-19%	-13%	8%
Total	1,443.31	8,901.11	-	1,218.50	10,145.29	-	1,337.00	9,591.00	45.80	449.54	3,546.79	41.92

District	Pithoragarh			Champawat			Total (Uttarakhand)		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Turmeric	72.70	1,080.50	14.86	48.00	392.00	8.17	1,769.01	14,748.65	8.34
Ave. % increase	7%	8%	1%	2%	1%	-1%	8%	8%	0%
Chilli	70.40	83.20	1.18	127.00	374.00	2.94	2,844.76	9,632.02	3.39
Ave. % increase	4%	5%	1%	2%	1%	0%	4%	4%	-1%
Coriander	70.65	200.61	2.84	36.00	112.00	3.11	1,458.39	4,148.43	2.84
Ave. % increase	3%	2%	0%	3%	3%	1%	8%	6%	-2%
Garlic	169.71	507.02	2.99	104.00	786.00	7.56	2,091.96	11,441.59	5.47
Ave. % increase	21%	13%	-7%	2%	1%	-1%	8%	6%	-2%
Ginger	176.58	2,853.73	16.16	357.00	2,713.00	7.60	5,061.37	49,688.93	9.82
Ave. % increase	4%	3%	-1%	-1%	-5%	-5%	1%	1%	0%
Fenugreek (Methi) Seed	86.70	602.81	6.95	32.00	69.00	2.16	692.33	3,851.99	5.56
Ave. % increase	1%	2%	1%	4%	5%	1%	3%	3%	-1%
Black Cardamom	12.71	24.65	1.94	11.00	11.00	1.00	67.42	77.68	1.15
Ave. % increase	-6%	0%	7%	7%	7%	0%	-3%	-4%	-1%
Other Spices	48.00	224.26	4.67	38.00	188.00	4.95	547.83	2,692.75	4.92
Ave. % increase	3%	4%	0%	3%	3%	0%	6%	9%	3%
Total	707.45	5,576.78	51.60	753.00	4,645.00	37.48	14,533.07	96,282.04	41.49

Source: UKDHFP

Note: Average % increase is a geometric mean to calculate average increase rate per year from 2012 to 2020.

3.4.6 Production of Flowers

District-wise analysis of various varieties in Uttarakhand is shown in Table 3.4.8 below. The analysis is on the area taken up in year 2019-20, production and productivity. In addition, average increase rate is calculated to identify the production status in each district by comparison between data of 2019-20 and 2012-13.

In all the districts, all data remained blank on each flower and production aspect. Average increase rate could not be calculated due to no availability of data in 2012-13, although some columns of production data in 2019-20 have been inputted. There are several flowers with increasing production area and volume. Production volume in the entire state is less than 5,000 MT in 2019-20, which is just 5% of the production volume of flowers in Uttarakhand.



Source: Photo by ILSP Chamoli District, January (left up), February (left down), and March (right) 2021

Figure 3.4.6 ILSP Supported Damask Rose Cultivation for Essence Production in Chamoli District, Uttarakhand

Table 3.4.8 District-wise Area, Production and Productivity of Flowers in Uttarakhand in 2019-20

1) Garhwal Division

District	Dehradun			Pauri			Tehri			Chamoli		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Gerbera	43.00	23.99	0.56	-	-	-	-	-	-	-	-	-
Ave. % increase	2%	-	-	-100%	-	-	-	-	-	-	-	-
Carnation	10.75	17.65	1.64	-	-	-	-	-	-	-	-	-
Ave. % increase	4%	-	-	-	-	-	-	-	-	-	-	-
Gladiolus	52.00	60.31	1.16	9.50	6.99	0.74	-	-	-	-	-	-
Ave. % increase	3%	-	-	-1%	-	-	-	-	-	-100%	-	-
Lilium	1.04	1.53	1.47	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	-	-	-	-	-	-	-	-	-	-
Marigold	78.50	529.50	6.75	24.50	123.60	5.04	16.87	105.32	6.24	53.33	11.70	0.22
Ave. % increase	2%	2%	0%	6%	2%	-4%	6%	6%	1%	21%	-4%	-21%
Rose	9.20	4.74	0.52	2.45	2.46	1.00	2.03	7.55	3.72	2.43	2.99	1.23
Ave. % increase	9%	3%	-5%	3%	11%	8%	-	-	-	-37%	-36%	2%
Tuberose	5.08	4.95	0.97	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	-	-	-	-	-	-	-	-	-	-
Other	19.00	16.81	0.88	-	-	-	-	-	-	5.51	0.72	0.13
Ave. % increase	-1%	1%	2%	-	-	-	-	-	-	-17%	-38%	-26%
Total	218.57	659.48	13.95	36.45	133.05	-	18.90	112.87	-	61.27	15.41	-

District	Rudrapur			Uttarkashi			Haridwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Gerbera	-	-	-	-	-	-	37.00	687.24	18.57
Ave. % increase	-	-	-	-	-	-	-	-	-
Carnation	-	-	-	-	-	-	5.00	10.70	2.14
Ave. % increase	-	-	-	-	-	-	-3%	-	-
Gladiolus	4.00	165.60	41.40	33.76	3.14	0.09	136.00	285.60	2.10
Ave. % increase	11%	-	-	-	-	-	1%	-	-
Lilium	-	-	-	-	-	-	-	-	-
Ave. % increase	-	-	-	-	-	-	-	-	-
Marigold	54.50	69.00	1.27	41.60	29.13	0.70	489.50	1,253.69	2.56
Ave. % increase	8%	11%	3%	21%	-17%	-31%	1%	12%	11%
Rose	7.30	7.44	1.02	35.34	30.75	0.87	79.50	87.45	1.10
Ave. % increase	10%	9%	-1%	52%	39%	-9%	1%	5%	4%
Tuberose	-	-	-	-	-	-	11.26	12.96	1.15
Ave. % increase	-	-	-	-	-	-	2%	2%	0%
Other	12.00	12.30	1.03	31.77	34.00	1.07	44.00	61.60	1.40

District	Rudrapur			Uttarkashi			Haridwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Ave. % increase	8%	6%	-2%	58%	51%	-4%	-3%	5%	8%
Total	77.80	254.34	-	142.47	97.02	-	802.26	2,399.24	-

Source: UKDHFP

Note: Average % increase is a geometric mean to calculate average increase rate per year from 2012 to 2020.

2) Kumaon Division and the State of Uttarakhand

District	Nainital			Udham Singh Nagar			Almora			Bageshwar		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Gerbera	14.00	254.20	18.16	20.00	149.00	7.45	-	-	-	-	-	-
Ave. % increase	-8%	-	-	-8%	-	-	-	-	-	-	-	-
Carnation	3.54	73.50	20.76	-	-	-	1.30	24.00	18.46	-	-	-
Ave. % increase	-7%	-	-	-7%	-	-	7%	-	-	-	-	-
Gladiolus	21.20	32.00	1.51	46.00	49.40	1.07	12.80	34.10	2.66	-	-	-
Ave. % increase	-11%	-	-	-11%	-	-	1%	-	-	-	-	-
Lilium	8.65	16.00	1.85	2.00	4.00	2.00	0.37	0.58	1.57	-	-	-
Ave. % increase	3%	-	-	3%	-	-	6%	-	-	-	-	-
Marigold	13.70	151.60	11.07	53.00	383.00	7.23	5.90	4.25	0.72	14.19	3.37	0.24
Ave. % increase	4%	39%	34%	4%	68%	34%	22%	16%	-5%	-3%	-24%	-22%
Rose	6.00	68.50	11.42	-	-	-	3.75	4.45	1.19	-	-	-
Ave. % increase	6%	49%	41%	6%	-100%	-	-3%	0%	2%	-	-	-
Tuberose	-	-	-	1.50	1.55	1.03	-	-	-	-	-	-
Ave. % increase	-	-	-	-	-53%	-34%	-	-	-	-	-	-
Other	3.75	4.50	1.20	9.50	11.80	1.24	-	-	-	2.08	1.16	0.56
Ave. % increase	-5%	-4%	1%	-5%	7%	3%	-	-	-	-19%	-31%	-14%
Total	70.84	600.30	-	132.00	598.75	-	24.12	67.38	-	16.27	4.53	-

District	Pithoragarh			Champanaut			Total (Uttarakhand)		
Crop	Area	Product	Productivity	Area	Product	Productivity	Area	Product	Productivity
unit	ha	MT	MT/ha	ha	MT	MT/ha	ha	MT	MT/ha
Jarbera	-	-	-	-	-	-	114.00	1,114.43	9.78
Ave. % increase	-	-	-	-	-	-	-3%	-	-
Carnation	-	-	-	-	-	-	20.59	125.85	6.11
Ave. % increase	-	-	-	-	-	-	-4%	-	-
Gladiolus	0.46	0.03	0.07	5.70	12.45	2.18	321.42	649.62	2.02
Ave. % increase	-14%	-	-	2%	-	-	-5%	-	-
Lilium	-	-	-	0.55	1.85	3.36	12.61	23.96	1.90
Ave. % increase	-	-	-	-	-	-	8%	-	-
Marigold	5.39	5.22	0.97	-	-	-	850.98	2,669.38	3.14
Ave. % increase	22%	15%	-6%	-	-	-	4%	9%	5%
Rose	-	-	-	-	-	-	148.00	216.33	1.46
Ave. % increase	-	-	-	-	-	-	-1%	5%	6%
Tuberose	-	-	-	-	-	-	17.84	19.46	1.09
Ave. % increase	-	-	-	-	-	-	-5%	-33%	-29%
Other	10.10	5.32	0.53	1.90	2.29	1.21	139.61	150.50	1.08
Ave. % increase	26%	3%	-18%	7%	8%	1%	1%	3%	2%
Total	15.95	10.57	-	8.15	16.59	-	1,625.05	4,969.53	26.58

Source: UKDHFP

Note: Average % increase is a geometric mean to calculate average increase rate per year from 2012 to 2020.

3.4.7 Production of Food Grains

1) Cultivated Area and Production of Food Grains

While the production of wheat has increased by 69,491 MT (Source: 2016-17 to 2018-19, hereunder same year and data source), the production of paddy has reduced by 10,710 MT. Production of other cereals has also decreased by 65,243 MT (2016-17 to 2018-19). Among pulses, the production of *Urd* and *Matar* is reduced by 1,116 MT and 932 MT, respectively. The production of *Masoor* is increased by 1,875 MT (2016-17 to 2018-19). Among the oilseeds, one of the major observations is that the production of soybean has reduced substantially by 3,629 MT. The production of mustard has increased by 4,750 MT. Overall production of oilseeds has increased by 1,426 MT, pulses by 3,821 MT, and cereals by 1,625 MT. This shows that production of pulses in Uttarakhand has substantially enhanced. The production of sugarcane has increased by 841,008 MT. Analysis of change in Average Production in

Quintal per ha (2016-17 to 2018-19) showed that it has decreased in case of paddy and groundnuts. All the other crops showed an increase in average production per hectare (in Quintals).

Table 3.4.9 Cultivated Area and Production of Food Grains in Uttarakhand

Agriculture Crops	Area (ha)			Change 2016-17 to 2018-19		Production (MT)			Change 2016-17 to 2018-19	
	2016-17	2017-18	2018-19*	Cultivated Area (ha)	%	2016-17	2017-18	2018-19*	Avg. Production (MT)	Avg. Production (Quintal/ ha)
Cereals	816,480	787,012	775,821	-40,659	-0.05	1,820,790	1,873,030	1,822,415	1,625	1.19
Paddy	260,707	260,492	256,632	-4,075	-0.02	629,859	664,872	619,149	-10,710	-0.03
Wheat	341,429	330,401	326,999	-14,430	-0.04	882,002	929,884	951,493	69,491	3.27
Barley	21,663	19,216	23,226	1,563	0.07	26,406	25,480	33,071	6,665	2.05
Maize	21,895	20,872	20,785	-1,110	-0.05	37,271	42,659	38,693	1,422	1.6
Others	170,786	156,031	148,179	-22,607	-0.13	245,252	210,135	180,009	-65,243	
Pulses	60,867	55,377	59,874	-993	-0.02	51,387	47,560	55,208	3,821	0.78
Urd	14,634	12,981	12,406	-2,228	-0.15	11,872	9,904	10,756	-1,116	0.56
Mater	6,178	4,348	5,405	-773	-0.13	6,212	4,095	5,280	-932	NA
Masoor	10,221	9,500	10,764	543	0.05	7,619	6,582	9,494	1,875	NA
Chana	668	530	746	78	0.12	531	440	597	66	0.05
Others	29,166	28,018	30,553	1,387	0.05	26,203	26,539	29,081	2,878	NA
Oil Seeds	27,604	27,189	29,342	1,738	0.06	26,139	25,749	27,565	1,426	0.10
Sarson-Mustard	13,129	13,592	17,018	3,889	0.3	11,235	11,126	15,985	4,750	0.83
Moongfali (Groundnuts)	729	805	1,174	445	0.61	947	1,109	1,219	272	-2.61
Til	2,087	1,888	1,960	-127	-0.06	602	563	584	-18	NA
Soybean	11,585	10,537	9,115	-2,470	-0.21	13,355	12,759	9,726	-3,629	NA
Others	74	367	75	-	-	64	192	51	-13	NA
Others Crops (Sugar Cane)	92,958	91,618	91,233	-1,725	-0.02	5,504,562	6,385,778	6,345,570	841,008	103.37

Source: JICA Survey Team based on the Data of Agriculture Directorate, Uttarakhand / Statistical Diary 2018-19 Uttarakhand, Economic and Statistical Directorate, Government of Uttarakhand

2) Distribution of Cultivated Area

The average area of each farmland is one of key factors for development of vegetable or fruits clusters. There is no common rule on the minimum size of farmland for starting up a new cluster. Also, the proper size of farmlands for cluster development varies depending on the crops or its target market. In addition, agriculture machines for introducing the cluster will be different depending on the size of the farmland. Currently, the statistical data could not be confirmed on the size of farmland. Therefore, the data collection will be continued for further consideration for planning.

3) Slope and Terrace of Cultivation Land

Depends on the photo information, there are many vegetable farmlands or fruit orchards located on the terrace. On the other hand, slope farming could not be confirmed except for grazing land. Horticulture farming including fruit orchard on the flat land has an advantage than slope farming. For instance, ploughing work on the steep slope farmland is difficult and fruit harvesting work on the slope is also hard. Since the farmland gradient data is one of essential factors for planning the cluster development up to now could not be confirmed, therefore, data correction will be continued.

3.4.8 Production Trend of Crops in Uttarakhand

(1) Production Trend of Entire India

Indian production transitions of vegetables, fruits, and spices proposed for UKIHDP were confirmed based on Horticultural Statistics at a Glance 2018 for four years from 2014/15 – 2017/18. Vegetables, fruits, spices, and flower show the trends of increasing production area and amount.

1) Production Trend of Vegetables

Pea production and area in all India are continuously increasing for the last five years from 2014-15 to 2017-18. Indian potato production ranked second place after China. All Indian potato production area and amount are in upward trends from 2014-15 to 2017-18 although the production decreased from 2014-15 to 2015-16 as well as the area from 2016-17 to 2017-18. Similarly, Indian tomato production

placed second after China. The production is also increasing from 2014-15 to 2016-17 although the production area and amount decreased from 2016-17 to 2017-18.

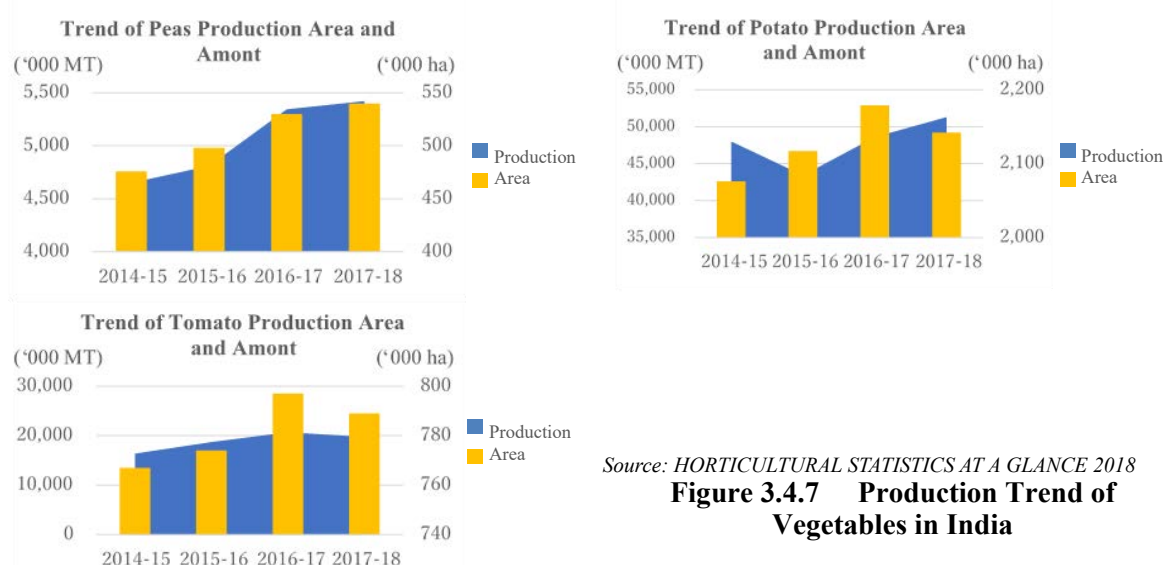


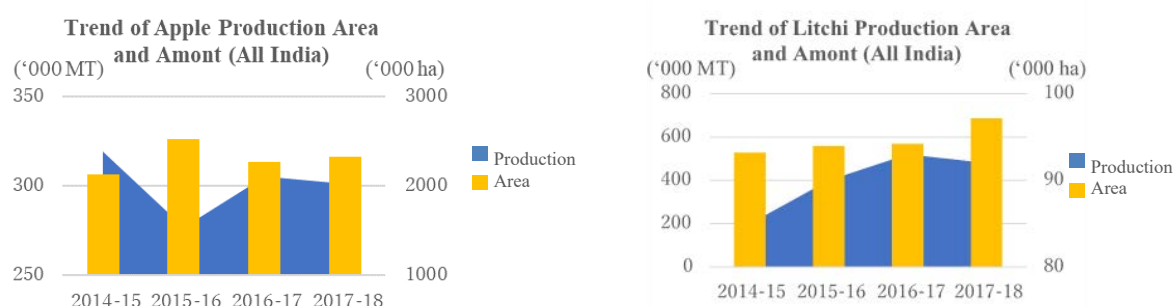
Figure 3.4.7 Production Trend of Vegetables in India

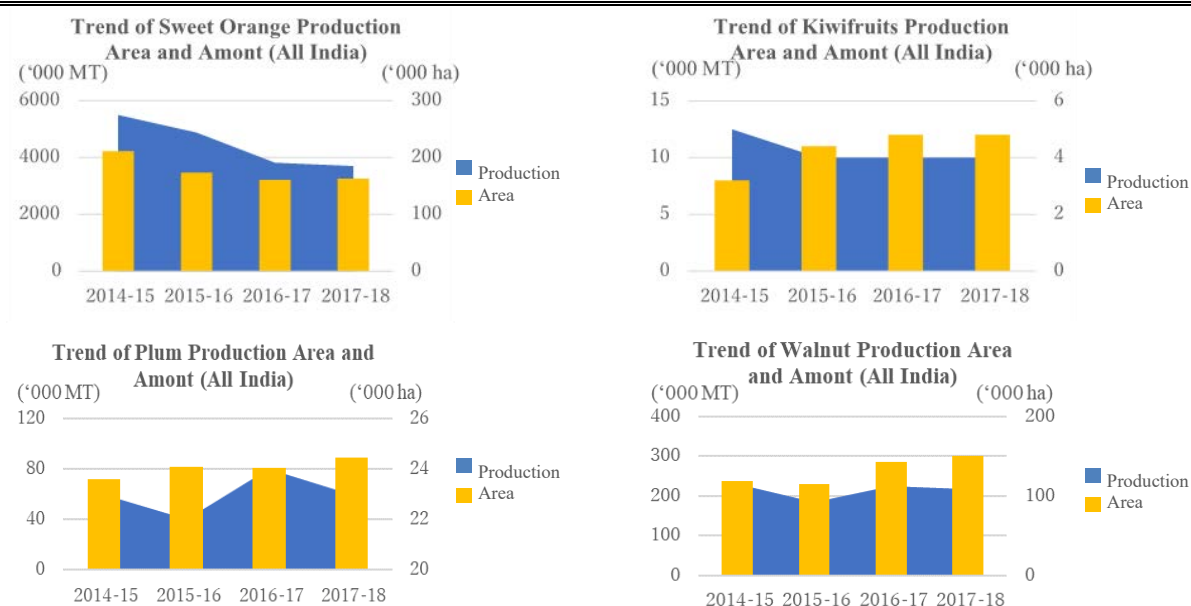
2) Production Trend of Fruits

Apple production area and amount in India are on the increasing trends although there is an annual up and down for the production and area. It is estimated that annual production and area go up and down due to alternating bearing. Maybe Indian apple production is not applying fruit thinning technique; therefore, alternating bearing occurs, and some apple orchards have no harvest so they could not be counted. Litchi production area and amount in all India are increasing certainly year by year.

Sweet orange production areas and amount in India are decreasing every year. It is estimated that the reason for the decline is the increasing number of competitive fruits; however, Japanese Unshu (C. Unshiu) is decreasing. The trend of all Indian kiwi fruit production area and amount shows an increase every year, although the increasing area and production amount are not appearing clearly on the graph because of the limited quantity. Presently, India is producing 13,000 MT of kiwi fruits in an area of about 4,000 ha extended in sub-Himalayan Region; Arunachal Pradesh, Nagaland, Mizoram, and Himachal Pradesh.

Trend of peach production area and amount are increasing in India after 2015-16, although the production decreased from 2014-15 to 2015-16. For four years, all Indian plum production area and production are increasing although alternating bearing could be estimated therefore production is repeating up and down. Walnut production area and amount are steady and slightly increasing from 2014-15 to 2017-18 in India.



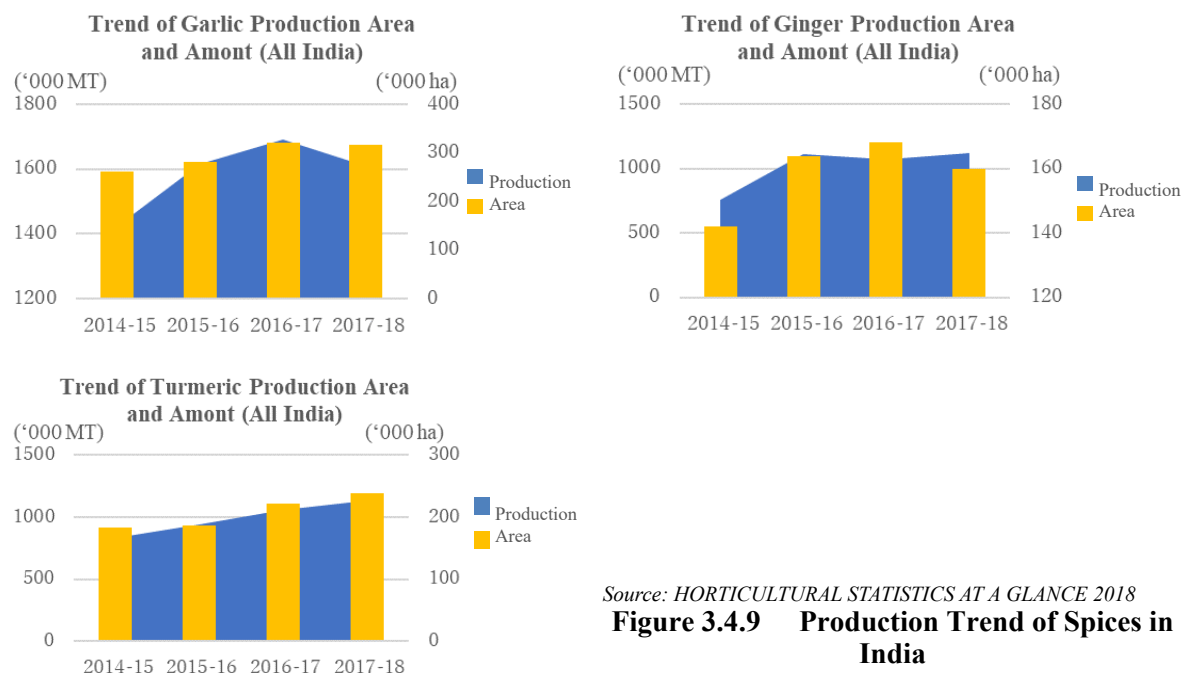


Source: HORTICULTURAL STATISTICS AT A GLANCE 2018

Figure 3.4.8 Production Trend of Fruits in India

3) Production Trend of Spices

Production area of garlic is increasing from 2014-15 to 2017-18 but the production decreased only from 2016-17 to 2017-18. Ginger production shows an increasing trend during the four years although the production area decreased from 2016-17 to 2017-18. All Indian turmeric production area and amount are increasing every year.

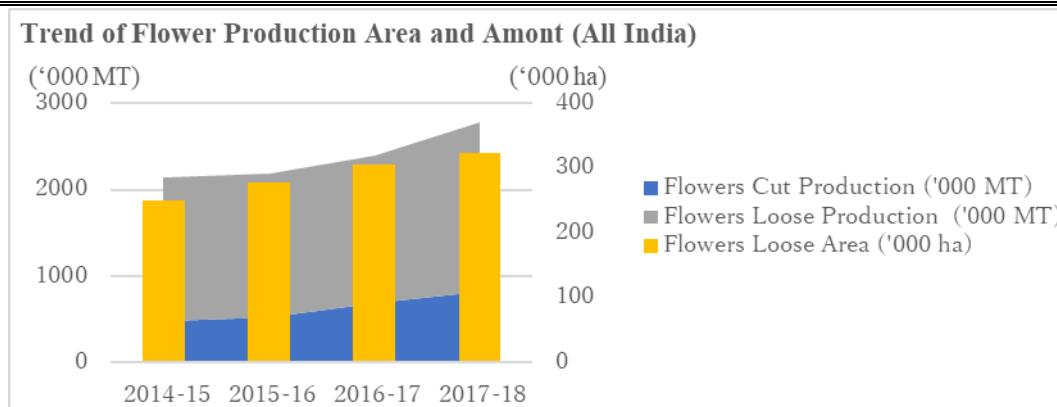


Source: HORTICULTURAL STATISTICS AT A GLANCE 2018

Figure 3.4.9 Production Trend of Spices in India

4) Production Trend of Flowers

All Indian cut flower and flower loose production are increasing every year as well as the production area, where majority of the production area is led by states of Southern Region.



Source: HORTICULTURAL STATISTICS AT A GLANCE 2018

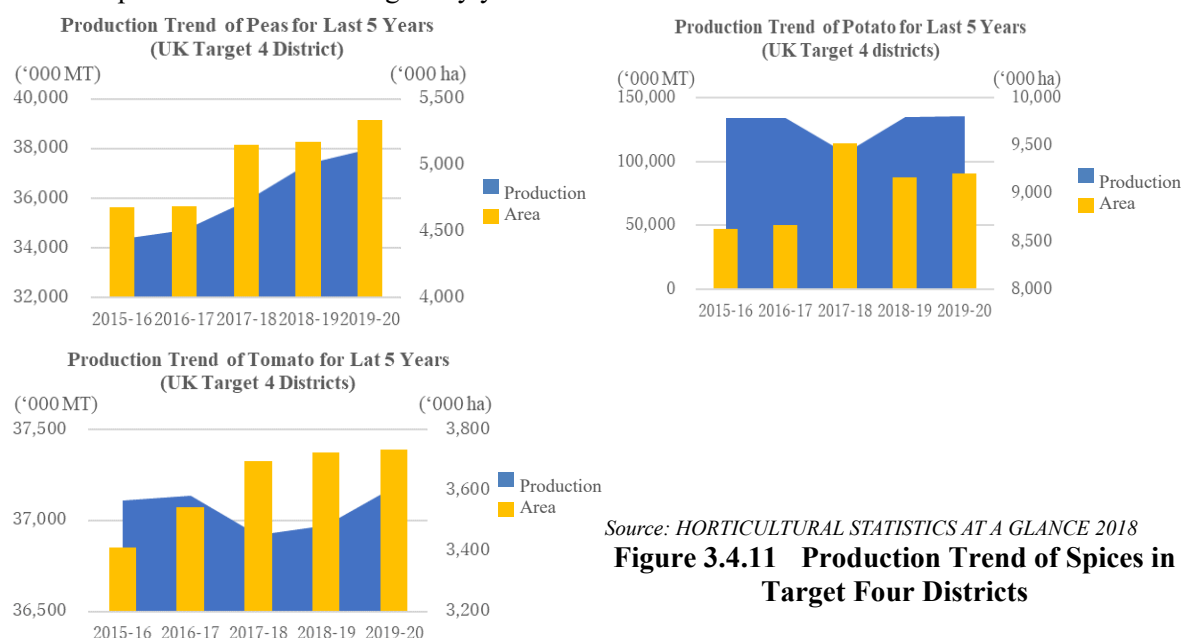
Figure 3.4.10 Production Trend of Flowers in India

(2) Production Trend of Uttarakhand

Transition of crop production is confirmed for target crops proposed in UKIHDP, namely, (1) vegetables: Peas, Potato, and Tomato; (2) fruits: apple, litchi, plum, peach, and walnuts; and (3) spices: turmeric, garlic and ginger. The trends were confirmed especially for the target districts of the Project, i.e., Nainital, Pithoragarh, Tehri Garwal, and Uttarkashi. In addition, flowers of gladiolus and rose are also confirmed in the transition. All listed crops are confirmed those increment of production area and amount including flowers based on the UKDHFP supplied crop production data. Trend of each listed crop is shown hereunder.

1) Production Trend of Vegetables in Uttarakhand

Pea production and area in the four districts are surely increasing year by year. In case of potato, the production area increased to more than double in 2017-18 while production decreased at the same year. The area of tomato production decreased in the succeeding year 2018-19 but production increased up to 2019-20 also. Tomato production of the four district is increasing every year except in 2017-18. Area of the tomato production is increasing every year in the four districts.



Source: HORTICULTURAL STATISTICS AT A GLANCE 2018

Figure 3.4.11 Production Trend of Spices in Target Four Districts

2) Production Trend of Fruits in Uttarakhand

Apple production decreased in 2017-18, 2018, and 2019, but production recovered in 2019-20 at the same level of 2017-18. Areas of apple orchards are increasing more than double of the 2017-18-19 to 2018-19. Litchi production and production area increased for three years from 2015-16 to 2017-18 and kept on increasing up to 2019-20.

Sweet orange production of the four districts is increasing although all Indian production is clearly decreasing. There are climatical advantages of the sweet orange production in the state. Walnut production area is increasing for the last five years.

Production trends of peach and plum are increasing every year except for peach which happened in 2017-18. On the other hand, the peach production obtained low yield in the succeeding years of 2018-19 to 2019-20. Plum production and the area are increasing every year.

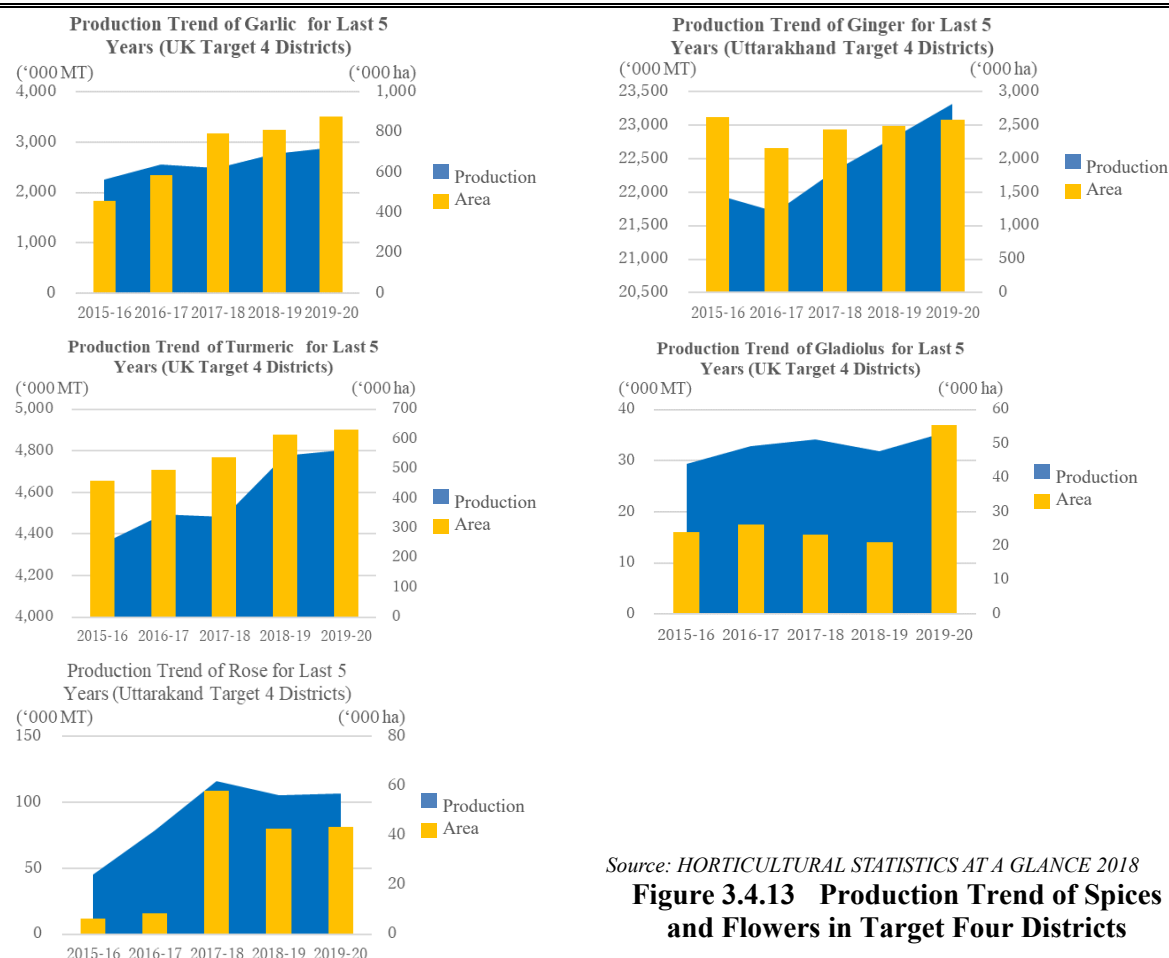


Source: HORTICULTURAL STATISTICS AT A GLANCE 2018

Figure 3.4.12 Production Trend of Fruits in Target Four Districts

3) Production Trend of Spices and Flowers in Uttarakhand

Garlic production is increasing every year in terms of area and production. During the last five years Madhya Pradesh (Ratlam, Ujjain, Mandsaur, Neemuch, Indore, etc.), Rajasthan (Kota, Baran, Jhalawar, Pratapgarh, Chittorgarh, etc.), and Gujarat also produced garlic. Ginger production and area decreased in 2016-17 after 2015-16. After the 2016-17, the production increases every year up to 2019-20 as well its yield. Turmeric production and area are also increasing every year. Production of gladiolus is limited to 20-30 ha and had increased more than 50 ha in year 2019-20. Also, rose production is limited to under 100 ha. Gladiolus production area was increased from 20 ha to more than 50 ha in year 2019-20. Similarly, rose production area was increased in 2015-16 from 10 ha scale to 50 ha. The change is not natural, probably some projects would like to look into this new production.



Source: HORTICULTURAL STATISTICS AT A GLANCE 2018

Figure 3.4.13 Production Trend of Spices and Flowers in Target Four Districts

3.4.9 Comparison of Crop Calendars between Uttarakhand and Competing States

(1) Current Crop Harvest Season of Target Districts in Uttarakhand

Current crop harvest seasons by month for target crops of each district are reported as shown in the table below.

1) Nainital

In this district, almost 1,800 ha is devoted for peach cultivation while harvest season is from May to July. Similarly, 1,800 ha is used for litchi cultivation and harvest season is from June to July. In Nainital almost 1,600 ha is cultivated for tomatoes and there are two peak seasons of May-June and November-January and two lean seasons of February-April and July-October. Harvesting of tomatoes is usually in the months of January and February. Almost 190 ha is used for garlic cultivation and harvesting is done in May.

2) Pithoragarh

In the district, almost 1,600 ha is cultivated for apple and harvesting is done from June to October, same season with Uttarkashi. Also 3,400 ha is used for sweet orange cultivation while harvest season is from December to February. Turmeric cultivation is almost 70 ha in Pithoragarh and harvesting is done in January and February. Almost 170 ha in the district is used for garlic cultivation and harvesting occurs in May.

3) Tehri Garhwal

In Tehri Garhwal District, almost 2,200 ha was for pea cultivation in 2019-20 and there are two peak harvest seasons in April to May and November to December and two lean seasons in January to February and June. Potato cultivation occupies almost 2,500 ha and harvesting occurs in July to August and

October to December while lean months start from January to March and May. Ginger cultivation used almost 1,500 ha and harvest season is from November to January.

4) Uttarkashi

In Uttarkashi District, almost 9,200 ha is reserved for apple orchard as reported in 2019-20 (same year hereunder for the production area in this section) and harvesting starts from June to October. Walnut cultivation utilized almost 1,500 ha and harvesting occurs in a short period from the end of September to beginning of November. Kiwifruits are harvested from November to December. Potato cultivation taken up almost 3,000 ha in the district and cropped almost year-round in the district. There are two peak seasons from July to August and from October to December, while lean season starts from January to March and May also.

	Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Nainital	Peach					L	L	P	P	P	L		
	Litchi						L	P	P	L			
	Tomato	P	L	L	L	P	P	L	L	L	L	P	P
	Garlic					P	P						
	Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pithoragarh	Apple						L	P	P	P	L	L	
	Citrus (Sweet Orange)	P	P										P
	Turmeric	L	P	P	L								
	Garlic					P	P						
	Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tehri Garhwal	Plum						L	P	P	L			
	Peas	L	L		P	P	L					P	P
	Potato	L	L	L		L		P	P		P	P	P
	Ginger	P	L									L	P
												P	P
	Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Uttarkashi	Apple						L	P	P	P	L	L	
	Walnut									L	P	P	L
	Kiwifruits											L	P
	Potato	L	L	L		L		P	P		P	P	P

Source: JICA Survey Team

Note: L: Leaning time for harvest; P: Peak time for harvest

Figure 3.4.14 Crop Production Trend in Target Four Districts

(2) Major Crop Harvest Season of Competing State of the Target Crops

Indian Horticulture Database 2013 is sharing harvest season / months of crops and referred orange and apple as fruits and tomato and potato for vegetables. Harvest month of each crop at each state in India is shown in Attachment 3.4.3.

1) Harvest Season of Orange and Apple

Harvest season of all citrus varieties in all India and majority of the harvest months start in December and end in April. During this season, 66% of oranges are harvested. The major fruit varieties in season would be orange, mandarin, and sweet orange, those are competing cultivars of sweet orange of Uttarakhand. For the remaining season, the balance of 34% of other citrus varieties such as pomelo can be harvested from January to February and from August to September.

Harvest season of citrus varieties (sweet orange) in Uttarakhand would be the same with other orange varieties of competing state. However, Pithoragarh District is situated in higher elevation from almost 450 m – 2,500 m so the temperature condition especially at night-time is different. Since the sweet orange in Pithoragarh must have advantage for quality.

Apple production is reported by the four states of Jam & Kashmir, Himachal Pradesh, Uttarakhand, and Arunachal Pradesh. It is reported that the harvest season of apple starts in July and ends in October in Jammu and Kashmir and Himachal Pradesh, and August to October for Uttarakhand by Indian Horticulture Database. While UKHFPD reported that the harvest season of apple in Pithoragarh and Uttarkashi starts in July up to October. Apple harvest season differs usually by varieties. However, the

varieties of Jam & Kashmir, Himachal Pradesh, and Uttarakhand are not reported as well. There are early, medium, and late harvest season of apple varieties and harvest time also differs.

Harvest season of other target fruits such as peach, plum, kiwifruits, or walnuts is not specified in the report. There is not much difference on the harvest season among the production states since climate conditions are the same. Further survey will be continued for detailed planning attaining the cluster development.

2) Harvest Season of Tomato, Potato and Peas

Tomato is the crops cultivated all year-round and monthly production amount is almost same for 12 months in India. Tomatoes of Nainital District are also harvested all year-round and peak months are from May to July and November to January. Wholesale price of tomatoes during May to July is cheaper than the average while prices rose in November to January.

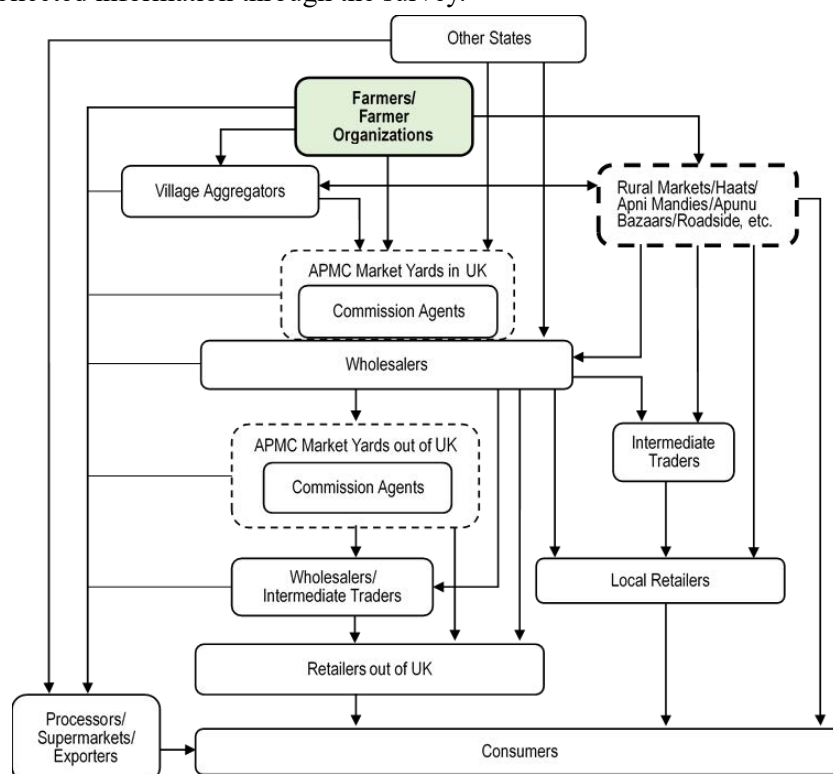
All Indian potatoes are harvested almost all year-round and 50% of the total are harvested for four straight months from December to March. Uttarakhand harvests potatoes also all year-round and the peak month starts from July to December, however, it is different with other states.

All Indian peas are also year-round crop but mainly harvested from December to March while in other season harvest is decreasing. Himachal Pradesh is one of leading states of peas production, and harvests its peas almost all year-round with peak harvest months between July and August. Uttarakhand (Tehri Garhwal District) peas peak harvest months are in April to May and November and December, whereas lean harvest months are after the peak months.

3.5 Supply Chain of Vegetables and Fruits in Uttarakhand

3.5.1 Overview of the Supply Chain

The supply chain of agricultural produce in India is characterized by a segmented structure. The supply chain involves various kinds of intermediaries in its multi-layered structure. It is reported that vegetables and fruits must pass five to six different distribution channels from the farm gates to the consumers on average. The figure below outlines the distribution channels of vegetables and fruits in Uttarakhand based on the collected information through the survey.



Source: The JICA Survey Team

Figure 3.5.1 Distribution Channels of Horticultural Produce in Uttarakhand

According to the farm-household survey carried out by the Japan International Cooperation Agency (JICA) Survey Team, rural markets are the most popular marketing place of horticultural produce for farmers in UKIHDP target four districts. In rural areas in India, traditionally/voluntary emerged markets are held weekly, every two weeks, etc., depending on the local circumstances in a certain open space in rural hub villages/towns. Such markets get to be called in different names depending on the area and function. They are usually managed by a community council, a cooperative or trusted individual entrepreneurs, while an administrative facilitation is provided in some cases. Farmers, especially in remote areas far distant from a permanent market, have an opportunity to sell their produce not only directly to consumers, but also to local retailers, village aggregators, wholesalers, intermediate traders, etc., as shown in the figure.

3.5.2 Distribution of Horticultural Produce

Reliable statistical information on the distribution of horticultural produce in Uttarakhand, e.g., supply-demand, distributed amount by major supply channels, etc., is not available in Uttarakhand Department of Horticulture and Food Processing (UKDHFP) and other concerned agencies. An estimation is made based on collected information from experienced personnel in marketing the produce as shown in Table 3.5.1, such as ex-officers of DHFP, respective APMCs, etc., for the second-best option. The estimation is summarized as shown below.

Table 3.5.1 Informants of Horticultural Produce Market Status in Uttarakhand

No	District	Designation
1	Dehradun	Secretary, APMC Dehradun
2	U S Nagar	Secretary, APMC Rudrapur
3	U S Nagar	Secretary, APMC Rudrapur
4	Nainital	Mandi Inspector, APMC Haldwani
5	Champawat	Mandi Inspector, APMC Tanakpur
6	Nainital	Mandi Inspector, APMC Ramnagar
7	Dehradun	Retired Officer, District Horticulture Office
8	Uttarkashi	Officer, District Horticulture Office
9	Nainital	Officer District Horticulture Office
10	U S Nagar	Employee, Cold Storage Company
11	U S Nagar	Employee, Cold Storage Company
12	Uttarkashi	Employee, Apple Distribution Company
13	U S Nagar	Employee, Frozen Produce Company
14	Pauri Garhwal	Assistant Manager, ILSP-IFAD
15	Pithoragarh	District Project Manager, ILSP-IFAD

Source: The JICA Survey Team

The estimation reveals that Uttarakhand State has a shortage in most of the major vegetables, contrary to fruits. It is estimated that not a small percentage of the state demand for major vegetables are being fulfilled by the produce from other states. The self-sufficiency rate might be relatively low for onion, potato, and tomato, which are the best three common and popular vegetables among the Indian people.

Table 3.5.2 Estimated Market Supply and Distribution of Major Horticultural Produce in Uttarakhand (in %)

No	Crops	Supply (inflow)		Total	Distribution (outflow)	
		Produced in UK State	From Other States		Markets in UK State	To Other States
1	Cabbage	35	65	100	80	20
2	Cauliflower	30	70	100	80	20
3	Onion	10	90	100	90	10
4	Peas	40	60	100	35	65
5	Potato	25	75	100	85	15
6	Tomato	25	75	100	85	15
7	Garlic	60	40	100	80	20
8	Ginger	80	20	100	65	35
9	Turmeric	65	35	100	60	40
10	Apple	55	45	100	40	60
11	Litchi	55	45	100	45	55
12	Mango	40	60	100	65	35
13	Peach	70	30	100	45	55
14	Pear	60	40	100	55	45

No	Crops	Supply (inflow)		Total	Distribution (outflow)	
		Produced in UK State	From Other States		Markets in UK State	To Other States
15	Plum	80	20	100	45	55

Note: Surplus crops with colored marks

Source: The JICA Survey Team made based on the collected information

The above table shows that all horticultural produce are dynamically traded in both the inflow and outflow across state borders, even though there is a surplus produce, such as apple which is the most famous fruits produce in Uttarakhand. The following table shows inflow origins and outflow destinations of selected vegetables and apple marketed in the state. Delhi and Uttar Pradesh are the major origins of produce as well as destinations. Markets in both states may function as a large consuming market, as well as a hub connecting Uttarakhand and other states in the whole India.

Table 3.5.3 Inflow Origins and Outflow Destinations of Major Horticultural Produce in Uttarakhand

No.	Produce	Inflow Origins	Outflow Destinations
1	Cabbage	Uttar Pradesh, Punjab, and Delhi	Delhi, Uttar Pradesh, and Punjab
2	Cauliflower	Uttar Pradesh, Punjab, and Delhi	Delhi, Uttar Pradesh, and Punjab
3	Onion	Uttar Pradesh, Delhi, and Madhya Pradesh	Uttar Pradesh
4	Peas	Uttar Pradesh, Delhi, and Gujarat	Delhi, Uttar Pradesh, and Punjab
5	Potato	Uttar Pradesh, Delhi, and Punjab	Delhi and Uttar Pradesh
6	Tomato	Uttar Pradesh and Punjab	Delhi and Uttar Pradesh
7	Garlic	Uttar Pradesh and Delhi	Delhi, Uttar Pradesh, and Haryana
8	Ginger	Uttar Pradesh and Delhi	Delhi, Maharashtra, and Gujarat
9	Turmeric	Uttar Pradesh, Haryana, and Delhi	Delhi, Maharashtra, and Karnataka
10	Apple	Himachal Pradesh and Jammu Kashmir	Delhi, Uttar Pradesh, and Maharashtra
11	Litchi	Uttar Pradesh and Delhi	Delhi, Haryana, and Punjab
12	Mango	Uttar Pradesh, Delhi, and Punjab	Delhi and Uttar Pradesh
13	Peach	Himachal Pradesh	Delhi, Uttar Pradesh, and Gujarat
14	Pear	Jammu Kashmir and Himachal Pradesh	Delhi, Haryana, and Maharashtra
15	Plum	Jammu Kashmir and Himachal Pradesh	Delhi, Uttar Pradesh, and Haryana

Source: The JICA Survey Team based on the collected information

The farm-household survey carried out by the JICA Survey Team implies that a small percentage of the locally produced horticultural crops are marketed in the UKIHDP target four districts, since many of the farmers interviewed do not often sell their produce in the markets. It is probable that farmers in the districts grow crops mainly for self-consumption and sell the surplus if it happens. Only a limited number of the farmers would be involved in commercial production of limited crops.

3.5.3 APMC Market Model and APMC Mandi

The GOI urged respective state governments to implement APMC Acts to frame rules and enforce them to protect farmers from exploitation by intermediaries in the supply chain. Most of the state governments have established their own APMC Act during 1960-70. The stated APMC Acts have aimed at regulating, controlling, and monopolizing the agricultural market, while the contents differ slightly from state to state.

Under the APMC Acts, the whole geographical area is divided and declared as a market area wherein the markets are managed by the Agricultural Produce Marketing Committee (APMC) constituted by the state governments. All agricultural produce except for national strategic food commodities procured by the government were transacted only in markets approved by APMC ("APMC markets" or "APMC *mandi*"). Farmers were not allowed to sell their produce outside the designated APMC *mandi*. No marketing and processing industries in the agricultural sector could procure raw materials directly from the farmers.

Operation system of APMC *mandi* is much like the system of Japanese public wholesale markets. All commodities are basically auctioned at APMC *mandi* before distribution. Commission agents (CAs) who are private intermediators located in APMC *mandi* are mandated to organize a public auction. In this way, CAs are engaged in consignment sales by playing a role in mediating the auction with a commission, CAs in APMC *mandi* charge the commission on the sales, which ranges from 1% to 2.5% in food grains and 4% to 8% in case of fruits and vegetables. APMCs are authorized to collect market

fee from the buyers/traders on the sale of notified agricultural produce in lieu of the services provided by APMCs. The market fee is usually from 1% to 2%.

GOI had formulated the Model APMC Act 2003 as the standard legal frame for the state governments to overcome the stagnation of the APMC market model. The Model Act allowed wider options for the marketing as mentioned below.

- Facilitating contract farming mode
- Special market for perishables
- Allowing farmers and private persons to set up their own market
- Relaxation of licensing norms
- Single market fee
- APMC revenue to be used for improving market infrastructure

However, not all states have passed the bill. Some states have passed but neither framed rules nor notified it. In Uttarakhand, farmers are free to sell their produce anywhere without entering in APMC *mandi* at present. Traders and wholesalers are directly reaching to farmers without any legal restrictions.

3.5.4 Status of APMC *Mandi* in Uttarakhand

(1) APMC *Mandi* Staffs

In Uttarakhand state, the APMC Act has come into effect in 2011. There are 23 principal markets, 30 submarkets and 27 weekly markets for marketing of agricultural produce as shown in Table 3.5.4. Not only the state lacks in number of APMC *mandies* but also it lacks proper facilities therein. Further, the principal markets are largely located in mainly five districts, i.e., Nainital, Udham Singh Nagar, Champawat, Dehradun, and Haridwar in the plain regions. Many farmers in the hill regions of the state have difficulty in accessing to APMC *mandi*.

Among the 23 principal markets, no APMC staff is allocated to five principal markets. According to collected information, the five markets hire temporary staff when necessary. It implies that the five markets and some others which have only a few staffs would function seasonally. Haldwani in Nainital and Dehradun are called as terminal markets, since they play a leading role in functioning APMC *mandi* system in Kumaon Division and Garhwal Division, respectively.

Table 3.5.4 APMC *Mandies* and the Number of Staffs Allocated

No.	District/APMC	Principal Market	No. of Sub-market	No. of Weekly Market	No. of Staff
1	Nainital	1.1 Haldwani	5	1	34
		1.2 Ramnagar	2	4	14
2	Udham Singh Nagar	2.1 Rudrapur	4	0	20
		2.2 Kashipur	0	1	17
		2.3 Jaspur	0	3	9
		2.4 Sitarganj	1	1	14
		2.5 Nanakmatta	0	0	7
		2.6 Khatima	0	2	17
		2.7 Kichha	0	0	14
		2.8 Gadarpur	1	3	12
		2.9 Bazpur	2	2	17
3	Champawat	3.1 Tanakpur	3	0	0
4	Dehradun	4.1 Dehradun	2	1	23
		4.2 Vikashnagar	0	3	4
		4.3 Chakrata	1	3	0
		4.4 Rishikesh	0	1	5
5	Haridwar	5.1 Manglore	2	0	4
		5.2 Lakshar	4	0	0
		5.3 Haridwar	1	2	7
		5.4 Roorkee	1	0	5
		5.5 Bhagwanpur	0	0	0
6	Pauri Garhwal	6.1 Kotdwar	1	0	0
7	Chamoli	7.1 Karanprayag	0	0	2
Total		23	30	27	225

Source: Uttarakhand Agricultural Produce Marketing Board (UKAPMB)

In addition to the markets listed in Table 3.5.4, several APMCs are managing additional market facilities, namely, Collection Centers and Apunu Bazaars as shown in Table 3.5.5. Some of them are in a district where APMC *mandi* is not existing.

Table 3.5.5 Additional Market Facilities Operated by APMCs

No.	District/APMC	Principal Market	Collection Center	Apunu Bazaar
1	Nainital	Haldwani	10	3
2	Champawat	Tanakpur	3	1
3	Dehradun	Dehradun	2	3
4	Pauri Garhwal	Kotdwar	1	0
5	Chamoli	Karanprayag	1	0

Source: Uttarakhand Agricultural Produce Marketing Board (UKAPMB)

The Collection Center is an aggregation point of agricultural produce with storage facility at the village level. An APMC *mandi* provides a common marketing facility for farmers who intend to sell their produce through the APMC *mandi* without any charge. The APMC *mandi* is directly responsible for the operation and maintenance.

Apunu Bazaar is a marketing place for farmers to sell their produce directly to consumers. They are generally established in remote locations where APMC *mandi* is far away from farmers. They open daily, weekly, fortnightly, or monthly depending on the local circumstances. Basic infrastructure facilities of Apunu Bazaar are usually boundary wall, market platform, toilet and water facility, and shed house. Farmers can use Apunu Bazaar without any levy and are free to set their own prices for their produce. Respective APMC *mandi* is responsible to ensure the smooth operation of Apunu Bazaar.

Among the four target districts of UKIHDP, three districts, namely: Pithoragarh, Tehri Garhwal, and Uttarkashi do not have APMC *mandi* facilities in their territories. The farm-household survey has revealed that many farmers have difficulty of long distance transportation in their marketing practice. Popular APMC *mandies* for farmers in the three districts are shown in Table 3.5.6.

Table 3.5.6 Familiar Mandies for Farmers in Three Target Districts of UKIHDP

No	District	Familiar Mandies
1	Pithoragarh	Tanakpur (Champawat), Khatima (Udham Singh Nagar)
2	Tehri Garhwal	Rishikesh (Dehradun), Dehradun (Dehradun), Haridwar (Haridwar)
3	Uttarkashi	Dehradun (Dehradun), Vikashnagar (Dehradun), Rishikesh (Dehradun)

Source: Uttarakhand Agricultural Produce Marketing Board (UKAPMB)

(2) Facilities in APMC Mandi

Major facilities of principal markets of APMC are outlined in Table 3.5.7. Most of the principal markets have relatively large space and are facilitated with water and electricity supply. However, some of them do not have basic facilities necessary for daily market transactions, e.g., parking area, auction shed/hall, loading platform, and bank/ATM. The markets are also not well equipped with storage facilities including cold/CA storages. Waste/garbage management is the most serious issue of many APMCs according to interviews with them. Followed by unavailability of grading and packing facilities and storage/cold storage facilities in managing the principal markets. Traffic jam, no parking area, small space for the market operation and no bank/ATM facilities are the third issues. APMCs need to invest more heavily in market facilities in order to attract many market intermediaries and farmers to activate the market transactions.

Cold storage facilities installed in APMC principal markets are intended for the users to store perishable produce with a storage fee. In addition to the cold storage facilities in the table, there are two cold storages established by UKAPMB in Rudrapur, Udham Singh Nagar District (100 MT) and Narendra Nagar, Tehri Garhwal District (250 MT). According to collected information, these are leased out to the private sector due to lack of human resources of APMC.

Table 3.5.7 Major Facilities of APMC Principal Markets

District /APMC	Principal Market		Major Facilities									
			Land Area	Parking Area	Auction Shed/Hall	Loading Platform	Weigh Bridge	Banks /ATM	Ordinary Storage	Cold/CA Storage	Water Supply	Electric Supply
			m ²	m ²	m ²	Yes/No	No.	No.	m ²	m ²	Yes/No	Yes/No
Nainital	1.1	Haldwani	NA	NA	NA	Yes	2	3	NA	0	Yes	Yes
	1.2	Ramnagar	83,568	0	1,108	No	1	0	1,092	0	Yes	Yes
Udham Singh Nagar	2.1	Rudrapur	56,657	5,931	3	Yes	1	0	0	0	Yes	Yes
	2.2	Kashipur	183,955	0	yes (NA)	Yes	2	NA	7	11	Yes	Yes
	2.3	Jaspur	38,379	0	2,568	No	2	0	1,305	0	Yes	Yes
	2.4	Sitarganj	119,666	950	2,736	Yes	2	0	4,688	843	Yes	Yes
	2.5	Nanakmatta	20,073	0	300	No	1	0	0	0	Yes	Yes
	2.6	Khatima	78,023	540	2,112	Yes	1	0	27,052	0	Yes	Yes
	2.7	Kichha	169,968	8,000	3,000	Yes	1	0	0	NA	Yes	Yes
	2.8	Gadarpur	7,082	0	0	No	0	0	0	NA	Yes	Yes
	2.9	Bazpur	129,502	yes (NA)	yes (NA)	Yes	1	0	0	0	Yes	Yes
Champawat	3.1	Tanakpur	62,500	100	35	No	0	0	100	0	Yes	Yes
Dehradun	4.1	Dehradun	70,739	0	NA	NA	2	1	13,282	NA	Yes	Yes
	4.2	Vikashnagar	140,920	1,000	300	Yes	1	0	100	0	Yes	Yes
	4.3	Chakrata	18,211	400	0	No	0	0	0	0	No	No
	4.4	Rishikesh	18,211	545	12	No	1	1	0	0	Yes	Yes
Haridwar	5.1	Manglore	209,198	0	80	Yes	1	1	1,500	25 MT	Yes	Yes
	5.2	Lakshar	17,200	0	0	No	1	0	0	0	Yes	Yes
	5.3	Haridwar	64,751	0	0	No	3	1	97	0	Yes	Yes
	5.4	Roorkee	47,000	0	0	No	1	0	0	0	Yes	Yes
	5.5	Bhagwanpur	4,510	0	yes (NA)	No	0	0	0	0	Yes	Yes
Paudi	6.1	Kotdwar	29,660	0	960	No	1	0	0	0	Yes	Yes
Chamoli	7.1	Karanprayag	4,800	120	1	No	4	0	7,200	0	Yes	Yes

Source: Uttarakhand Agricultural Produce Marketing Board (UKAPMB)

(3) Market Intermediaries in APMC Mandi

APMCs have a registration system of market intermediaries doing business in their market facilities as shown in Table 3.5.8. Most market intermediaries registered are categorized into the “wholesaler-cum-commission agent (CA)”. They have a dual function in the supply chain. They sometimes play a role of CA while they also sometimes play a role of wholesaler in transactions in APMC *mandies*. They play different roles based on their business occasion. According to collected information, most wholesaler-cum-CAs place much importance on the role of wholesaler rather than the role of CA in Uttarakhand. This means that they quite often transact agricultural produce without organizing a public auction as stated in APMC Acts.

Table 3.5.8 Registered Market Intermediaries in APMC Mandies

No	District /APMC	Principal Market		Number of Registered Market Intermediaries				
				Wholesaler cum CA	Wholesaler	Commission Agent (CA)	Retailer	Transporter
1	Nainital	1.1	Haldwani	665	0	0	0	0
		1.2	Ramnagar	247	83	23	87	2
2	Udham Singh Nagar	2.1	Rudrapur	261	0	0	0	0
		2.2	Kashipur	233	135	29	0	3
		2.3	Jaspur	127	0	3	0	0
		2.4	Sitarganj	124	0	0	0	0
		2.5	Nanakmatta	55	0	0	0	0
		2.6	Khatima	201	0	0	0	0
		2.7	Kichha	120	60	41	87	1
		2.8	Gadarpur	132	0	0	0	0
		2.9	Bazpur	116	0	0	0	0
3	Champawat	3.1	Tanakpur	13	0	0	0	0
4	Dehradun	4.1	Dehradun	716	4	46	0	1
		4.2	Vikashnagar	166	0	0	0	0
		4.3	Chakrata	18	0	0	0	0
		4.4	Rishikesh	101	2	1	0	0
5	Haridwar	5.1	Manglore	158	0	0	0	0
		5.2	Lakshar	41	0	0	0	0
		5.3	Haridwar	497	52	14	248	8
		5.4	Roorkee	268	10	0	0	0

No	District /APMC	Principal Market		Number of Registered Market Intermediaries				
				Wholesaler cum CA	Wholesaler	Commission Agent (CA)	Retailer	Transporter
		5.5	Bhagwanpur	149	6	0	0	0
6	Paudi	6.1	Kotdwar	74	0	0	0	0
7	Chamoli	7.1	Karanprayag	18	0	0	0	0
Total				4,500	352	157	422	15

Source: Uttarakhand Agricultural Produce Marketing Board (UKAPMB)

According to the findings of the JICA Survey Team discussed in Attachment 3.5.1, they procure horticultural produce directly from local farmers, via village aggregators sometimes, or from other APMC *mandies* located in and outside Uttarakhand. The wholesaler-cum-CAs marketing vegetables tend to procure the produce often from local farmers while the wholesaler-cum-CAs marketing fruits tend to procure the produce often from other APMC *mandies*. They usually provide an advance payment or a credit to familiar farmers although other convenience, i.e., market information, technical assistance and farm inputs arrangements are almost not provided. Such reality implies that the relationship between the wholesaler-cum-CAs and farmers might be a patron-client relationship rather than an equal partnership. Transformation from the patron-client relationship to an equal partnership should be a critical challenge to liberalize and vitalize the agricultural produce supply chain as GOI envisaged.

(4) Issues in APMC *Mandi* Management

The following frustrations against the management of APMC *mandies* are soon to emerge among farmers, as well as the market intermediaries.

- Fewer and fragmented APMC *mandies*
- Inadequate or poor condition of the infrastructures
- High and vague market fee or charges and intermediation costs
- Imposed restriction in licensing
- Asymmetrical market information

Major reasons behind the complaints are widely recognized that there are a lot of inefficient and opaque operations in APMC *mandies* caused by vested interests and cozy relationships among stakeholders. The APMC model has not been able to deal with a dynamic change of agricultural supply chain to the expansion of area and diversification. It is reported that the APMC market model guided by the intervention of the state governments is not necessarily performing the originally expected roles in protecting farmer interests.

3.5.5 Transaction Volume of Horticultural Produce in APMC *Mandi*

The following table shows transacted volume of selected horticultural produce in APMC *mandies* in Uttarakhand based on GOI's database of Agmaknet. It is generally considered that a substantial percentage of marketed vegetables and fruits is distributed through APMC *mandies*, although no statistical data is available.

Table 3.5.9 Transacted Volume of Selected Horticultural Produce in APMC *Mandi* in Uttarakhand in 2015-2019 (Ave.)

District	Volume/Share	Cabbage	Cauli-flower	Onion	Peas (wet)	Potato	Tomato	Garlic	Ginger (Green)	Turmeric
Nainital	Volume (ton/year)	7,156.44	618.84	8,930.53	36.58	32,674.82	14,648.84	122.98	116.04	1.37
	Share in UK (%)	(60.1)	(4.7)	(19.0)	(0.1)	(26.7)	(32.6)	(17.7)	(5.3)	(5.6)
U. S. Nagar	Volume (ton/year)	485.28	1,135.90	2,993.66	4,555.22	13,155.58	1,355.49	59.22	83.58	5.84
	Share in UK (%)	(4.1)	(8.6)	(6.4)	(7.8)	(10.7)	(3.0)	(8.5)	(3.8)	(24.1)
Champawat	Volume (ton/year)	340.20	12.80	70.78	9.40	100.12	70.30	0.00	323.90	0.38
	Share in UK (%)	(2.9)	(0.1)	(0.2)	(0.0)	(0.1)	(0.2)	(0.0)	(14.8)	(1.6)
Dehradun	Volume (ton/year)	3,595.78	8,235.12	27,318.89	53,632.54	51,039.18	25,176.63	467.71	1,618.71	3.14
	Share in UK (%)	(30.2)	(62.1)	(58.0)	(91.5)	(41.7)	(56.1)	(67.2)	(73.7)	(12.9)

District	Volume/ Share	Cabbage	Cauli- flower	Onion	Peas (wet)	Potato	Tomato	Garlic	Ginger (Green)	Turmeric
Haridwar	Volume (ton/year)	336.56	2,931.72	7,565.24	362.88	24,823.62	3,472.02	45.86	53.14	13.52
	Share in UK (%)	(2.8)	(22.1)	(16.1)	(0.6)	(20.3)	(7.7)	(6.6)	(2.4)	(55.8)
Garhwal (Pauri)	Volume (ton/year)	0.00	337.04	235.62	0.00	690.68	184.16	0.00	0.00	0.00
	Share in UK (%)	(0.0)	(2.5)	(0.5)	(0.0)	(0.6)	(0.4)	(0.0)	(0.0)	(0.0)
All UK State	Volume (ton/year)	11,914.26	13,271.42	47,114.72	58,596.62	122,484.00	44,907.44	695.77	2,195.37	24.25
	Share in UK (%)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

District	Volume/ Share	Apple	Citrus	Kiwifruit	Litchi	Mango	Peach	Pear	Plum	Walnut
Nainital	Volume (ton/year)	2,976.16	NA	NA	206.28	5,786.94	4,509.46	6,319.50	378.52	NA
	Share in UK (%)	(12.7)	-	-	(24.0)	(27.0)	(97.8)	(86.2)	(97.6)	-
U. S. Nagar	Volume (ton/year)	2,055.08	NA	NA	42.90	1,570.16	18.48	62.81	5.48	NA
	Share in UK (%)	(8.8)	-	-	(5.0)	(7.3)	(0.4)	(0.9)	(1.4)	-
Champawat	Volume (ton/year)	249.96	NA	NA	21.40	182.80	0.00	428.40	0.00	NA
	Share in UK (%)	(1.1)	-	-	(2.5)	(0.9)	(0.0)	(5.8)	(0.0)	-
Dehradun	Volume (ton/year)	15,242.44	NA	NA	521.22	9,767.45	40.70	37.82	0.76	NA
	Share in UK (%)	(65.1)	-	-	(60.5)	(45.6)	(0.9)	(0.5)	(0.2)	-
Haridwar	Volume (ton/year)	2,460.32	NA	NA	63.42	3,895.16	42.02	486.62	3.00	NA
	Share in UK (%)	(10.5)	-	-	(7.4)	(18.2)	(0.9)	(6.6)	(0.8)	-
Garhwal (Pauri)	Volume (ton/year)	438.68	NA	NA	5.68	235.00	0.00	0.00	0.00	NA
	Share in UK (%)	(1.9)	-	-	(0.7)	(1.1)	(0.0)	(0.0)	(0.0)	-
All UK States	Volume (ton/year)	23,422.65	NA	NA	860.90	21,437.51	4,610.66	7,335.15	387.76	NA
	Share in UK (%)	(100.0)	-	-	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	-

Note: NA = No data found

Source: <https://agmarknet.gov.in/>

APMC *mandi* system is working in six districts out of the 13 districts in Uttarakhand according to the transaction record. It is apparent that marketing of horticultural produce in the districts on the Himalayan hill side depends much on APMC *mandies* in districts on the plain side. Nainital and/or Dehradun districts have a large share of transaction except for turmeric. APMC *mandies* in both districts function as the distribution hub of horticultural produce in the eastern part (Kumaon Division) and in the western part (Garhwal Division), respectively. Detailed information of the transaction volume is shown in Attachment 3.5.2.

3.5.6 Market Price of Vegetables and Fruits in APMC *Mandi*.

Market prices of the selected horticultural produce in APMC *mandies* in Uttarakhand are discussed below based on GOI's database of Agmaknet. Table 3.5.10 shows correlation between the price changes and the market arrival changes of each selected produce with several related information. Vegetable crops have several patterns of correlation probably influenced by their different supply chain status. The price gap between the minimum price and the maximum price is about 200% or more, except for potatoes. Spice crops, i.e., garlic, ginger, and turmeric do not have the correlation. The price gap is less than the gap of vegetable crops. Fruits crops have a remarkably short arrival season to *mandies* except for several small exemption cases, probably due to their short harvesting season and perishability (and/or undeveloped cold chain technology). The price gap is higher than vegetable crops because of high price of off-season arrival (inflow from other states or imported). Apple is an exemption fruit crop as it has a relative long-term arrival season and a smaller price fluctuation compared with other fruit crops. A detailed discussion for each produce is made in Attachment 3.5.2.

Table 3.5.10 Patterns of the Price Changes in APMC Mandi in Uttarakhand

No.	Crop	Correlation with the Arrival Changes	Seasonal Difference (State Average)		
			Min (INR/kg)	Max (INR/kg)	Max/Min (%)
1	Cabbage	Simply inverse	4.9	9.7	198.0
2	Cauliflower	Simply inverse	4.8	12.0	250.0
3	Onion	Little inverse	8.7	21.5	247.1
4	Peas (wet)	No	9.4	21.9	233.0
5	Potato	Little inverse	5.0	7.7	154.0
6	Tomato	No	7.7	15.9	206.5
7	Garlic	No	26.5	38.2	144.2
8	Ginger	No	23.6	30.4	122.8
9	Turmeric	No	44.8	72.9	162.7
10	Apple	Inverse	31.0	42.9	138.4
11	Citrus	NA	NA	NA	NA
12	Kiwifruit	NA	NA	NA	NA
13	Mango	Simply inverse	12.3	40.0	325.2
14	Pear	Simply inverse	4.5	14.5	322.2
15	Peach	Simply inverse	11.3	24.0	212.4
16	Plum	Simply inverse	14.1	40.0	277.8
17	Lichi	No	26.6	35.6	133.8
18	Walnut	NA	NA	NA	NA

Source: The JICA Survey Team based on information from <https://agmarknet.gov.in/>

3.5.7 Transaction in APMC Mandi in Delhi

The following table shows transacted volume of selected horticultural crops in APMC mandies in NCT Delhi including Azadpur Market.

Table 3.5.11 Transacted Volume of Selected Horticultural Produce in APMC Mandi in NCT Delhi in 2015-2019

No	Crop	2015	2016	2017	2018	2019	Average
1	Cabbage	63,647.67	67,870.62	53,617.78	61,487.43	51,100.34	59,544.77
2	Cauliflower	88,229.33	84,191.55	85,882.88	87,748.20	73,647.91	83,939.97
3	Onion	346,544.19	389,150.44	387,076.98	386,066.42	363,661.83	374,499.97
4	Peas (wet)	34,287.81	51,061.87	54,740.07	57,963.95	53,143.76	50,239.49
5	Potato	502,611.11	544,561.13	551,366.48	556,189.04	508,267.75	532,599.10
6	Tomato	205,978.62	256,039.99	223,786.32	267,885.46	237,941.70	238,326.42
7	Garlic	NA	NA	NA	NA	NA	NA
8	Ginger (Green)	80,529.30	84,978.60	94,618.80	85,763.70	76,335.40	84,445.16
9	Turmeric	NA	NA	NA	NA	NA	NA
10	Apple	596,166.50	498,921.60	700,818.90	498,177.40	535,739.70	565,964.82
11	Citrus	NA	NA	NA	NA	NA	NA
12	Kiwifruit	NA	NA	NA	NA	NA	NA
13	Litchi	NA	NA	NA	NA	NA	NA
14	Mango	158,252.00	157,123.00	157,059.60	165,056.10	140,291.15	155,556.37
15	Peach	NA	NA	NA	NA	NA	NA
16	Pear	NA	NA	NA	NA	NA	NA
17	Plum	NA	NA	NA	NA	NA	NA
18	Walnut	NA	NA	NA	NA	NA	NA

Note: NA = No data found

Source: <https://agmarknet.gov.in/>

Among spices and fruits, no data is available for many crops. The reason is probably considered that the transaction volume of those crops is minimal or none. An extensive distribution network connected with APMC mandies in NCT Delhi is not well developed for the crops due to probably the following reasons:

- Limited production in a limited area and difficult to transport for long distance (maybe for fruits)
- Most part of the harvest is consumed locally due to self-sufficient nature (maybe for spices)
- Alternative supply chain excluding APMC mandies is dominant (processing, direct selling, etc.)

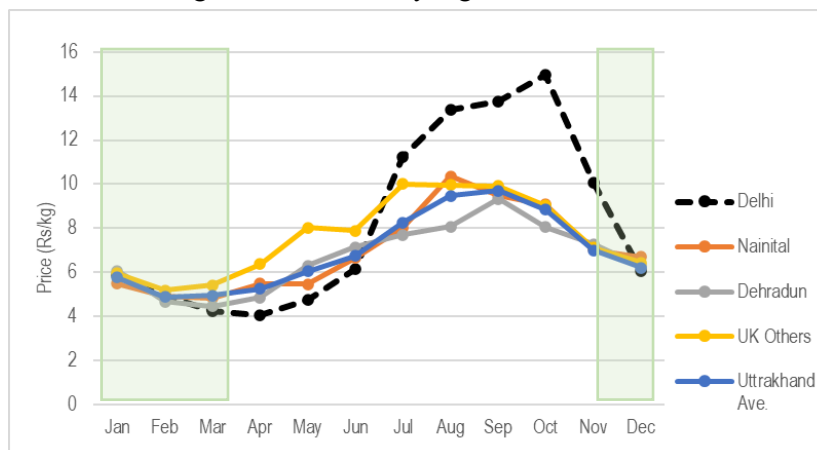
3.5.8 Influence APMC Mandi in Delhi on Uttarakhand Market

Price changes in APMC mandies in Uttarakhand and in APMC mandies in NCT Delhi are compared for selected horticultural produce to find relationships among them. As limitation of data availability in Agmarknet, only nine produce, namely: cabbage, cauliflower, onion, peas, potato, tomato, ginger, and

apple are chosen for the comparison. In general, the APMC *mandies* in both areas are bound up each other as almost crops share a similar pattern of the price changes.

(1) Cabbage

The price changes show a similar pattern in all areas, while the price increases much during July-October in NCT Delhi. The price gap among all areas is minimal during December-March when corresponds with the high-arrival season and main harvesting season in the plain regions in Uttarakhand. It is probable that cabbage produced in Uttarakhand is not marketed to NCT Delhi, except during August – September, when is the harvesting season in the hilly regions in Uttarakhand.



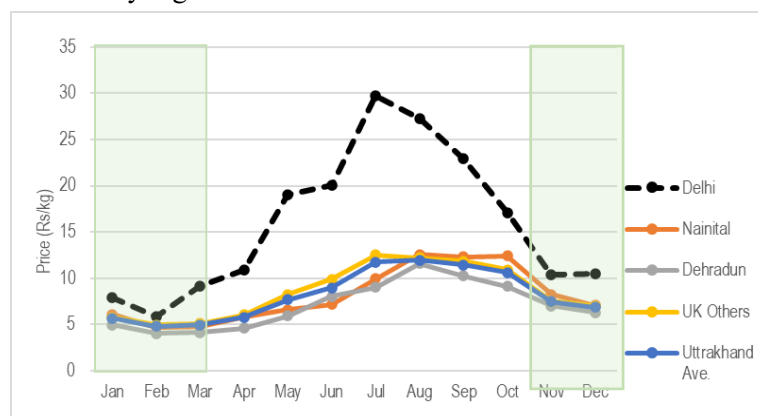
Note: Shaded months are high-arrival months in APMC mandi in Uttarakhand

Source: <https://agmarknet.gov.in/>

Figure 3.5.1 Price Changes of Cabbage in Uttarakhand and NCT Delhi

(2) Cauliflower

The price changes show a similar pattern in all areas, while the price is much higher during May-September in NCT Delhi. The price gap among all areas is, however, small during November-March when corresponds with the high-arrival season and the main harvesting season in plain regions in Uttarakhand. It is probable that a limited volume of cauliflower produced in Uttarakhand is marketed to NCT Delhi in December and March. Also, a certain volume is marketed during June-August when it is the harvesting season in the hilly regions in Uttarakhand.



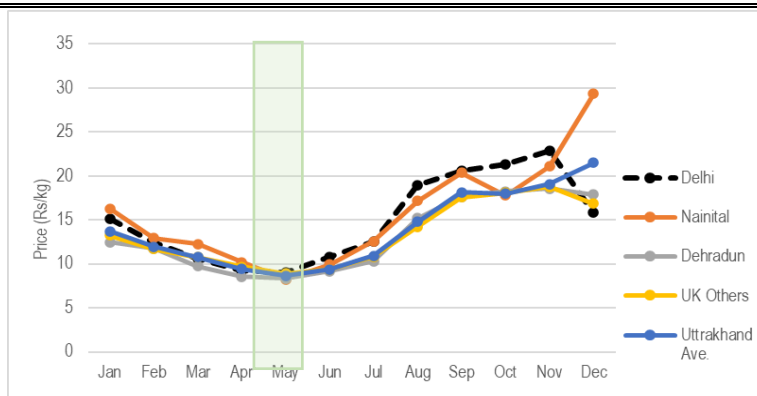
Note: Shaded months are high-arrival months in APMC mandi in Uttarakhand

Source: <https://agmarknet.gov.in/>

Figure 3.5.2 Price Changes of Cauliflower in Uttarakhand and NCT Delhi

(3) Onion

The price changes show a similar pattern in all areas and the price gap among all areas is small throughout the year. It is probable that onion is commonly marketed throughout the year in a diverse distribution network connecting the whole country.

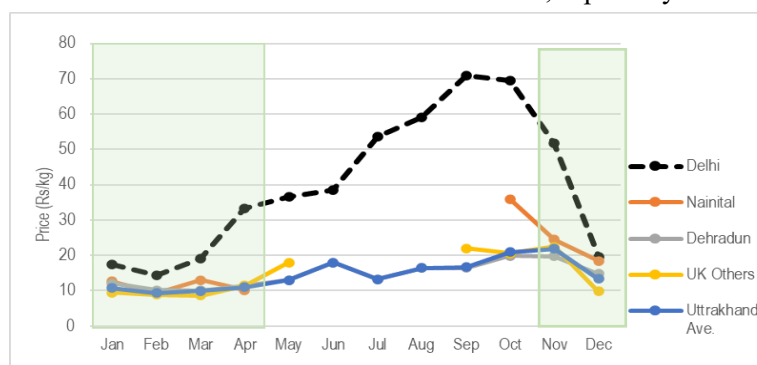


Note: Shaded month is high-arrival month in APMC mandi in Uttarakhand
Source: <https://agmarknet.gov.in/>

Figure 3.5.3 Price Changes of Cauliflower in Uttarakhand and NCT Delhi

(4) Peas

The price changes are not similar between Uttarakhand and NCT Delhi. The annual price changes in NCT Delhi are dynamic while the changes in Uttarakhand are relatively stable. There is a substantial price gap in the beginning and at the end of the high-arrival season. The former corresponds with the early harvesting season in the plain regions, while the latter is the late harvesting season in the plain regions and early harvesting season in the hilly regions in Uttarakhand. It is probable that a substantial volume of peas produced in Uttarakhand is marketed to NCT Delhi, especially in November and April.

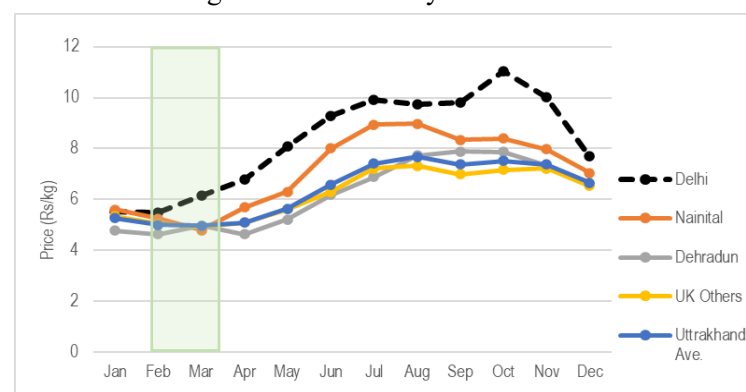


Note: Shaded months are high-arrival months in APMC mandi in Uttarakhand
Source: <https://agmarknet.gov.in/>

Figure 3.5.4 Price Changes of Peas (Wet) in Uttarakhand and NCT Delhi

(5) Potato

Like onions, the price changes show a similar pattern in all areas and the price gap among all areas is small throughout the year. It is probable that potatoes are commonly marketed throughout the year in a diverse distribution network connecting the whole country.

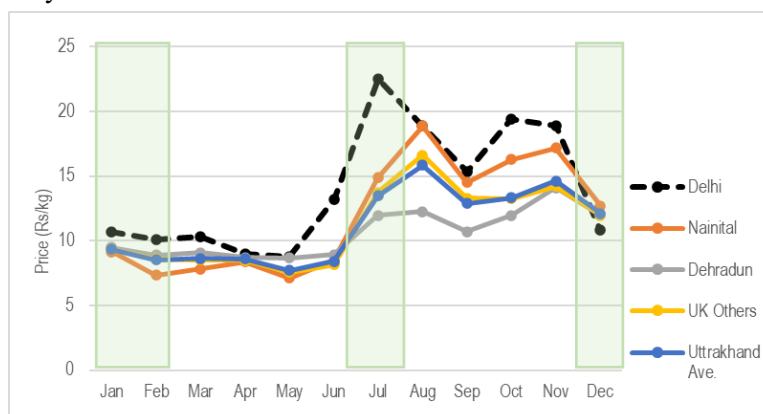


Note: Shaded months are high-arrival months in APMC mandi in Uttarakhand
Source: <https://agmarknet.gov.in/>

Figure 3.5.5 Price Changes of Potato in Uttarakhand and NCT Delhi

(6) Tomato

The price changes show a similar pattern in all areas, while the price in NCT Delhi is higher during June-July and October-November. The price gap among all areas is, however, small during December-February when corresponds with the high-arrival season and the main harvesting season in plain regions in Uttarakhand. A substantial price gap between Uttarakhand and NCT Delhi is recorded in July in another high-arrival season when corresponds with the harvesting season in the hilly regions in Uttarakhand. It is probable that a large volume of tomato produced in the hilly regions is marketed to NCT Delhi around July.



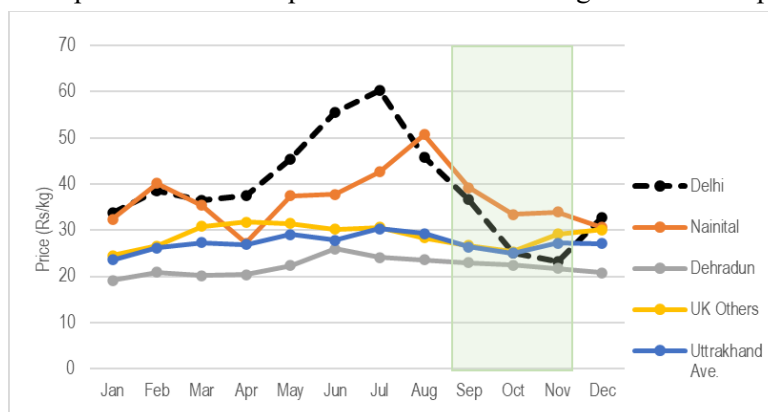
Note: Shaded months are high-arrival months in APMC mandi in Uttarakhand

Source: <https://agmarknet.gov.in/>

Figure 3.5.6 Price Changes of Tomato in Uttarakhand and NCT Delhi

(7) Ginger

The price changes are not similar between Uttarakhand and NCT Delhi. The annual price changes in NCT Delhi are dynamic while the changes in Uttarakhand are relatively stable, except in Nainital. The price is always higher in NCT Delhi except in the price bottom season around November. The bottom price season corresponds with high-arrival season in Uttarakhand and harvesting season in the hilly regions. It is probable that a certain volume of ginger produced in Uttarakhand is marketed to NCT Delhi mainly during March–April when it corresponds with the harvesting season in the plain regions.



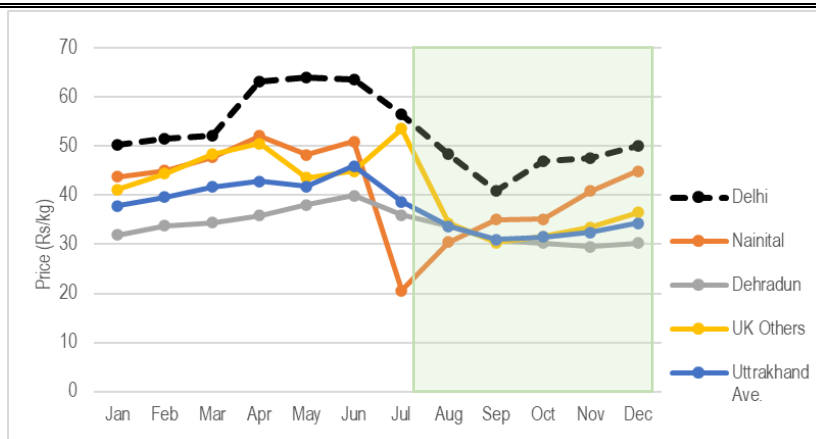
Note: Shaded months are high-arrival months in APMC mandi in Uttarakhand

Source: <https://agmarknet.gov.in/>

Figure 3.5.7 Price Changes of Ginger in Uttarakhand and NCT Delhi

(8) Apple

The price changes show a similar pattern in all areas, while the price in NCT Delhi is always higher and shows relatively dynamic changes. It is probable that a substantial volume of apple produced in Uttarakhand is marketed to NCT Delhi.



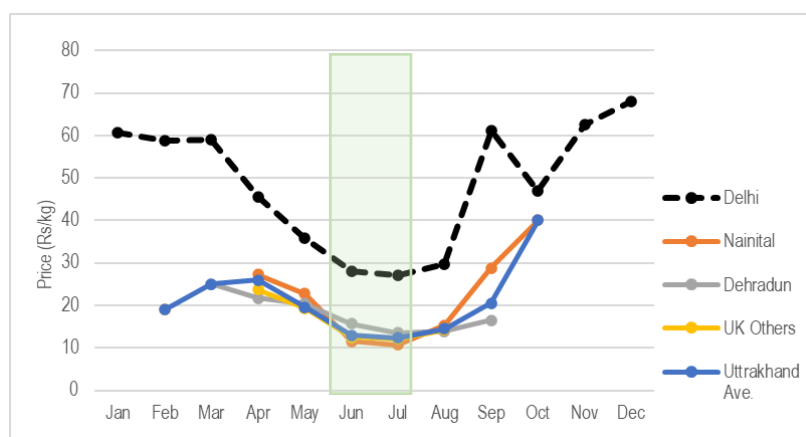
Note: Shaded months are high-arrival months in APMC mandi in Uttarakhand

Source: <https://agmarknet.gov.in/>

Figure 3.5.8 Price Changes of Ginger in Uttarakhand and NCT Delhi

(9) Mango

The price changes show a similar pattern in all areas, while the price in NCT Delhi is always higher throughout the year. Difference from apple, the high-arrival season is short in Uttarakhand due to the short harvesting season and perishable nature of fruits. It is probable that a substantial volume of mango produced in Uttarakhand is marketed to NCT Delhi during the high-arrival season.



Note: Shaded months are high-arrival months in APMC mandi in Uttarakhand

Source: <https://agmarknet.gov.in/>

Figure 3.5.9 Price Changes of Mango in Uttarakhand and NCT Delhi

3.5.9 Demand Forecast of Horticultural Produce and Promising Crops

(1) Demand Forecast

Future demand for agricultural crops in a certain area is theoretically estimated using the following information, which covers at least over the last decade continuously.

- Consumption of the said produce
- Income (GDP) per capita
- Population

The demand is forecasted by analyzing the correlation between the consumption and the gross domestic product (GDP), and between forecasted trend of the population and the GDP. Availability of reliable information on the consumption of produce is always a bottleneck to estimate the demand, especially for a crop other than the essential food like ordinary vegetables and fruits, even in countries which have a sophisticated statistical information system.

A country-wise information of the consumption (supply) is available in FAO's database, i.e., FAOSTAT (<http://www.fao.org/faostat/en/#data>), although the information only covers limited agricultural crops.

Table 3.5.12 and 3.5.13 show available information concerned in FAOSTAT. Figure 3.5.10 shows indexes of the information to compare their trend in a decade (2009–2018).

Table 3.5.12 Per Capita Supply of Horticultural Produce in India 2009-2018 (unit: kg/year)

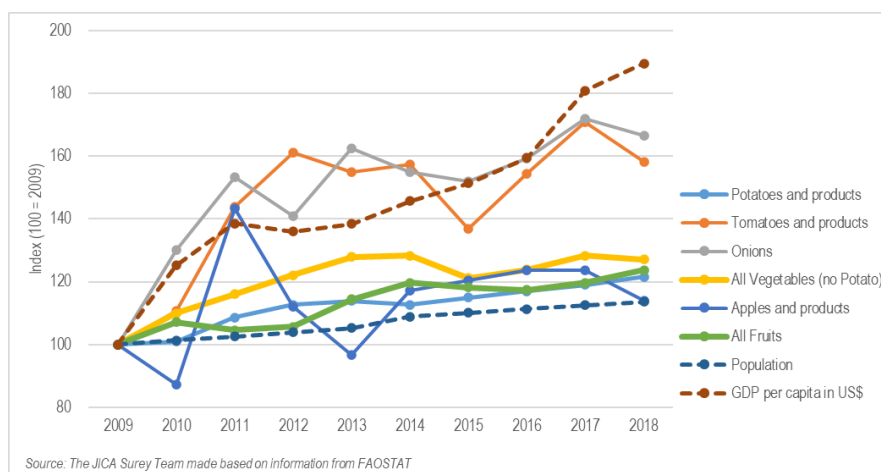
Crops	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Potatoes and products	21.43	21.63	23.27	24.14	24.40	24.14	24.64	25.08	25.50	26.04
Tomatoes and products	8.35	9.24	12.01	13.45	12.93	13.15	11.44	12.89	14.27	13.20
Onions	8.30	10.79	12.72	11.69	13.48	12.86	12.61	13.21	14.27	13.83
All vegetables (no Potato)	69.38	76.29	80.53	84.72	88.71	89.05	84.08	85.96	89.00	88.15
Apples and products	1.57	1.37	2.25	1.76	1.52	1.84	1.89	1.94	1.94	1.79
All fruits	49.24	52.76	51.50	52.00	56.37	58.93	58.17	57.80	58.90	60.95

Source: FAOSTAT

Table 3.5.13 Population and Per Capita GDP in India 2009-2018

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Population (x 1,000)	1,190,138	1,205,625	1,221,156	1,236,687	1,252,140	1,295,601	1,310,152	1,324,517	1,338,677	1,352,642
GDP per capita (USD)	1,083	1,356	1,501	1,473	1,499	1,579	1,640	1,727	1,960	2,053

Source: FAOSTAT



Source: FAOSTAT

Figure 3.5.10 Per Capita Consumption, Per Capita GDP and Population Index (100 = 2009)

The above figure shows the following trend in India in 2009-2018.

- Population has steadily increased (about 14% in a decade).
- Per Capita GDP (income) has highly increased (about 90% in a decade).
- Per Capita Consumption of all vegetables (no potato) and that of all fruits have steadily increased, although income elasticities of them are becoming low and likely to remain on a plateau after 2014.
- Per Capita Consumptions of tomato and that of onion have increased in parallel with the income growth, while the consumption of both crops has shown a modest increase in the recent year.

The following table compares per capita consumption of selected vegetables and fruits between India and neighboring countries in 2018. While the consumption level differs from the country to country, India seems to reach a higher level of consumption among the countries. It is probable that the consumption level will not increase remarkably even though the present high economic growth continues in the country.

Table 3.5.14 Per Capita Consumption in India and Neighbor Countries in 2018

Country	GDP per Capita (USD)	Per Capita Consumption (kg/year)					
		Potato and Products	Tomato and Products	Onions	All Vegetables (Except Potato)	Apples and Products	All Fruits
India	2,050.55	26.04	13.2	13.83	61.12	1.79	29.29
Nepal	995.10	84.38	0.45	4.30	130.80	3.44	26.83
Pakistan	1,338.98	13.46	3.15	8.74	13.69	2.83	13.75
Bangladesh	1,670.80	51.66	2.18	11.77	20.54	1.19	18.01
Sri-Lanka	4,165.38	9.69	4.43	15.75	31.59	1.30	23.83
Myanmar	1,370.69	6.07	0.10	17.21	66.46	0.39	22.89
Malaysia	11,377.57	14.42	5.21	16.64	46.93	3.40	13.18
Japan	38,952.21	18.51	6.95	10.62	75.35	5.36	10.98

Source: FAOSTAT

The following comprehensive future demand for vegetables and fruits in India is forecasted with the above analysis.

- The total demand continuously increases mainly with the increase of the population (forecasted at 8.4% in 2021-31, Report of the Technical Group on Population Projections, Census of India), as income elasticities of vegetables and that of fruits have been static for several years and the per capita consumption level has been to a certain high level compared with neighboring countries.
- The total demand of tomato and onion will be influenced much by the economic growth in the foreseeable future, probably in parallel with the increased demand for meat.
- The market demand gradually shifts to diversification and quality-oriented.

(2) Potential Scarcity and Surplus Horticulture Produce in Uttarakhand

When examining the marketability of a crop, scarcity and surplus are major discussion points. A high local market demand is expected if scarcity of crop supply is experienced in the area. On the contrary, high sales potential to outside areas is expected if a crop has high surplus beyond the needs of the people in an area.

The next table shows a trial calculation of the scarcity and surplus of major horticultural crops in Uttarakhand. As reliable statistical information to estimate the deficiency and surplus is not available in Uttarakhand, the crops listed in the table are categorized into three groups in the following manner with an available information.

- Potential deficient crops (per capita production in Uttarakhand is less than 50% of the national per capita production)
Carrot, chili, eggplant onion, garlic, turmeric, banana, kiwifruit, and sweet orange
- Potential surplus crops (per capita production in Uttarakhand is more than 200% of the national per capita production)
Beans, capsicum, peas, radish, ginger, apple, peach, pear, plum, litchi, and walnut
- Potential balanced crops: other than the above crops

Table 3.5.15 Potential Deficient and Surplus Horticulture Crops in Uttarakhand

No.	Crop	Production in Uttarakhand (Population: 11 million)		Production in India (Population: 1,380 million)		Per Capita Production (UK/India)
		Total (ton)	Per Capita (kg)	Total (ton)	Per Capita (kg)	
1	Beans	40,220	3.66	2,276,950	1.65	222%
2	Cabbage	67,890	6.17	9,037,340	6.55	94%
3	Capsicum	15,700	1.43	325,680	0.24	605%
4	Carrot	0	0	1,648,250	1.19	0%
5	Cauliflower	41,970	3.82	8,668,220	6.28	61%
6	Chili (green)	0	0	3,592,170	2.60	0%
7	Egg plant	31,340	2.85	12,800,770	9.28	31%
8	Okra	26,100	2.37	6,094,940	4.42	54%
9	Onion	44,090	4.01	23,262,330	16.86	24%
10	Peas	93,400	8.49	5,422,140	3.93	216%

No.	Crop	Production in Uttarakhand (Population: 11 million)		Production in India (Population: 1,380 million)		Per Capita Production (UK/India)
		Total (ton)	Per Capita (kg)	Total (ton)	Per Capita (kg)	
11	Potato	362,160	32.92	51,310,010	37.18	89%
12	Radish	59,900	5.45	3,061,290	2.22	245%
13	Tomato	103,850	9.44	19,759,320	14.32	66%
14	Garlic	2,170	0.20	1,610,620	1.17	17%
15	Ginger	19,070	1.73	1,118,160	0.81	214%
16	Turmeric	1,740	0.16	1,132,720	0.82	19%
17	Apple	58,660	5.33	2,326,900	1.69	316%
18	Banana	NA	NA	30,807,500	22.32	0%
19	Kiwifruit	0	0	10,650	0.01	0%
20	Peach	57,930	5.27	107,190	0.08	6780%
21	Pear	78,780	7.16	322,240	0.23	3067%
22	Plum	36,160	3.29	82,120	0.06	5524%
23	Lichi	18,700	1.70	497,300	0.36	472%
24	Sweet orange	0	0	3,265,830	2.37	0%
25	Mango	152,710	13.88	21,822,320	15.81	88%
26	Walnut	21,170	1.92	299,710	0.22	886%

Source: Horticultural Statistics at a Glance 2018, Ministry of Agriculture & Farmers' Welfare, GOI. APEDA Agri Exchange/National Horticulture Board

(3) Popular Horticulture Produce in Uttarakhand

The JICA Survey Team carried out a series of interview surveys with market intermediaries, retailers and restaurants/holes in Uttarakhand in June 2021. The survey findings are discussed in Attachments 3.5.1 and 3.5.3. According to the interview surveys, the informants considered the following vegetables and fruits as promising crops:

<Market intermediaries in APMC Mandies>

Vegetables: Beans, capsicum, peas, potato, and tomato

Fruits: Apple, banana, citrus, peach, and mango

<Retailers and restaurants/hotels>

Vegetables: Beans, capsicum, cauliflower, onion, peas, and potato

Fruits: Apple, banana, citrus, and mango

(4) Popular Horticulture Produce in Delhi Market

Familiar horticultural produce for commission agents, wholesalers, and retailers in Delhi are onion, potato, and tomato among vegetables; and apple, banana and mango among fruits; according to a market survey result carried out by the JICA Survey Team in June 2021. The market intermediaries said that those crops have constant demand almost throughout a year as popular food items for the people. The crops must be base commodities for running daily business of many market intermediaries in Delhi.

Table 3.5.16 shows the demand for major horticulture produces in Delhi Market envisaged by the market intermediaries. The table shows that Delhi Market has a high demand for almost major horticultural commodities except for eggplant, okra and radish. This means that Delhi Market is still expanding and diversifying due to concentration of the population and has a big capacity to absorb various kind of horticultural produce, if the price and quality are reasonably balanced. The table also shows a prospective demand for the horticultural produce in the market. A lot of market intermediaries are expecting a high potential of increased market demand for several spices (garlic, ginger, and turmeric), which receive a wide recognition as having medicinal benefits, and fruits (apple, kiwifruit and mango) in the future. They consider that the demand for vegetables does not have a high potential to increase in future although it keeps a steady trend. Exotic vegetables like broccoli, bell pepper (colored), lettuce, etc., are, however, in the spotlight recently influenced by a health-conscious diet trend in line with the economic growth.

The following horticultural crops are relatively highlighted as promising crops by the informants considering the market circumstances.

Vegetables and Spices: Broccoli, capsicum, onion, potato, tomato, and garlic

Fruits: Apple, banana, citrus, kiwifruit, litchi, and mango

Table 3.5.16 Demand of Horticultural Produce in Delhi Market

No.	Crop	Present Demand		Future Demand		No Answer /No Idea	Total Answers
		High	No-high	Increase	No-change		
1	Cabbage	7	2	4	5	6	15
2	Capsicum	9	0	5	4	6	15
3	Cauliflower	7	2	2	7	6	15
4	Chili (red)	7	2	0	9	6	15
5	Egg plant	4	5	0	9	6	15
6	French beans	7	2	3	6	6	15
7	Onion	9	1	3	7	5	15
8	Okra	3	6	0	9	6	15
9	Peas	8	1	2	7	6	15
10	Potato	9	1	3	7	5	15
11	Radish	0	9	0	9	6	15
12	Tomato	8	1	3	6	6	15
13	Garlic	10	0	8	2	5	15
14	Ginger	9	0	8	1	6	15
15	Turmeric	9	1	9	1	5	15
16	Apple	12	0	10	2	3	15
17	Apricot	10	2	2	10	3	15
18	Citrus	10	2	5	7	3	15
19	Kiwi fruit	10	1	11	0	4	15
20	Litchi	10	0	4	6	5	15
21	Mango	11	0	8	3	4	15
22	Peach	11	1	1	11	3	15
23	Pear	11	0	3	8	4	15
24	Plum	11	0	2	9	4	15
25	Walnut	7	1	6	2	7	15

Source: Market Survey, The JICA Survey Team, June 2021

Table 3.5.17 shows the popularity of major horticultural crops from Uttarakhand in Delhi Market recognized by interviewed market intermediaries in the market survey. Garlic and turmeric, and selected seasonal fruits such as apricot, litchi, peach, and plum are well recognized by them, while no vegetables are included in the well-recognized commodities. The unfortunate thing is that apple, which is a representative horticultural produce from Uttarakhand, is not included in the commodities. Questionnaire and findings of the market survey in Delhi are shown in Attachments 3.5.4 and 3.5.5, respectively.

Table 3.5.17 Popularity of Horticultural Produce from Uttarakhand in Delhi Market

No	Crop	High	So-so	No/Less	No Answer	Total
1	Cabbage	1	7	1	6	15
2	Capsicum	1	7	1	6	15
3	Cauliflower	0	6	3	6	15
4	Chili (red)	5	3	0	7	15
5	Eggplant	0	3	6	6	15
6	French beans	0	2	6	7	15
7	Onion	0	1	8	6	15
8	Okra	0	0	8	7	15
9	Peas	6	3	0	6	15
10	Potato	4	6	0	5	15
11	Radish	0	2	6	7	15
12	Tomato	3	5	1	6	15
13	Garlic	10	0	0	5	15
14	Ginger	1	8	0	6	15
15	Turmeric	10	0	0	5	15
16	Apple	4	9	1	1	15
17	Apricot	13	0	0	2	15
18	Citrus	0	6	7	2	15
19	Kiwi fruit	0	11	2	2	15
20	Litchi	13	0	0	2	15
21	Mango	3	7	3	2	15

No	Crop	High	So-so	No/Less	No Answer	Total
22	Peach	11	2	0	2	15
23	Pear	0	9	4	2	15
24	Plum	12	0	0	3	15
25	Walnut	0	2	8	5	15

Source: Market Survey, The JICA Survey Team, June 2021

Many of the interviewed market intermediaries in the market survey suggested that Uttarakhand should pay more attention in increasing the volume of the marketed produce through increased production, as well as improvement in the quality of produce, especially by replacing old varieties of fruits with new ones (see table below). Many of them indicated that the quality of the produce from Uttarakhand is usually inferior compared with the produce from Himachal Pradesh and Jammu Kashmir in terms of taste, appearance, damage, and size. They, however, consider that Uttarakhand has a potential of early harvesting because of its advantageous agro-climate conditions over Himachal Pradesh and Jammu Kashmir.

Table 3.5.18 Suggestions to Uttarakhand Horticultural Produce to Gain Better Value

No.	Suggestion	Number
1	Increased volume of the marketed produce	9
2	Introduce new varieties/crops	8
3	Quality improvement	3
4	Improve logistics/transportation	2

Source: Market Survey, The JICA Survey Team, June 2021

Improvement of the postharvest handling and treatment system such as careful sorting and packaging and handling are other critical technical issues to be addressed since many of the interviewed market intermediaries are concerned about damages of horticultural produce due to rough handling and mixture of various sizes, shapes, and maturity degrees in a lot of produce.

(5) Promising Horticultural Crops to be Produced in Uttarakhand

Promising crops highlighted in the series of surveys carried out in Uttarakhand and Delhi are shown in Table 3.5.19.

Table 3.5.19 Promising Horticultural Crops

No.	Crops	Uttarakhand		Delhi	Possible Scarcity/ Surplus in Uttarakhand
		Market Intermediaries	Retailers and Restaurants /Hotels	Market Intermediaries	
1	Beans	Yes	Yes	No	Surplus
2	Broccoli	No	No	Yes	-
3	Capsicum	Yes	Yes	Yes	Surplus
4	Cauliflower	No	Yes	No	Almost Balanced
5	Onion	No	Yes	Yes	Scarce
6	Peas	Yes	Yes	No	Surplus
7	Potato	Yes	Yes	Yes	Almost Balanced
8	Tomato	Yes	No	Yes	Almost Balanced
9	Garlic	No	No	Yes	Scarce
10	Apple	Yes	Yes	Yes	Surplus
11	Banana	Yes	Yes	Yes	Scarce
12	Citrus	Yes	Yes	Yes	Scarce
13	Kiwifruit	No	No	Yes	Scarce
14	Litchi	No	No	Yes	Surplus
15	Peach	Yes	No	No	Surplus
16	Mango	Yes	Yes	Yes	Almost Balanced

Source: The JICA Survey Team

The crops are categorized into the following groups according to their potential market and production status.

Table 3.5.20 Categorization of the Promising Horticultural Crops

No	Potential Markets and Production Status	Crops
1	Promising in Uttarakhand & Delhi markets and production surplus	Capsicum, Apple
2	Promising in Uttarakhand & Delhi markets and insufficient production or almost balanced	Onion, Potato, Tomato, Banana, Citrus, Mango
3	Promising in Delhi Market and insufficient production	Litchi
4	Promising in Delhi Market and insufficient production	Broccoli, Garlic, Kiwifruit
5	Promising in Uttarakhand market and production surplus	Beans, Peas, Peach
6	Promising in Uttarakhand market and production almost balanced	Cauliflower

Source: The JICA Survey Team

It seems that a marketing strategy would be effectively applied for promoting sales of capsicum, apple and litchi, while increase in production would be still an essential challenge for promoting broccoli, onion, potato, tomato, garlic, citrus, kiwifruit, and mango.

3.5.10 eNAM (National Agriculture Market) and Quality Standards

eNAM is a platform for e-trading of agricultural produce aiming at networking APMC *mandies* in the whole country to develop a nationwide agricultural market. The ultimate goals are providing adequate choices of marketing to farmers and reducing transaction costs through streamlined distribution channels in the supply chain. eNAM was launched in April 2016 under the strong direction of the Prime Minister. The Small Farmers Business Consortium (SFAC) is the lead agency for the implementation under the aegis of the Ministry of Agriculture and Farmers' Welfare.

eNAM also discloses detailed quality standards of major agricultural products in its website (<https://enam.gov.in/web/commodity/commodity-quality>)¹⁹. Each product on the website is graded into three classes in accordance with the stated quality requirements. The eNAM standards cover 40 kinds of vegetables and 29 kinds of fruits. However, it is reported that eNAM still needs to build a workable system at the field level by facilitating necessary equipment and manpower. Further, it is recommendable that the present quality standard parameters should be reviewed in accordance with local requirements. A workable system for horticultural crops should be localized at the primary marketing stage in the beginning, as quality parameters for the crops, different from those of cereals and pulses, much vary with varieties, local preference, purposes to use, etc. Then, different local standard parameters shall be gradually integrated with integration of different markets. The following figure shows the typical procedure of eNAM transaction practiced in APMC *mandies*:



Source: Preparatory Survey on Himachal Pradesh Crop Diversification Project Phase-II (HPCDP II) in the Republic of India, Final Report, JICA, March 2021

Figure 3.5.11 eNAM Transaction Procedure

In Uttarakhand, there are only 16 APMC *mandies* in four districts connected with the eNAM portal at present (see the following table).

Table 3.5.21 eNAM Connected APMC Mandi in Uttarakhand

District	No.	eNAM APMC Mandi
Nainital	2	Haldwani, Ramnagar
Udham Singh Nagar	9	Rudrapur, Kashipur, Jaspur, Sitarganj, Nanakmatta, Khatima, Kichha, Gadarpur, Bazpur
Dehradun	3	Dehradun, Vikashnagar, Rishikesh
Haridwar	2	Haridwar, Roorkee

Source: Reply to Questionnaire, UKAMB

¹⁹ There is another quality standards system employed on agricultural products in India, named AGMARK, which is legally enforced by Agricultural Produce (Grading and Marking) Act, 1937 (amended in 1986), while eNAM standards system is not. Quality parameters of AGMARK cover wide range of quality aspects, e.g., hygiene, packaging, labelling, etc., in addition to physical parameters.

According to the information from UKAPMB, there are the following difficulties in operation eNAM system at present. Consequently, farmers and traders continue to have a limited awareness about eNAM trading, and they are stuck in the accustomed trade practices.

- A lot size is too small to sell on eNAM, as most of the farmers are marginal and small in Uttarakhand
- Value of the produce is too low to take it to a bank account
- Farmers prefer cash payment (cash on delivery system)
- Lack of manpower to operate and to maintain the entire eNAM process

The core reason of the issues is probable that the present eNAM system does not fit the requirement of the farmers and traders. There are a lot of challenges to be addressed at the field level, although the promotion of e-trading of agricultural produce is an expected centerpiece of GOI's agricultural market reform policy. As APMCs alone cannot address the issues on the lot size and the online payment system, GOI and state governments need a steady and long-term approach to overcome the issues including review and adjustment of the present eNAM system.

3.5.11 Value Change of Vegetables and Fruits

(1) Postharvest Losses

There are a number of literatures reporting that quantitative and qualitative losses of vegetables and fruits after the harvest are relatively high in India. The Concept Note of Uttarakhand Integrated Horticulture Development Project (UKIHDP) prepared by the Department of Horticulture and Food Processing, Government of Uttarakhand, stated that the extent of postharvest losses of fruits and vegetables in Uttarakhand ranges between 10% and 40%.

A study to examine the nature and extent of postharvest losses in vegetable supply chain was made in Kumaon Division of Uttarakhand in 2008-09. Table 3.5.22 shows aggregated postharvest losses of major vegetables obtained through the study. The losses assessed by a similar study in Varanasi District in Uttar Pradesh are also included in the table for comparison.

Table 3.5.22 Total Postharvest Losses of Vegetables in Uttarakhand

No.	Vegetable	Losses (%)							
		Kumaon Division, Uttarakhand				Varanasi District, Uttar Pradesh			
		Grower	Wholesale (Storage)	Retail	Total	Grower	Wholesale	Retail	Total
1	Cabbage	5.33	-	3.32	8.65	5.45	-	2.80	8.25
2	Capsicum	4.59	-	5.84	10.43	9.09	-	5.84	14.95
3	Cauliflower	8.27	-	5.16	13.43	7.84	-	3.94	11.78
4	Chili	9.89	-	6.86	16.75	9.09	-	6.00	15.09
5	Egg plant	11.00	-	5.81	16.81	9.57	-	5.71	15.28
6	French bean	11.06	-	5.67	16.73	NA	NA	NA	NA
7	Okra	8.54	-	7.09	15.63	11.16	-	6.64	17.80
8	Onion	5.95	3.50	4.32	13.77	NA	NA	NA	NA
9	Pea	10.06	-	6.31	16.37	7.78	-	5.27	13.05
10	Potato	6.94	5.00	4.94	16.88	NA	NA	NA	NA
11	Radish	3.89	-	2.63	6.52	7.43	-	5.25	12.68
12	Tomato	15.16	-	8.03	23.19	14.31	-	7.70	22.01

Source: *Economic Analysis of Postharvest Losses in Marketing Vegetables in Uttarakhand*, Agricultural Economic Research Review, January 2011 (<https://www.researchgate.net/publication/227365154>)

Extent of Physical Postharvest Losses of Important Vegetables of Varanasi in Uttar Pradesh, International Journal of Agricultural Science and Research (IJASR), Vol 5, Issue 5, Oct 2015, 139-146

The above table reveals that the postharvest losses in Uttarakhand are around 15%-17% in general, while they range from 6.52% of Radish to 23.19% of Tomato. The figures of Uttar Pradesh show the same range of losses as the losses in Uttarakhand. The result seems to be less than the losses reported in many concerned papers and perception generally among most persons concerned in India. Considering the nature of supply chain of vegetables and fruits in India which involves various kinds and lots of small-scale market intermediaries in its multi-layered structure, the actual losses must be higher than the figures in the table, probably at least 5%-10% higher by estimation. The table also reveals that the losses at grower level is obviously higher than the losses at wholesale and retail levels except for capsicum in Uttarakhand.

Table 3.5.23 and 3.5.24 show the postharvest losses in Uttarakhand in different stages at grower level and at retail level, respectively.

Table 3.5.23 Postharvest Losses of Vegetables at Grower Level in Uttarakhand

No.	Vegetables	Losses (%)				
		Harvesting	Grading and Packing	Handling and Transport	Marketing	Total
1	Cabbage	1.68	1.46	0.98	1.22	5.33
2	Capsicum	1.93	0.89	1.78	-	4.59
3	Cauliflower	1.38	2.82	2.46	1.60	8.27
4	Chili	3.17	1.63	4.56	0.53	9.89
5	Egg plant	4.50	6.00	0.50	-	11.00
6	French bean	3.86	0.80	5.89	0.51	11.06
7	Okra	3.83	3.76	0.94	-	8.54
8	Onion	3.25	1.51	-	1.20	5.95
9	Pea	4.87	1.05	3.70	0.44	10.06
10	Potato	3.56	1.38	-	2.00	6.94
11	Radish	2.59	1.30	-	-	3.89
12	Tomato	7.01	1.59	6.42	0.14	15.16

Source: *Economic Analysis of Postharvest Losses in Marketing Vegetables in Uttarakhand*, Agricultural Economic Research Review, January 2011 (<https://www.researchgate.net/publication/227365154>)

Table 3.5.24 Postharvest Losses of Vegetables at Retail Level in Uttarakhand

No.	Vegetables	Losses (%)				Total
		Loading and Unloading	Transport	Grading	Selling (in a store)	
1	Cabbage	0.63	0.76	0.90	1.03	3.32
2	Capsicum	0.35	0.37	1.15	3.97	5.84
3	Cauliflower	0.70	1.01	1.93	1.51	5.16
4	Chili	0.71	0.85	1.15	4.15	6.86
5	Egg plant	0.87	0.93	0.60	3.47	5.81
6	French bean	0.67	0.37	1.15	3.48	5.67
7	Okra	0.71	0.87	1.11	4.31	7.09
8	Onion	-	1.40	1.53	1.39	4.32
9	Pea	0.52	0.67	1.15	3.97	6.31
10	Potato	-	1.53	2.40	1.01	4.94
11	Radish	1.13	0.63	0.46	0.40	2.63
12	Tomato	1.79	0.80	0.73	4.71	8.03

Source: *Economic Analysis of Postharvest Losses in Marketing Vegetables in Uttarakhand*, Agricultural Economic Research Review, January 2011 (<https://www.researchgate.net/publication/227365154>)

At grower level, many vegetables recorded the highest losses in harvesting stage, while cauliflower and eggplant recorded the losses in grading and packing stage and chili and French bean recorded the losses in handling and transportation stage. At the retail level, many vegetables recorded the largest losses in the selling stage in a store, while cauliflower, onion and potato recorded losses in the grading stage and radish recorded losses in the loading and unloading stage.

The study result suggested that the most effective countermeasure to overcome the issue of postharvest losses should be capacity building of growers through training on appropriate harvesting time and proper management practice in handling, grading, packing, storing, etc. Improvement of retailers' knowledge and skills in postharvest management in their store should be the second priority option to tackle the issue. While development of cold chain system as emphasized in many concerned papers in India including the Concept Note could be an effective option to address the issue, a capacity-building program for growers, retailers and other market intermediaries must be combined with the facility development.

Economic incentive is a hidden but a critical factor in reducing the postharvest losses, although many Indian papers do not mention it. If growers or market functionaries can expect due returns from saving the losses, they should pay more serious attention to their postharvest management practice without a complicated intervention. Economic feasibility should be carefully evaluated whenever measures to reduce the losses will be taken at the field level. Table 3.5.25 shows an interview output from 15 market intermediaries in Delhi in a market survey carried out by the JICA Survey Team in June 2021. The table shows their divided expectation on investing in cold storage facilities except for the investment in apple storage. Someone has positive expectation, while the others have negative expectation. The dichotomous

views imply that they are not confident of a certain benefit from the investment except for apple, due to relatively high operation costs of the facilities, a fickle market circumstance of horticultural produce and unaccomplished technology applicable for many horticultural produces at the field level.

Table 3.5.25 Expected Economic Value Improvement by Cold Storage Facilities

No.	Crop	Total Answers	Cold Storage			CA Storage		
			Highly Likely	Not Likely	No Need/No Answer	Highly Likely	Not Likely	No Need/No Answer
1	Broccoli	2	0	2	0	2	0	0
2	Cabbage	3	0	3	0	1	1	1
3	Capsicum	3	0	3	0	1	1	1
4	Carrot	2	0	2	0	1	1	0
5	Cauliflower	1	0	0	1	1	0	0
6	Egg plant	2	0	2	0	0	0	2
7	Lettuce	1	1	0	0	1	0	0
8	Onion	9	1	5	3	3	4	2
9	Potato	8	0	5	3	2	4	2
10	Tomato	8	5	3	0	4	2	2
11	Garlic	3	0	1	2	1	2	0
12	Apple	8	8	0	0	7	1	0
13	Banana	3	0	3	0	2	1	0
14	Citrus	6	1	5	0	1	5	0
15	Guava	1	0	1	0	0	1	0
16	Kiwi Fruit	3	1	2	0	2	1	0
17	Litchi	3	0	3	0	1	2	0
18	Mango	3	0	3	0	1	2	0
19	Peach	1	0	1	0	1	0	0
20	Plum	1	0	1	0	1	0	0

Source: Market Survey, The JICA Survey Team, June 2021

(2) Price Changes (Marketing Cost and Margins)

The Concept Note says that the producers' share in consumer price is very less in case of perishable produce and the major share goes in the hands of market intermediaries due to inefficient supply chain in Uttarakhand. This recognition seems to be widely shared throughout the whole India.

Table 3.5.26 and 3.5.27 show a price spread of selected vegetables and apple in Uttarakhand analyzed in the past market studies. The former table shows the price spread of selected vegetables in two marketing channels in Nainital District, i.e., one is an ordinary channel of "Producer - Wholesaler-cum-Commission Agent (at APMC *mandi*) - Retailer - Consumer", while the other is a direct selling channel of "Producer - Retailer - Consumer". The later table shows the price spread of apple in a marketing channel of "Producer - Commission Agent (at APMC *mandi*) - Wholesalers - Retailer - Consumer" in Uttarkashi District.

Table 3.5.26 Price Spread of Selected Vegetables in Nainital District in Uttarakhand

(Unit: INR/100 kg)

Crop	Channel	Producer Level			Wholesaler-cum-CA Costs and Margins (c)	Sub-total (d = a + b + c)	Retailer Level		
		Net Receipt (a)	Marketing Costs (b)	Total (a + b)			Costs (e)	Margins (f)	Retail Price (d + e + f)
Bean	Via CA/Wholesaler	923.80	130.00	1,053.80	91.63	1,145.43	94.95	395.60	1,635.98
	(%)	(56.47)	(7.95)	(64.41)	(5.60)	(70.01)	(5.80)	(24.18)	(100.00)
	Direct to Retailer	1,278.83	96.67	1,375.50	-	1,375.50	47.99	538.51	1,962.00
	(%)	(65.18)	(4.93)	(70.11)	-	(70.11)	(2.45)	(27.45)	(100.00)
Cabbage	Via CA/Wholesaler	373.25	130.00	503.25	43.76	547.01	85.89	122.10	755.00
	(%)	(49.44)	(17.22)	(66.66)	(5.80)	(72.45)	(11.38)	(16.17)	(100.00)
	Direct to Retailer	435.83	96.67	532.50	-	532.50	45.02	217.48	795.00
	(%)	(54.82)	(12.16)	(66.98)	-	(66.98)	(5.66)	(27.36)	(100.00)
Tomato	Via CA/Wholesaler	673.25	212.00	885.25	76.97	962.22	90.97	301.81	1,355.00
	(%)	(49.69)	(15.65)	(65.33)	(5.68)	(71.01)	(6.71)	(22.27)	(100.00)
	Direct to Retailer	907.67	172.00	1,079.67	-	1,079.67	46.77	456.06	1,582.50
	(%)	(57.36)	(10.87)	(68.23)	-	(68.23)	(2.96)	(28.82)	(100.00)
Pea	Via CA/Wholesaler	840.49	130.00	970.49	84.39	1,054.88	104.56	290.56	1,450.00
	(%)	(57.96)	(8.97)	(66.93)	(5.82)	(72.75)	(7.21)	(20.04)	(100.00)

Crop	Channel	Producer Level			Wholesaler -cum-CA	Sub-total (d = a + b + c)	Retailer Level		
		Net Receipt (a)	Marketing Costs (b)	Total (a + b)	Costs and Margins (c)		Costs (e)	Margins (f)	Retail Price (d + e + f)
	Direct to Retailer	929.73	96.67	1,026.40	-	1,026.40	53.27	420.33	1,500.00
	(%)	(61.98)	(6.44)	(68.43)	-	(68.43)	(3.55)	(28.02)	(100.00)

Source: Marketing of Vegetables in Nainital District, Uttarakhand, Page 118-125, Indian Journal of Hill Farming, 2018 Special Issue

Table 3.5.27 Price Spread of Apple in Uttarkashi District in Uttarakhand (Unit: INR/kg)

Producer Level			Mandi (CA)	Sub-total (d = a + b + c)	Wholesaler	Retailer Level		
Net Receipt (a)	Marketing Costs (b)	Total (a + b)	Costs and Margins (c)		Costs and Margins (e)	Costs (f)	Margins (g)	Retail Price (d + e + f + g)
24.70	20.30	45.00	5.40	50.40	12.40	4.20	23.00	90.00
(27.44)	(22.56)	(50.00)	(6.00)	(56.00)	(13.78)	(4.67)	(25.56)	(100.00)

Source: Apple Value Chain Analysis and Market Assessment for Uttarkashi District, Uttarakhand, 2018, CCS National Institute of Agricultural Marketing

In case of vegetables, the price share of producers in the retail price is 64.41–66.93% (Ave. 65.83%) in the ordinary channel and 66.98–70.11% (Ave. 68.44%) in the direct selling channel. The share of net receipt of producers after deducting the marketing costs is 49.44–57.96% (Ave. 53.39%) and 54.82–65.18% (Ave. 59.84%), respectively. It is interesting that the retail prices in the direct channel are higher than the prices in the ordinary channel for all vegetables. This means that consumers do not reap a cost-saving benefit from the direct selling. Prevailing of high-quality produce in the direct selling channel may cause the higher prices. The benefit by reducing marketing costs through a direct selling is only shared by producers and retailers.

Considering the general understanding of agricultural marketing channel in India, which involves various kinds and lots of small-scale stakeholders in its multi-layered structure, it is probable that the market channel discussed in Table 3.5.26 is rather simple and compact than the prevailing market channel in the field. Also, costs and margins of Wholesaler-cum-Commission Agent, 5.60–5.82%, might be calculated on the basis that a Wholesaler-cum-Commission Agents act as commission agents only in transactions. They act a wholesaler in most cases according to collected information from many APMC *mandies*. Costs and margins of wholesaler might be much higher than those calculated in the table referring to Table 3.5.27. The share of net receipt producers in the table, therefore, might be overestimated. The reference source of the table has mentioned other estimation without analytical data that a vegetable producer receives 30-35% of the price that consumer pays. The figures would be more realistic than the figures in the table.

In case of apple, the price share of producers in the retail price is 50%, while the share of net receipt of producers after deducting the marketing costs is only 27.44%. Producers spend many costs for marketing apple compared with vegetables, probably due to the high shipping costs including the cost of packaging box. Table 3.5.27 implies that the price share of producers substantially suffers from the involvement of wholesalers between APMC *mandi* and retailers, although the wholesalers must play an important role in the supply chain as apple is extensively distributed compared with many vegetables. Another implication is that a part of vegetables extensively marketed to other states may be similar in their price spread to apple.

Table 3.5.28 Price Spread of Selected Vegetables and Apple in Japan in 2017/18

(Unit: JPY/100 kg)

Crop	Channel	Producer Level			CA Margins (c)	Sub-total d = a + b + c	Wholesaler Cost (e)	Retailer Level	
		Net Receipt (a)	Marketing Cost (b)	Total (a + b)				Cost & Margins (f)	Retail Price (d + e + f)
Cabbage	Via Wholesaler	7,258	2,755	10,013	832	10,845	1,171	2,007	14,023
	(%)	(51.76)	(19.65)	(71.40)	(5.93)	(77.34)	(8.35)	(14.31)	(100.00)
	Direct to Retailer	7,643	-	7,643	-	7,643	-	1,284	8,927
	(%)	(85.62)	-	(85.62)	-	(85.62)	-	(14.38)	(100.00)
Onion	Via Wholesaler	4,938	3,039	7,977	509	8,486	1,460	3,223	13,169
	(%)	(37.50)	(23.08)	(60.57)	(3.87)	(64.44)	(11.09)	(24.47)	(100.00)

Crop	Channel	Producer Level			CA Margins (c)	Sub-total d = a + b + c	Wholesaler Cost (e)	Retailer Level	
		Net Receipt (a)	Marketing Cost (b)	Total (a + b)				Cost & Margins (f)	Retail Price (d + e + f)
Potato	Direct to Retailer	6,326	-	6,326	-	6,326	-	2,530	8,856
	(%)	(71.43)	-	(71.43)	-	(71.43)	-	(28.57)	(100.00)
	Via Wholesaler	8,866	3,629	12,495	898	13,393	3,710	5,370	22,473
	(%)	(39.45)	(16.15)	(55.60)	(4.00)	(59.60)	(16.51)	(23.90)	(100.00)
	Direct to Retailer	13,272	-	13,272	-	13,272	-	5,070	18,342
Tomato	(%)	(72.36)	-	(72.36)	-	(72.36)	-	(27.64)	(100.00)
	Via Wholesaler	22,742	7,962	30,704	2,977	33,681	4,480	8,968	47,129
	(%)	(48.25)	(16.89)	(65.15)	(6.32)	(71.47)	(9.51)	(19.03)	(100.00)
	Direct to Retailer	24,448	-	24,448	-	24,448	-	6,356	30,804
	(%)	(79.37)	-	(79.37)	-	(79.37)	-	(20.63)	(100.00)
Apple	Via Wholesaler	20,200	9,729	29,929	1,127	31,056	3,665	9,618	44,339
	(%)	(45.56)	(21.94)	(67.50)	(2.54)	(70.04)	(8.27)	(21.69)	(100.00)
	Direct to Retailer	24,684	-	24,684	-	24,684	-	8,220	32,904
	(%)	(75.02)	-	(75.02)	-	(75.02)	-	(24.98)	(100.00)

Source: Food Market Pricing Survey in 2017/18, Ministry of Agriculture, Forestry and Fisheries, Government of Japan

This table shows a price spread of selected vegetables and apple in Japan for comparison. The table also shows the price spread in two marketing channels, i.e., one is an ordinary channel of “Producer - Commission Agent (at the public wholesale market) - Wholesaler - Retailer - Consumer”, while the other is a direct selling channel of “Producer - Retailer – Consumer”. The price share of producers in the retail price is 55.60–71.40% (Ave. 64.05) in the ordinary channel and 71.43–85.62% (Ave. 76.76%) in the direct selling channel. The share of net receipt of producers after deducting the marketing costs is 37.50–51.76% (Ave. 44.50%) in the ordinary channel. In the channel, producers spend relatively high percentage of marketing costs which are usually paid to cooperatives they belong. Despite the high percentage of the costs, producers in Japan can enjoy generous supporting services from the cooperatives, such as sorting and grading, packing, joint marketing, transportation, market information, etc. Consequently, they can expect higher net receipt than an individual marketing in general, although not a small number of them express dissatisfaction with the high percentage of the costs. Producers’ marketing costs in the direct selling channel are not counted in the table, while producers themselves and retailers share necessary costs by mutual agreement.

This is very much different from the case in Uttarakhand, retail prices in the direct selling channel in Japan are much lower than the prices in the ordinary channel for all vegetables and apple. The greatest beneficiaries of cost-saving benefit from the direct selling are consumers, while producers also enjoy a certain part of the benefit. Only retailers seem to be the losers in the direct selling channel as costs and margins at the retailer level is lower than those in the ordinary channel. The direct selling is commonly practiced by relatively large-scale retailers like supermarket chain stores in Japan. They have a business strategy to maximize the profits by expanding their transaction volume rather than increasing their unit margin under a tough competitive market condition in Japan. The market condition has strongly motivated them to supply quality produce at a cheaper price. A consumer-oriented market environment has encouraged the retailers to streamline their supply chain.

Those tables imply that the producers’ share in the retail prices in both ordinary channels in Uttarakhand and in Japan are almost in the same range. The share in Uttarakhand does not seem to be so small as commonly recognized. However, the share may be easily eroded by additional market intermediaries in a supply chain. Reducing the number of market intermediaries could be an effective measure to increase the share. The price spread of direct selling channel is quite different between Uttarakhand and Japan. A large part of cost-saving benefit from the direct selling goes to consumers in Japan, while the benefit is only shared by producers and retailers in Uttarakhand. The difference implies that a consumer-oriented market of horticultural produce is still underdeveloped in Uttarakhand, as well as in India. The undeveloped consumer-oriented market must cause prevalence of inefficiency in the local supply chain.

The present GOI's reform policies aiming at promoting a competitive business environment in agricultural marketing could establish a foothold in streamlining the local supply chain. Empowerment of producers is also indispensable option to allow them to enjoy a fair share in the benefit generated by the supply chain reforms. Producers should be motivated and trained so that they will be well united in overcoming difficulties in their marketing.

3.5.12 GOI's Agricultural Market Reform Policies

Many literatures suggest that the present agricultural marketing system established and implemented through the strong initiative of GOI has failed in performing the expected role as the outdated legal framework cannot adopt to the changing social needs, and it has made a negative impact on the ability of farmers. GOI has recognized the problem of out-modeled agricultural supply chain system for a long time. After a series of attempts to address the problem, GOI had released several model farming acts to reform the marketing system in 2017. The Standing Committee on Agriculture (2018-19), however, noted that not a small number of reforms suggested in the model acts had not been implemented by the states. The committee particularly stressed that the concerned laws regulating agricultural markets were not implemented fairly and honestly. An exclusive and uncompetitive environment was thought to be created with undue commissions, market fees and monopolization under the centralized and inflexible marketing system.

The following three new acts, often referred to as the 2020 Farm Bills, were announced by GOI in September 2020. The 2020 Farm Bills have been enacted aiming at ensuring a complete transformation of the agriculture sector and empowering tens of millions of farmers according to the Prime Minister.

- (1) The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020
 - To expand the scope of trade areas of farmers' produce from select areas to "any place of production, collection, and aggregation";
 - To allow electronic trading and e-commerce of scheduled farmers' produce; and
 - To prohibit state governments from levying any market fee, access, or levy on farmers, traders, and electronic trading platforms for the trade of farmers' produce conducted in an 'outside trade area'.
- (2) Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020
 - To provide a legal framework for farmers to enter into pre-arranged contracts with buyers including mention of pricing; and
 - To define a dispute resolution mechanism.
- (3) Essential Commodities (Amendment) Act, 2020²⁰
 - To remove foodstuff such as cereals, pulses, potato, onions, edible oilseeds, and oils, from the list of essential commodities;
 - To remove stockholding limits on agricultural items produced by horticulture techniques except under "extraordinary circumstances"; and
 - To require imposition of any stock limit on agricultural produce only occur if there is a steep price rise.

Despite GOI's expectation, the 2020 Farm Bills have faced strong protests from farmers in various parts of India alleging that they will hurt their earnings and threaten farming communities throughout India. The main reasons for opposition are the uncertainty regarding the implementation of the reforms, controversy surrounding the minimum support prices (MSPs), and low bargaining power of the farmers. A major point of their concern is lack of statutory support for MSPs in the 2020 Farm Bills, especially for farmers from Punjab and Haryana, where a large part of produced wheat has been procured by MSPs. Various opposition parties have also urged that the 2020 Farm Bills were passed unconstitutionally in

²⁰ GOI has been regulating the production, supply, and distribution of certain commodities with a declaration of "essential commodities" to make them available to consumers at fair prices under the Essential Commodities Act (ECA) since 1955. Additionally, GOI also fixes the minimum support price (MSP) of the declared commodities. The commodities consist of basic foodstuffs, drugs, fertilizers, fuel (petroleum products), etc., subject to change in accordance with the social needs.

complete disregard of parliamentary norms and are anti-farmer and corporate friendly. The protests have obtained sympathies from wide-ranging third parties, e.g., central trade unions, academicians from across the country, and several abroad universities, while there are a lot of economists and academicians supporting the 2020 Farm Bills on the other hand. The Supreme Court stayed the implementation of the 2020 Farm Bills on January 12, 2021 and appointed a committee to look into the grievances related to the Farm Bills.

On November 19, 2021, the Prime Minister announced that GOI would repeal the 2020 Farm Bills. On December 1, 2012, the Farm Bills were formally replaced. However, GOI needs to continue its efforts to promote a streamlined business environment in the agricultural market system involving all stakeholders, such as farmers, private traders, etc. in the reform in order to adopt to the changing social needs.

3.5.13 Government Schemes Supporting Supply Chains of Vegetables and Fruits

GOI has continuously paid serious attention to the development of supply chains in horticultural sector covering vegetables, fruits, spices, and other crops in order to attain higher incomes of farmers and to stimulate the related industries including food processing and exporting. Table 3.5.29 shows major centrally sponsored schemes related to the supply chain development available in Uttarakhand at present.

Table 3.5.29 GOI Schemes Supporting Supply Chains of Horticultural Produce

N o.	Scheme	Supporting Contents	Incentives	Responsible Agency (GOI)	Window Agency in Uttarakhand
1	Pradhan Mantri Kisan Sampada Yojana (Prime Minister's Scheme for Agro-marine Processing and Development of Agro-Processing Clusters)	• Mega Food Park • Cold chain and value addition infrastructure • Processing & preservation facilities • Agro-processing infrastructure • Civil works and plant/machinery • Food standards and quality control system • R&D, training and seminars	Grant in aid (a part of the cost)	Ministry of Food Processing Industries	Dept of Horticulture & Food Processing
2	Capital Investment Subsidy Scheme for Construction/Expansion/Modernization of Cold Storage and Storages for Horticulture Products	• Cold storage unit • Modernization of cold chain facilities • Refrigerated transport vehicles	Credit (a part of the cost)	National Horticulture Board (NHB), Ministry of Agriculture & Farmers Welfare	Dept of Horticulture & Food Processing
3	Horticulture Mission for North-East & Himalayan States (HMNEH), under Mission for Integrated Development of Horticulture (MIDH)	• Primary processing and packing facilities • Cold storage/unit • Modernization of cold chain facilities • Refrigerated transport vehicles • Ripening chamber • Market facilities/outlets • Quality control laboratories • Rope way in the hilly area • Horticulture based food processing unit	Credit/Grant (a part of the cost)	Ministry of Agriculture & Farmers Welfare	Dept of Horticulture & Food Processing
4	Integrated Scheme for Agricultural Marketing (ISAM)	• Marketing infrastructure • Research and information network • Grading facilities • Agribusiness development	Grant (a part of the cost)	Small Farmers' Agribusiness Consortium (SMAC), Ministry of Agriculture & Farmers Welfare	-

N o.	Scheme	Supporting Contents	Incentives	Responsible Agency (GOI)	Window Agency in Uttarakhand
5	Agriculture Export Promotion Plan Scheme	- Packing house - Pre-cooling and cold storage facility - Quarantine treatment facilities	Grant (a part of the cost)	Agricultural and Processed Food Products Export Development Authority (APEDA), Ministry of Commerce & Industry	-
6	Credit Linked Capital Subsidy Scheme (CLCSS)	Technology upgrading	Credit (a part of the cost)	Ministry of Micro, Small & Medium Enterprises	-
7	Venture Capital Assistance Scheme	Agribusiness development	Credit (a part of the cost)	Small Farmers' Agribusiness Consortium (SMAC), Ministry of Agriculture & Farmers Welfare	-
8	A Scheme for Promotion of Innovation, Rural Industry and Entrepreneurship (ASPIRE)	Venture capital	Grant (a part of the cost)	Ministry of Commerce & Industry	-
9	Pradhan Mantri Kaushal Vikas Yojana (PMKVY) (Prime Minister's Scheme for Skill Development)	Training to farmers	-	Ministry of Skill Development & Entrepreneurship	-

Source: Food Processing Sector Profile, State Horticulture Mission, State Government of Uttarakhand, September 2018
Department of Horticulture & Food Processing, Uttarakhand

It is remarkable that GOI leads a way in the development of the whole supply chains in horticulture sector with a lot of schemes. All necessary components to facilitate the supply chain development from A to Z are covered by the schemes. The schemes have been implemented by various government agencies and ministries concerned targeted at a wide variety of beneficiaries, e.g., farmers including their groups, private entrepreneurs, and related agencies in the public sector.

The State Horticulture Mission of the Department of Horticulture and Food Processing is a coordination body responsible to facilitate the supply chain development in Uttarakhand. However, the coordination of the GOI schemes does not necessarily work well as envisaged due to lack of mutual communication among concerned agencies. It is concerned that an intervention of the schemes is sometimes implemented without collaboration with other related schemes. Integration of the GOI schemes under a definite state policy should be a challenge to boost an impact of the schemes on the supply chain development in horticulture sector.

3.5.14 Agribusiness Related to Supply Chains of Vegetables and Fruits

(1) Agribusiness Industries

The Directorate of Industries (DI) of Uttarakhand has a registration system of industries newly invested in the state. According to the record of DI, there are 48 of large-scale industries and 1,511 of medium-, small- and micro-scale industries registered in last five years (2016-21) in the agriculture sector including food processing industries, as of September 2021. Attachment 3.5.6 shows the detailed information of the registered industries.

(2) Food Processing Industries

In general terms, the development of food industries in India is left behind compared with other Asian countries. The people in India still prefer fresh food much, while processed food are becoming popular among the people, especially in the urban areas in recent years. There are 270 food processing industries for fruits and vegetables out of the total 2,500 industries in operation in Uttarakhand, according to a

website information of the Ministry of Food Processing Industries. Table 3.5.30 shows the distribution of the food industries by districts in Uttarakhand.

Table 3.5.30 Food Processing Industries by Districts in Uttarakhand

No	District	Cereals	Fruits and Vegetables	Dairy Products	Bakery Products	Fats Oils	Beverages	Salts	Others	Total
1	Almora	8	7	1	3	3	7	7	11	47
2	Bageshwar	1	1	0	2	0	1	0	0	5
3	Chamoli	1	5	1	2	0	1	2	0	12
4	Champawat	8	1	1	0	0	2	4	2	18
5	Dehradun	81	50	25	75	30	60	73	159	553
6	Garhwal	11	9	3	6	2	14	10	21	76
7	Hardwar	111	81	47	65	70	110	98	335	917
8	Nainital	61	30	4	20	11	21	34	42	223
9	Pithoragarh	1	0	1	0	0	1	0	0	3
10	Rudraprayag	2	3	1	1	1	5	1	3	17
11	Tehri Garhwal	2	1	2	2	4	6	3	5	25
12	Udham Singh Nagar	151	77	39	38	44	68	64	110	591
13	Uttarkashi	1	5	0	0	0	4	3	0	13
Uttarakhand		439	270	125	214	165	300	299	688	2,500

Note: The industries categorized in "Storage & Transport" are not counted

Source: <http://indiafoodprocessingmap.nic.in/#>, The Ministry of Food Processing Industries

These food processing industries are located mainly in four districts of Dehradun, Hardwar, Nainital and Udham Singh Nagar which are in the plain regions in Uttarakhand. This is partly due to the availability of good road networks, a stable supply of electricity and water, and human resources. A limited number of the industries are established in the hilly regions.

Table 3.5.31 shows investment plans for horticultural produce processing industries in last five years (2016-20) in Uttarakhand. In total 39 investment plans (11 of large-scale industries and 28 of small- and micro-scale industries) with INR 6,136.4 million were approved by the Department of Industries in Uttarakhand during the period. All large-scale investments were planned for processing fruits and vegetables, while the small- and micro-scale investments were mainly planned for spice processing and mushroom growing and packing. Location of the large-scale investment plans were concentrated in Udham Singh Nagar District, where is a highly industrialized district in Uttarakhand.

Table 3.5.31 Approved Investments in Processing Industries for Horticultural Produce in Uttarakhand in Last Five Years (2016-20)

No	Name of the Enterprise	District	Location	Product	Proposed Investment (Million)	Year of Approval
<1. Large Scale>					5,857.3	
1	PARLE AGRO PRIVATE LIMITED Email: kapil.kumar@parleagro.com	Haridwar	Sector 3 Integrated Industrial Estate Village Lalarpatti and Lalarkhas	Manufacturing of fruit juices, etc.	1,686.1	2016
2	Shanti Frozen Foods Email: shantifrozenfoods@gmail.com	Udham Singh Nagar	Himalayan Food Park, Mahuakhera-ganj	Preservation of fruits and vegetables	192.0	2018
3	JAI KISSAN FOODS Email: canaveenarora@gmail.com	Udham Singh Nagar	VILLAGE NIJHRA	Preservation of fruits and vegetables	230.1	2018
4	Shivanya Frozen Food products Email: uksharma88@yahoo.com	Udham Singh Nagar	VILL.PAIGA ALIGANJ ROAD KSHIPUR	Manufacturing of fruit or vegetable juices	189.3	2018
5	AGARWAL FROZEN FOODS Email: agarwalfrozenfoods@gmail.com	Udham Singh Nagar	VILLAGE SHIMLA PISTOUR MALSA ROAD RUDRAPUR	Canning of fruits and vegetables	167.5	2018

No	Name of the Enterprise	District	Location	Product	Proposed Investment (Million)	Year of Approval
6	S K FROZEN FOODS Email: jindal@hotmail.com	Udham Singh Nagar	Village Mahuakheraganj	Preservation of fruits and vegetables	171.4	2018
7	Parle Agro Private Limited Email: compliance@parleagro.com	Udham Singh Nagar	Sector 3, Phase II, SIDCUL, Sitarganj	Manufacturing of fruit or vegetable juices	1,250.7	2018
8	Parle Agro Private Limited Email: compliance@parleagro.com	Udham Singh Nagar	Sector 3 Phase II, SIDCUL Sitarganj	Manufacture of fruit or vegetable juices	1,323.0	2019
9	ANAND FOODS Email: himanshuarora1979@yahoo.com	Udham Singh Nagar	Jagatpur patti	Preservation of fruits and vegetables	231.4	2019
10	Shri Dev Suman Agri Cluster Email: dgmdunem@gmail.com	Tehri Garhwal	Village- Nautha, Tehsil- Dhanaulti	Manufacture of fruit or vegetable juices	232.5	2019
11	R.K. FOOD PRODUCTS Email: rkfoodproductskashipur@gmail.com	Udham Singh Nagar	VILL.PAIGA ALIGANJ ROAD KASHIPUR	Preservation of fruits and vegetables	183.3	2020
<2. Small and Micro Scale>					279.1	
1	BHAWANI GANPATI PVT LTD Email: bhuwanjoshi200@gmail.com	Tehri Garhwal	VILLAGE SATAGAD BANSI	Grinding and processing of spices	1.8	2016
2	Pooja masala udyog Email: prasadjagdish8888@gmail.com	Pithoragarh	Talla tharkote pithoragarh	Grinding and processing of spices	0.2	2016
3	Jagdish atta & masala udyog Email: jagdishkohli.ot@gmail.com	Pithoragarh	Takana Pithoragarh	Grinding and processing of spices	0.3	2016
4	Pratishtha Mushroom Production & Packaging Unit Email: ashok72bhandari@gmail.com	Pithoragarh	Tarigaon	Growing of mushrooms and packing	1.9	2017
5	STERLING FARMSE Email: sterlingfarmsuk@gmail.com	Tehri Garhwal	Gram Sripur, Patti Saklana Near Kumalda Village	Growing of mushrooms and packing	13.5	2017
6	Punetha Masala & Atta Udhog Email: imbhuwan111@gmail.com	Pithoragarh	Naya Bazar	Grinding and processing of spices	1.0	2018
7	MS DEVBHUMI RASGANGA Email: nareshjoshi0072@gmail.com	Pithoragarh	JAJARDEWAL	Manufacture of fruit or vegetable juices	6.5	2018
8	GAVI FOODS Email: garg.vibhu12@gmail.com	Tehri Garhwal	Tehri Club and Resort, Ntt-chamba Road, Tehri Garhwal	Growing of mushrooms and packing	4.1	2018
9	Shivam masala Company Email: goel.mahesh0007@gmail.com	Nainital	Dvelchaur Bandobasti Rampur Road, Haldwani	Grinding and processing of spices	2.5	2018
10	M S DURGA GRAMIN AANWLA UTPAD Email: dgau.kaladhungi@gmail.com	Nainital	Vill Mankantpur, P.O. Pawalgarh	Preservation of fruits and vegetables	6.9	2018
11	AAKANSHA ORGANIC Email: aakanshaorganic@gmail.com	Tehri Garhwal	Village Manjari	Grinding and processing of spices	6.0	2019
12	Surkanda Forest View Mushroom Cultivation and Processing Unit Email: aca3infravision@gmail.com	Tehri Garhwal	Vill- Dang, Patti-Gusain, P.O.- Bangiyal	Growing of mushrooms and packing	8.7	2019

No	Name of the Enterprise	District	Location	Product	Proposed Investment (Million)	Year of Approval
13	Deepika Masala Udtog Email: tejpalsb88@gmail.com	Pithoragarh	Pithoragarh	Grinding and processing of spices	0.5	2019
14	Rajendra Enterprises Email: rajsingh66452@gmail.com	Pithoragarh	Pithoragarh	Sun-drying of fruits and vegetables	1.0	2019
15	Rawat Atta Chakki Email: diwansingh262530@gmail.com	Pithoragarh	Vill- Bunga, Jakh Puran	Manufacture of potato flour & meals and prepared meals of vegetables	0.1	2019
16	GANPATI FOOD FARM Email: ganpatifoodfarm2019@gmail.com	Nainital	Nainital	Growing of mushrooms and packing	0.9	2019
17	Oyster mushroom production Email: er.chandanadikari@gmail.com	Nainital	S/O Late Shri Jasod Singh Adhikari, Village & Post- Pawalgarh, Tehsil- Kaladhungi	Growing of mushrooms and packing	0.0	2019
18	Harsh Enterprises Email: hrshbisht@yahoo.co.in	Nainital	Bindukhatta Indra Nagar II, Lalkuan	Grinding and processing of spices	3.8	2019
19	A R FOODS ENTERPRISES Email: dharmendrakumar2561@gmail.com	Nainital	DAHRIYA MUKHANI MANPUR PASHCHIM HALDWANI	Grinding and processing of spices	1.7	2019
20	Juwantha Apple Orchard Email: juwantha124@gmail.com	Uttarkashi	Vill Makhna, Tehsil Purola	Apple grading	1.5	2020
21	Shuchi foods and Mushrooms Email: monikapanwar3333@gmail.com	Tehri Garhwal	Rishikesh road, Near petrol pump, Nagni Tehri	Growing of mushrooms and packing	4.2	2020
22	Bio Nutraceuticops Pvt Ltd Email: dinesh@bionutraceuticops.com	Tehri Garhwal	Kokhliyal Gaon, Chamma	Growing of mushrooms and packing	30.0	2020
23	MVs Jai Kali Mushroom Email: lalit.upreti2020@yahoo.com	Pithoragarh	Ward- kunjanpur, po- Gangolihat Pithoragarh	Growing of mushrooms and packing	2.0	2020
24	MVs Masala Chakki Email: harishdasila5@gmail.com	Pithoragarh	Vill- Charsula, Aincholi Pithoragarh	Grinding and processing of spices	0.2	2020
25	MVS CHAND MASALA CHAKKI Email: chandbhagwan112@gmail.com	Pithoragarh	SUWAKOT WADDA PITHORAGARH	Grinding and processing of spices	0.4	2020
26	Mittal Enterprise Email: mukulag1112@gmail.com	Nainital	Shivlalpur Pandey Kashipur Road Ramnagar	Grinding and processing of spices	1.6	2020
27	NATURAL FROZEN Email: naturalfrozen20@gmail.com	Nainital	KHET NO 25 VILL HIMMATPUR POST BAILPARAO TEHSIL KALADHUNGI	Preservation of fruits and vegetables	177.3	2020
28	ANAND ENTERPRISES Email: aansinghaida37452@gmail.com	Nainital	WARD NO.-02, KALADHUNGI	Grinding and processing of spices	0.5	2020

Source: The Department of Industries, Uttarakhand

GOI has started the Mega Food Park Scheme in its 11th 5-year Plan (2007-11) to develop agro-industry clusters in the whole country. As shown in Table 3.5.32, the scheme is integrated in the Pradhan Mantri

Kisan Sampada Yojana (Prime Minister's Scheme for Agro-marine Processing and Development of Agro-Processing Clusters). Two Mega Food Parks in Uttarakhand as outlined in Table 3.5.32 are founded in Haridwar and Udham Singh Nagar, respectively.

Table 3.5.32 Outline of the Mega Food Parks in Uttarakhand

	Patanjali Food and Herbal Park	Himalayan Food Park
1. District	Hardwar	Udham Singh Nagar
2. Year established	2009	2018
3. Area	Over 70 acres	50 acres
4. No. of processing unit	17	20 (including under construction)
5. Major processing industries	flour, candy, juice, <i>murrabba</i> (fruits sweet preserve), spices	flour, bakery, pasta, biscuit, <i>paneer</i> (soya bean cake), juice, baby foods, frozen food
6. Supporting industries	cold storage, warehousing, ripening chamber, sorting and grading line, quick frozen facility, grain milling, packaging, quality testing laboratory	cold/frozen storage, ripening chamber, sorting & grading, packing, corrugated packaging

Source: Food Processing Sector Profile, State Horticulture Mission, Uttarakhand, September 19, 2018

(3) Cold Storage Facilities (CA Storages and Cold Storages)

Every food business operator including food storage facilities in India is required to be licensed under the Food Security and Standards Authority of India (FSSAI). Table 3.5.33 shows the licensed storage facilities in Uttarakhand as of January 2020, although all the facilities are not necessarily used for keeping horticultural produce. Like food processing industries, the storage facilities are concentrated in the four districts in the plain regions, i.e., Dehradun, Haridwar, Nainital, and Udham Singh Nagar.

Table 3.5.33 FSSAI Licensed Storage Facilities in Uttarakhand, as of January 2020

No	District	Central Licensed	State Licensed	Total
1	Almora	0	37	37
2	Bageshwar	0	9	9
3	Chamoli	8	13	21
4	Champawat	0	11	11
5	Dehradun	45	296	341
6	Garhwal	3	14	17
7	Haridwar	42	77	119
8	Nainital	26	153	179
9	Pithoragarh	7	61	68
10	Rudraprayag	0	0	0
11	Tehri Garhwal	0	6	6
12	Udham Singh Nagar	32	138	170
13	Uttarkashi	1	9	10
Uttarakhand		164	824	988

Source: Food Safety and Standard Authority of India (FSSAI)

According to UKDHFP, there are 55 cold storage facilities with capacity of 191,314 ton in Uttarakhand. A comprehensive information covering the 55 cold storage facilities is, however, not available in UKDHFP, as the facilities were constructed at the initiative of various GOI's schemes, as well as by investments from the private sector. Table 3.5.34 shows available information about cold storage facilities including CA storages in Uttarakhand constructed by the GOI's schemes on the websites of the concerned ministries. It shows that most of the cold storage facilities in Uttarakhand were developed by the GOI's schemes.

Table 3.5.34 Cold Storage Facilities Constructed by GOI's Schemes in Uttarakhand

No	GOI Scheme	Implementing Agency	Cold Storage and Integrated Cold Chain		CA Storage		Total	
			Number	Cap (MT)	Number	Cap (MT)	Number	Cap (MT)
1	Pradhan Mantri Kisan Sampada Yojana	Ministry of Food Processing Industries	27	99,800	0	0	27	99,800
2	Supply Chain & Food Processing Development related to Horticulture Products	National Horticulture Board (NHB), Ministry of Agriculture & Farmers Welfare	2	1,728	1	4,016	3	5,744
3	Horticulture Mission for Northeast & Himalayan States (HMNEH), MIDH	Ministry of Agriculture & Farmers Welfare	9	17,549	0	0	9	17,549

No	GOI Scheme	Implementing Agency	Cold Storage and Integrated Cold Chain		CA Storage		Total	
			Number	Cap (MT)	Number	Cap (MT)	Number	Cap (MT)
4	Agriculture Export Promotion Plan Scheme	APEDA, Ministry of Commerce & Industry	NA	NA	NA	NA	NA	NA
Total			38	119,077	1	4,016	39	123,093

Source: Ministry of Agriculture & Farmers Welfare (http://nhb.gov.in/OnlineClient/rptMISCrops_midh.aspx) and Ministry of Food Processing Industries (<https://foodprocessingindia.gov.in/state/uttarakhand>)

Table 3.5.35 shows the list of cold storage facilities consisting of 19 cold storages and 5 CA storages, which are available in UKDHFP with supplementary information collected by the JICA Survey Team through interviews with the facilities.

Table 3.5.35 List of Cold Storage Facilities in Uttarakhand Owned by UKDHFP

N o.	Name of the Facility	Location (Dist.)	Capacity (M. Ton)	Year Establish	Owner-ship	Govt. Scheme	Major Storing Commodity	Origin of Commodity (State)	Destination of Commodity (State)	Business Operation
<Cold Storage>										
1	M/s Rama Krishna Cold Chemical Ltd.	U.S. Nagar	5,024	NA	Private	NA	Fruits and Vegetables	U-Khand and Neighbor States	NA	NA
2	M/s Bharat Ice and Cold Storage	U.S. Nagar	1,000	NA	Private	NA	Fruits and Vegetables	U-Khand and Neighbor States	NA	NA
3	M/s Sandhu Sarai Cold Storage & Ice Factory	U.S. Nagar	4,583	2005	Private	NA	Fruits and Vegetables	U-Khand and Neighbor States	NA	NA
4	M/s Uttaranchal Cold Storage Pvt. Ltd.	U.S. Nagar	4,607	2008	Private	NHB	Potato and Peas	U-Khand (U.S. Nagar)	U-Khand and Bihar	Rental
5	M/s Jindal Cold Storage	U.S. Nagar	5,900	2008	Private	Personal Investment	Potato, Peas, Orange	U-Khand (U.S. Nagar)	Allover India	Rental
6	M/s Jindal Ice & Cold Storage	U.S. Nagar	10,508	2008	Private	NHB	Potato, Peas, and Carrot	U-Khand and U-Pradesh	U-Khand, Delhi and Bihar	Rental
7	M/s Rastogi Ice Cold Ltd.	U.S. Nagar	5,024	2002	Private	NA	NA	U-Khand and Neighbor States	NA	NA
8	Annapurna Cold Storage	U.S. Nagar	4,016	2012	Private	NHB	Potato and Seeds	U-Khand and Neighbor States	U-Khand and Neighbor States	Rental
9	M/s Roorkee Cold Storage	Haridwar	1,100	1995	Private	NA	Fruits and Vegetables	U-Khand and Neighbor States	NA	NA
10	M/s Vaishno Cold Storage	Haridwar	3,177	NA	Private	NA	Fruits, Vegetables and Cold Drinks	U-Khand and Neighbor States	NA	NA
11	M/s Ruchika Cold Store	Haridwar	1,100	1995	Private	NA	Fruits and Vegetables	U-Khand and Neighbor States	NA	NA
12	M/s Sanjeev Cold Store	Haridwar	1,209	1989	Private	Personal Investment	Potato	U-Khand and U-Pradesh	U-Khand	Rental
13	M/s MJ Cold Store	Haridwar	3,200	2007	Private	NA	Fruits and Vegetables	U-Khand and Neighbor States	NA	NA
14	M/s Yadav Food Ltd.	U.S. Nagar	1,000	2018-19	Private	NHB	Apple, Peas, Orange, and Vegetables	U-Khand, H-Pradesh, and Maharashtra	U-Khand, U-Pradesh, and Delhi	Rental
15	M/s Grandeur Agriotech Pvt. Ltd.	U.S. Nagar	600	2015-16	Private	NHB	Peas and Sweet Corn	U-Khand (U.S. Nagar)	Delhi, U-Pradesh, and Haryana	Rental and Wholesale
16	M/s Kinchad Agri Projects Pvt. Ltd.	Uttarkashi	1,080	2019-20	Private	Personal Investment	Apple	U-Khand and H-Pradesh	U-Khand, U-Pradesh, Delhi, and Bihar	Rental and Wholesale
17	M/s Jindal Frozen Foods Pvt. Ltd.	U.S. Nagar	3,068	2019-20	Private	HMNEH /MIDH	Fruits and Vegetables	U-Khand and Neighbor States	NA	NA

N o.	Name of the Facility	Location (Dist.)	Capacity (M. Ton)	Year Establish	Owner-ship	Govt. Scheme	Major Storing Commodity	Origin of Commodity (State)	Destination of Commodity (State)	Business Operation
18	M/s Nature Wellness Food Products	Haridwar	2,893	2018-19	Private	HMNEH /MIDH	Apple, Orange, Potato, and Vegetables	U-Khand, J-Kashmir, and U-Pradesh	NA	NA
19	M/s Nainy Frozen	U.S. Nagar	3,068	2020-21	Private	HMNEH /MIDH	Fruits and Vegetables	U-Khand and Neighbor States	NA	NA
	Total		62,156							
<CA Storage>										
1	M/s Himalaya Fresh Produce Pvt. Ltd (SHGW Dutch invested)	Uttarkashi	1,000	2011-12	Private (Private + Community)	NA	Apple (with juice processing)	U-Khand and Neighbor States	Delhi, U-Pradesh, Assam	Own business
2	M/s Flex Food Ltd.	Dehradun	1,128	2013-14	Private	NHB	Herbs, Vegetables and Dry Mushroom/Fruits	U-Khand, H-Pradesh, and U-Pradesh	Europe	Export
3	M/s Jai Durga Frozen Foods	U.S. Nagar	2,500	2016-17	Private	HMNEH /MIDH	Apple	U-Khand and Neighbor States	NA	NA
4	CA Storage	Uttarkashi	1,000	2018-19	Government (UHB)	APEDA	Apple	U-Khand and H-Pradesh	U-Khand, U-Pradesh, Haryana, and Delhi	Consignment to private
5	M/s Krishna Food Storage	Haridwar	2,112	2019-20	Private	HMNEH /MIDH	Apple	U-Khand and Neighbor States	NA	NA
	Total		7,740							

NA: No information available

Source: UKDHFP and the JICA Survey Team

The table shows that most of the cold storage facilities are established in Udham Singh Nagar District and Haridwar District, which are located on the plain side. The facilities must be constructed in strategic junctions of trade as commodities stored come and go between Uttarakhand and neighboring states, e.g., Uttar Pradesh, Himachal Pradesh, Jammu Kashmir, Delhi, Haryana, Bihar, etc. Only one cold storage and one CA storage mainly storing apple are exceptionally located in Uttarkashi District, which is the center of apple production in Uttarakhand. Both facilities store apples procured not only from Uttarakhand, but also from Himachal Pradesh.

All facilities except for one CA storage are owned by the private sector. It is probable that a storage space of the facilities is mainly rented out to traders, while many storage facilities do not provide information about their business operation model. Major commodities stored fruits and vegetables such as apple, orange, peas, and potato. CA storages are used mainly for apple.

3.6 Irrigation and Rural Infrastructures

3.6.1 Irrigation

As mentioned in Section 2.3, there are 1,548,985 ha of arable land²¹ in Uttarakhand State. Among the arable land, net sown area and net irrigated area are 698,359 ha and 329,837 ha, respectively. The percentage of the farm equipped with corresponding irrigation facilities varies with geography. While higher percentage of irrigated area is observed in Haridwar District and Udham Singh Nagar where the whole district area is classified into Zone A (EL.<1,000 m), the lowest percentage is shown in Chamoli District where more than 70% of the district area falls into Zone D (EL.>2,400 m).

²¹ Total of "Net Area Sown", "Misc. Tree Crops & Groves", and "Fallow & Culturable Waste" in Table 2.3.2.

Table 3.6.1 District-wise Irrigation Status in Uttarakhand

SN	State/District	Reported Area ¹ (ha)	Net Area Sown ² (ha)	Total Cropped Area ² (ha)	Cropping Intensity (5)/(4)	Net Irrigated Area ² (ha)	Gross Irrigated Area ² (ha)	Percentage of Irrigated Area (7)/(4)	Irrigation Intensity (8)/(7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Almora	464,942	78,278	115,796	147.9%	5,751	10,077	7.35%	175.22%
2	Bageshwar	207,902	24,295	39,710	163.4%	5,033	9,904	20.72%	196.78%
3	Chamoli	851,764	33,433	47,408	141.8%	1,574	2,936	4.71%	186.53%
4	Champawat	233,225	16,921	26,182	154.7%	1,655	3,147	9.78%	190.15%
5	Dehradun	363,371	39,443	57,134	144.9%	21,043	29,681	53.35%	141.05%
6	Haridwar	232,798	114,059	162,615	142.6%	107,479	153,581	94.23%	142.89%
7	Nainital	408,005	43,951	71,849	163.5%	26,545	38,246	60.32%	144.08%
8	Pithoragarh	746,734	41,891	71,368	170.4%	4,259	7,732	10.17%	181.54%
9	Pauri Garhwal	669,055	62,087	82,364	132.7%	6,176	10,064	9.95%	162.95%
10	Rudrapur	234,796	20,821	31,410	150.9%	2,538	3,825	12.19%	150.71%
11	Tehri Garhwal	485,517	53,809	81,095	150.7%	7,739	14,240	14.38%	184.00%
12	Udhamsingh Nagar	281,806	139,120	253,591	182.3%	135,224	248,726	97.20%	183.94%
13	Uttarkashi	812,689	30,251	42,182	139.4%	4,821	8,840	15.94%	183.36%
	Uttarakhand	5,348,300	698,359	1,082,704	155.0%	329,837	540,999	47.23%	164.02%

Sources: ¹. Statistical abstract of Uttarakhand 2015-16

². A Report on State Specific Action Plan for Water Sector (Draft), IRI Roorkee, 2018

(1) Types of Irrigation Scheme

There are chiefly three types of irrigation scheme in India, namely: major irrigation, medium irrigation, and minor irrigation system. These schemes are categorized based on their size of culturable command area (CCA) as follows:

Table 3.6.2 Category of Irrigation Schemes

Irrigation Scheme	CCA Threshold	Department in Charge
Major Irrigation	More than 10,000 ha	Irrigation Department
Medium Irrigation	2,000-10,000 ha	
Minor Irrigation	Up to 2,000 ha	Minor Irrigation Department

Source: Department of Water Resources, River Development and Ganga Rejuvenation

(2) Types of Irrigation System

There are three major types of minor irrigation system, i.e., flow irrigation, lift irrigation, and tube well irrigation systems.

The systems of flow irrigation and lift irrigation system use surface water and typically consist of tanks, weirs/check dams, canals and dams. Such interventions can serve as water conservation cum groundwater recharge scheme. These structures are generally prevalent in the hilly regions. Lift irrigation schemes are generally built in regions where the topography does not permit direct flow irrigation from the rivers and streams, hence, water has to be lifted into irrigation channels by installing pump machine.

The groundwater schemes comprise dug well, dug-cum-bore wells, shallow, medium and deep tube wells. Dug wells cover ordinary open wells of varying dimensions, dug or sunk from the ground surface into a water bearing stratum to extract water for irrigation. These are broadly masonry wells, kutchha wells (earth wall wells), and dug-cum-bore wells. Most of such schemes are of private nature belonging to individual cultivator. A shallow tube well consists of a bore hole built into the ground with the purpose of tapping groundwater from porous zones. In sedimentary formations, the depth of a shallow tube well does not exceed 25 m. These tube wells are either cavity tube wells or strainer tube wells. The 5th Minor Irrigation Census introduced the concept of medium tube wells with depth between the range of 35 m and 70 m. Deep tube wells extend to a depth of 70 m or more and are designed to give a discharge of 100-200 m³/hr.

1) Flow Irrigation System

The flow irrigation system carries water by gravity from water sources to the farm field through canal network with the construction of intake facilities and weir (called check dam) in most cases. The primary canals are supposed to be lined or pipeline according to the site conditions. For minor irrigation "Guls" (water channels as called in UK) are provided to carry water to the fields.

In the hilly areas, there are small rivers called Nallah flowing with sufficient gravity heads, which are tapped for irrigation. Snow-fed water sources are available in Chamoli, Pithoragarh Uttarkashi, Rudraprayag, and isolated places in Nainital, Dehradun, and Tehri districts. Udham Singh Nagar, Haridwar and Dehradun are blessed with medium and major irrigation projects on the rivers of Yamuna and Ganges or their tributaries.

2) Lift Irrigation System

Lift irrigation system is developed to carry water by means of pumps and force/rising mains from the water source to the delivery chamber, which distributes the water to the farm field by suitable distribution system such as lined canal in most cases or pipeline. In case the flow irrigation system is not applicable due to insufficient head between water sources and farm field, this system would be adopted.

3) Well Irrigation System

Well irrigation system would be adopted to the area available groundwater but unavailable surface water. Irrigation water is pumped up from various type of wells and distributed to farm field. Types of wells depend on the area properties, such as depth of groundwater, geological condition, available materials of well, etc.

The valleys of Haridwar and Udham Singh Nagar are covered extensively with deep and medium tube wells with discharges ranging 10 to 40 liter/sec constructed by the private and government sector²². On the other hand, the districts of Champawat, Nainital, and Dehradun have few shallow and medium tube wells/dug wells.

(3) Irrigation Method

To maximize water use efficiency, micro-irrigation is recommended by the government scheme of PMKSY in India. Under the scheme, micro irrigation has been introduced to Uttarakhand and 5,681 ha are covered until 2016-17²³. The most major irrigation methodologies, namely; drip irrigation and sprinkler irrigation, are mentioned as follows.

1) Drip Irrigation

Drip irrigation is sometimes called trickle irrigation and involves dripping water onto the soil at very low rates (2-20 liters/hour) from a system of small diameter plastic pipes fitted with outlets called emitters or drippers. Water is applied close to plants so that only a part of the soil in which the roots grow is wetted, unlike surface and sprinkler irrigation, which involves wetting the whole soil profile. With drip irrigation water, applications are more frequent (usually everyone to three days) than with other methods and this provides a very favorable high moisture level in the soil in which plants can flourish.

Drip irrigation system delivers water to the crop using a network of mainlines, sub-mains and lateral lines with emission points spaced along their lengths. Each dripper/emitter, orifice supplies a measured, precisely controlled uniform application of water, nutrients, and other required growth substances directly into the root zone of the plant.

Water and nutrients enter the soil from the emitters, moving into the root zone of the plants through the combined forces of gravity and capillary. In this way, the plant's withdrawal of moisture and nutrients is replenished almost immediately, ensuring that the plant never suffers from water stress, thus enhancing quality, its ability to achieve optimum growth and high yield. Farmers can produce higher yields while saving on water as well as fertilizers, energy, and even crop protection products.

Farmers prefer drip irrigation because of the following reasons:

- Higher consistent quality yields.
- Huge water savings: no evaporation, no runoff, no waste.
- 100% land utilization – drip irrigates uniformly in any topography and soil type.
- Energy savings: drip irrigation works on low pressure.

²² agriculture.uk.gov.in/flies, chapter 2 (page 21-22)

²³ <https://pmksy.gov.in/microirrigation/AtGlance/MI-Uttarakhand.pdf>

- Efficient use of fertilizer and crop protection, with no leaching.
- Less dependency on weather, greater stability and lower risks.

2) Sprinkler Irrigation

Sprinkler irrigation allows the application of water under high pressure with the help of a pump. It releases water similar to rainfall through a small diameter nozzle placed in the pipes. Water is distributed through a system of pipes, sprayed into air and irrigates in most of the soil type due to wide range of discharge capacity.

Advantages of sprinkler irrigation are as follows:

- Eliminates water conveyance channels, thereby reducing conveyance loss;
- Suitable in all types of soil except heavy clay;
- Water saving up to 30%-50%;
- Suitable for irrigation where the plant population per unit area is very high;
- Helps to increase yield;
- Reduces soil compaction;
- Mobility of system helps in easy system operation; and
- Suitable for undulating land system

(4) Development Procedure for Minor Irrigation²⁴

The Minor Irrigation Department is headed by the Chief Engineer. For creation of a minor irrigation scheme, farmers of a village or a cluster of villages submit a resolution with proposal of development of the scheme to Gram Sabha attended by representatives from all village(s) concerned. The resolution is generally forwarded to the local legislature, member of the Parliament, or directly to the Chief Minister of the State. In case the resolution submitted by more than one Panchayat, it will be approved in *Zila Parishad* (ZP, District Planning body) represented by ZP members and forwarded to the Chief Engineer of the Minor Irrigation Department.

The department will prepare a plan to develop the scheme including budget after ascertaining feasibility of the proposal and will integrate the plan into the work plan for the next year. Once the development of the scheme is included in the budget, the Minor Irrigation Department will prepare its designs, plans, and cost estimates based on the Schedule of Rates. Then, the appropriate authority will give sanction to execute.

The Chief Engineer or his subordinate officer, generally the Executive Engineer, invites and approves the tender attended by eligible contractors. The construction work is to be executed with due participation of WUA.

The eligible contractor enlisted in a particular class will be entitled to tender for works of value not exceeding the amount mentioned below. There are six classes of contractors in Uttarakhand Irrigation Department, which are Class AA, Class A, Class B, Class C, Class D, and Class E.

Table 3.6.3 Category of Contractor

Class	Registration Approved by	Ceiling Amount of Tender Budget	Required Staffs in their Regular Establishment
AA	Chief Engineer Level I	No limitation	➤ Two Graduate Engineers in Civil Engineering ➤ Four Diploma Holders in Civil Engineering
A		Up to IDR 100 million	➤ On degree holder in Civil Engineering
B	Chief Engineer Level II	Up to IDR 20 million	➤ One diploma holder in Civil Engineering
C	Superintending Engineer	Up to IDR 10 million	
D	Executive Engineer	Up to IDR 5 million	-
E		Up to IDR 0.02 million	

Source <https://uttarakhandirrigation.com/document/rti3.pdf> (updated thru personal contact in UK irrigation.)

Contractors under classes of AA, A, and B are permitted to tender for any work by the Irrigation Department anywhere in the state of Uttarakhand. Contractors enlisted in classes C, D, and E can participate in the jurisdiction of Circles and Divisions, whose headquarters are in particular

²⁴ <https://uttarakhandirrigation.com/document/rti3.pdf>

commissioner/district, respectively. The enlistment will be valid for a period of three years and the year will be reckoned from 1st July to 30th June.

Although the constructed facilities are owned by the government, the responsibility for O&M is transferred to the concerned WUA. While the major works on irrigation schemes such as construction and major repairment of structures are implemented by the department, minor repair and usual maintenance such as dry-stone masonry and cleaning of guls are carried out by WUA.

3.6.2 Other Rural Infrastructure

(1) Roads

The Uttarakhand Public Works Department (UKPWD) is engaged in the planning, construction, and maintenance of roads in the state. According to the national norms (Indian Roads Congress Recommendations), the roads are classified into five types²⁵ as shown below and length of the major roads in each district is summarized in Table 3.6.4:

- National Highways (NH)
- State Highways (SH)
- Major District Roads
- Other District Roads
- Village Roads

1) National Highways

National Highways (NH) are the major arterial road with the highest design specification spanning in the length and breadth of the country. NH connect the Capital to the various state capitals and the famous tourism places of the country. In addition, NH across the national border and connect to a city of neighboring countries.

2) State Highways

State Highways (SH) are the roads which connect the state capital to other states and to the district headquarters in the state. They have design specifications similar to those of NH because they are supposed to carry enough traffic.

3) Major District Roads

These roads connect the district headquarters to the main town centers in the district, and to the headquarters of the other districts also. They also connect these major town centers to the other state highways of importance. They have lower design specifications as compared with the NH and SH.

4) Other District Roads

While the major district roads connect main towns, other district roads connect the centers of rural town to the major district roads. They provide the facilities for the transportation of the raw materials and the goods, e.g., agricultural products, from the rural towns to the higher markets and vice-versa.

5) Village Roads

Village Roads connect the rural villages with one another, to the nearest higher-level road, or to the nearest town center. They have lower design specifications and many of them are not metalled.

Table 3.6.4 District-wise Road Condition in Uttarakhand

(Unit: km)

SN	State/District	Year	National Highway	State Highway	Major District Road	Total
1	Almora	2018-19	230	684	596	1,511
2	Bageshwar	2018-19	76	221	45	342
3	Champawat	2018-19	125	259	126	509
4	Chamoli	2018-19	55	238	264	587
5	Dehradun	2018-19	366	232	343	941

²⁵ National Highways and State Highways in international border states like Uttarakhand are also being constructed and maintained by the Director General Border Roads (DGBR)

SN	State/District	Year	National Highway	State Highway	Major District Road	Total
6	Haridwar	2018-19	152	177	75	404
7	Nainital	2017-18	128	460	93	681
8	Pauri Garhwal	2016-17	357	856	252	1,465
9	Pithoragarh	2018-19	223	372	230	825
10	Rudraprayag	2013-14	110	177	129	416
11	Tehri Garhwal	2019-20	462	455	321	1,238
12	Udhamisingh Nagar	2018-19	204	188	106	498
13	Uttar Kashi	2016-17	451	234	192	877
Uttarakhand			2,939	4,553	2,772	10,294

Source: www.District.nic.in/documents/statistical_report.

(2) Water Supply

The Uttarakhand Jal Sansthan is the responsible organization for the provision, operation, and maintenance of drinking water. The functions of the organization are explained as follows²⁶:

- To plan, promote and execute schemes and operate an efficient system of water supply.
- Where feasible, to plan, promote, and execute schemes and operate, sewerage, sewage, treatment and disposal and treatment of trade effluents.
- To manage all its affairs so as to provide the people of the area within its jurisdiction with wholesome water where feasible, efficient sewerage service.
- To take such measure, as may be necessary, to ensure water supply in times of any emergency.
- Such other functions as may be ensured to it by the State Government by notification in the Gazette.

District-wise status of water supply in Uttarakhand is summarized in the table below:

Table 3.6.5 District-wise Status of Water Supply

District	Area	Total Number of HHs	Number and Percentage of HH Having Following Source of Drinking Water					
			Tap Water from Treated Source		Tap Water from Untreated Source		Other Sources*	
Almora	Total	139,257	81,897	58.81%	30,152	21.65%	27,208	19.54%
	Rural	126,476	70,136	55.45%	29,724	23.50%	26,616	21.04%
	Urban	12,781	11,761	92.02%	428	3.35%	592	4.63%
Bageshwar	Total	57,712	31,546	54.66%	14,288	24.76%	11,878	20.58%
	Rural	55,748	29,855	53.55%	14,246	25.55%	11,647	20.89%
	Urban	1,964	1,691	86.10%	42	2.14%	231	11.76%
Chamoli	Total	85,765	54,401	63.43%	19,253	22.45%	12,111	14.12%
	Rural	72,744	43,087	59.23%	18,359	25.24%	11,298	15.53%
	Urban	13,021	11,314	86.89%	894	6.87%	813	6.24%
Champawat	Total	52,356	25,972	49.61%	8,211	15.68%	18,173	34.71%
	Rural	44,386	20,416	46.00%	8,078	18.20%	15,892	35.80%
	Urban	7,970	5,556	69.71%	133	1.67%	2,281	28.62%
Dehradun	Total	322,700	248,963	77.15%	24,263	7.52%	49,474	15.33%
	Rural	137,051	89,687	65.44%	17,550	12.81%	29,814	21.75%
	Urban	185,649	159,276	85.79%	6,713	3.62%	19,660	10.59%
Hardwar	Total	325,344	112,856	34.69%	18,811	5.78%	193,677	59.53%
	Rural	199,642	32,606	16.33%	9,482	4.75%	157,554	78.92%
	Urban	125,702	80,250	63.84%	9,329	7.42%	36,123	28.74%
Nainital	Total	187,108	122,605	65.53%	27,177	14.52%	37,326	19.95%
	Rural	112,670	54,932	48.75%	23,673	21.01%	34,065	30.23%
	Urban	74,438	67,673	90.91%	3,504	4.71%	3,261	4.38%
Pauri Garhwal	Total	161,688	98,696	61.04%	40,252	24.89%	22,740	14.06%
	Rural	137,102	77,989	56.88%	37,372	27.26%	21,741	15.86%
	Urban	24,586	20,707	84.22%	2,880	11.71%	999	4.06%
Pithoragarh	Total	111,542	62,473	56.01%	26,476	23.74%	22,593	20.26%
	Rural	95,130	48,748	51.24%	26,075	27.41%	20,307	21.35%
	Urban	16,412	13,725	83.63%	401	2.44%	2,286	13.93%
Rudraprayag	Total	53,492	34,325	64.17%	12,786	23.90%	6,381	11.93%

²⁶ <https://ujs.uk.gov.in>

District	Area	Total Number of HHs	Number and Percentage of HH Having Following Source of Drinking Water					
			Tap Water from Treated Source		Tap Water from Untreated Source		Other Sources*	
	Rural	51,064	32,263	63.18%	12,469	24.42%	6,332	12.40%
	Urban	2,428	2,062	84.93%	317	13.06%	49	2.02%
Tehri	Total	133,494	78,619	58.89%	24,541	18.38%	30,334	22.72%
	Rural	116,988	65,231	55.76%	23,916	20.44%	27,841	23.80%
	Urban	16,506	13,388	81.11%	625	3.79%	2,493	15.10%
Uttarkashi	Total	66,558	41,602	62.50%	11,974	17.99%	12,982	19.50%
	Rural	61,149	36,481	59.66%	11,818	19.33%	12,850	21.01%
	Urban	5,409	5,121	94.68%	156	2.88%	132	2.44%
UdhamSingh Nagar	Total	300,052	83,118	27.70%	27,179	9.06%	189,755	63.24%
	Rural	194,695	44,969	23.10%	18,863	9.69%	130,863	67.21%
	Urban	105,357	38,149	36.21%	8,316	7.89%	58,892	55.90%
Uttarakhand	Total	665,138	300,137	45.12%	102,956	15.48%	262,045	39.40%
	Rural	519,026	227,692	43.87%	93,141	17.95%	198,193	38.19%
	Urban	146,112	72,445	49.58%	9,815	6.72%	63,852	43.70%

*: Other sources include covered well, uncovered well, handpump, tubewell, borehole, spring, river, canal, tank, pond, lake, and any other sources.

Sources: District Census Handbooks of Each District, Census of India (2011)

(3) Electricity

Uttarakhand has a huge hydroelectric power potential which is yet to be developed. Hydroelectric power in the state is handled by three organizations, namely: Uttarakhand Jal Vidyut Nigam Limited (UJVN), Uttarakhand Power Corporation Limited (UPCL), and Power Transmission Corporation of Uttarakhand. District-wise status of electrification in Uttarakhand is summarized in the following table.

Table 3.6.6 District-wise Status of Electrification

District	Area	Total Number of HHs	Number and Percentage of HHs Having Following Main Source of Lighting					
			Electricity		Kerosene		Other Sources*	
Almora	Total	139,257	109,876	78.90%	25,175	18.08%	4,206	3.02%
	Rural	126,476	97,337	76.96%	24,978	19.75%	4,161	3.29%
	Urban	12,781	12,539	98.11%	197	1.54%	45	0.35%
Bageshwar	Total	57,712	47,083	81.58%	9,062	15.70%	1,567	2.72%
	Rural	55,748	45,172	81.03%	9,020	16.18%	1,556	2.79%
	Urban	1,964	1,911	97.30%	42	2.14%	11	0.56%
Chamoli	Total	85,765	71,524	83.40%	9,396	10.96%	4,845	5.65%
	Rural	72,744	58,791	80.82%	9,142	12.57%	4,811	6.61%
	Urban	13,021	12,733	97.79%	254	1.95%	34	0.26%
Champawat	Total	52,356	37,725	72.05%	11,948	22.82%	2,683	5.12%
	Rural	44,386	30,333	68.34%	11,460	25.82%	2,593	5.84%
	Urban	7,970	7,392	92.75%	488	6.12%	90	1.13%
Dehradun	Total	322,700	310,726	96.29%	10,036	3.11%	1,938	0.60%
	Rural	137,051	129,466	94.47%	6,410	4.68%	1,175	0.86%
	Urban	185,649	181,260	97.64%	3,626	1.95%	763	0.41%
Hardwar	Total	325,344	279,012	85.76%	42,517	13.07%	3,815	1.17%
	Rural	199,642	158,117	79.20%	38,713	19.39%	2,812	1.41%
	Urban	125,702	120,895	96.18%	3,804	3.03%	1,003	0.80%
Nainital	Total	187,108	169,001	90.32%	15,242	8.15%	2,865	1.53%
	Rural	112,670	96,746	85.87%	13,409	11.90%	2,515	2.23%
	Urban	74,438	72,255	97.07%	1,833	2.46%	350	0.47%
Pauri Garhwal	Total	161,688	143,963	89.04%	14,695	9.09%	3,030	1.87%
	Rural	137,102	119,829	87.40%	14,331	10.45%	2,942	2.15%
	Urban	24,586	24,134	98.16%	364	1.48%	88	0.36%
Pithoragarh	Total	111,542	95,421	85.55%	12,957	11.62%	3,164	2.84%
	Rural	95,130	79,202	83.26%	12,802	13.46%	3,126	3.29%
	Urban	16,412	16,219	98.82%	155	0.94%	38	0.23%
Rudraprayag	Total	53,492	49,182	91.94%	3,811	7.12%	499	0.93%
	Rural	51,064	46,794	91.64%	3,774	7.39%	496	0.97%
	Urban	2,428	2,388	98.35%	37	1.52%	3	0.12%
Tehri	Total	133,494	117,239	87.82%	12,552	9.40%	3,703	2.77%
	Rural	116,988	100,992	86.33%	12,329	10.54%	3,667	3.13%
	Urban	16,506	16,247	98.43%	223	1.35%	36	0.22%

District	Area	Total Number of HHs	Number and Percentage of HHs Having Following Main Source of Lighting					
			Electricity		Kerosene		Other Sources*	
Uttarkashi	Total	66,558	254,802	84.92%	41,967	13.99%	3,283	1.09%
	Rural	61,149	156,658	80.46%	36,023	18.50%	2,014	1.03%
	Urban	5,409	98,144	93.15%	5,944	5.64%	1,269	1.20%
UdhamSingh Nagar	Total	300,052	52,621	79.06%	11,848	17.80%	2,089	3.14%
	Rural	194,695	47,319	77.38%	11,758	19.23%	2,072	3.39%
	Urban	105,357	5,302	98.02%	90	1.66%	17	0.31%
Uttarakhand	Total	665,138	1,738,175	87.04%	221,206	11.08%	37,687	1.89%
	Rural	519,026	1,166,756	83.05%	204,149	14.53%	33,940	2.42%
	Urban	146,112	571,419	96.49%	17,057	2.88%	3,747	0.63%

*: Other sources include covered well, uncovered well, handpump, tubewell, borehole, spring, river, canal, tank, pond, lake, and any other sources.

Sources: District Census Handbooks of Each District, Census of India (2011)

1) Uttarakhand Jal Vidyut Nigam Limited²⁷

Uttarakhand Jal Vidyut Nigam (UJVN) Limited is a wholly owned corporation of the Government of Uttarakhand. UJVN operates hydropower plants ranging in a capacity from 1.5 MW to 304 MW, totaling to 1292.10 MW and is committed to develop new power stations in an early and efficient manner for economic well-being and growth of the State and its people.

2) Uttarakhand Power Corporation limited²⁸

Uttarakhand power Corporation limited (UPCL) is a sole electricity distribution licensee of the state, therefore, responsible for the supply of uninterrupted and quality power to 1.89 million consumers spread in the state. Load is classified as domestic, commercial, agricultural and industrial. Power is being supplied through networks, transmission, sub-transmission, and distribution lines laid in the state.

3) Power Transmission Corporation of Uttarakhand Limited²⁹

The Power Transmission Corporation of Uttarakhand Limited (PTCUL) is the power transmission utility of the State of Uttarakhand. The objectives of PTCUL are stated as follows:

- To acquire, establish, construct, take over, erect, lay, operate, run, manage, hire, lease, buy, sell, maintain, enlarge, alter, renovate, modernize, work and use electrical transmission lines and/or network through extra high voltage, medium voltage and low voltage lines and associated sub-stations, including cables, wire, accumulators, plants, motors meters, apparatus, computers, and materials connected with transmission and wheeling of electrical energy along with ancillary services, telecommunication, and telemetering equipment in the State of Uttaranchal and elsewhere. To undertake, for and on behalf of other erection, operation, maintenance, management of extra-high voltage, high voltage, medium voltage and low voltage, lines and associated sub-stations, equipment, apparatus, cable and wires.
- To coordinate the facilities for the interstate, regional and inter regional generation and efficient, economical and integrated transmission and supply of electricity. To levy and charge such fees and wheeling charges from the generating, distribution companies, licensees, bulk consumers as may be specified by appropriate Regulatory Commission.
- To facilitate and promote transmission, wheeling, and inter connection arrangements within the State of Uttaranchal for the transmission and supply of electricity by economical and efficient utilization of electricity.
- Till a separate SLDC is established as per law, for the time being, to establish, acquire, construct, take over the State Load Dispatch Center and run, manage supervise, operate the State Load Dispatch Center as the apex body to ensure integrated operation of the power system in the State of Uttaranchal and optimum scheduling and dispatch of electricity within the State of Uttaranchal, monitor grid operation; levy and collect such fees and charges from the generating companies and licensees engaged in intra state transmission of electricity as may be specified by appropriate Regulatory Commission. To schedule and dispatch generation

²⁷ <https://www.ujvnl.com/the-company>

²⁸ <https://www.upcl.org>

²⁹ <https://www.ptcul.org/ptcul-at-a-glance>

of all units connected to the state power system including the centrally owned generating stations, in respect of the share assigned to the state and electricity purchased from other state undertakings.

- To study, investigate, collect information and data, review operations, plan research, design, prepare project reports, diagnose operational difficulties and weakness, and advise on the remedial measures to improve and modernize. To tender and/or finalize contract for transmission and wheeling of power from generating stations and other sources.

3.7 Impact of Climate Change to Horticulture

3.7.1 Optimal Climatic Requirement for the Fruits and Vegetables Selected

In response to climate change under hilly regions – temperate zone in India, the temperate fruit of nut, pome, stone fruits, or kiwifruits, vegetables, or spices also, those productions are highly affected. The prevailing climatic conditions in Himalayan regions like temperature fluctuates, inadequate chilling requirements, enhanced instances of hailstorms and rainfall leads to poor pollination, substandard flower retention and fruit setting and results in poor productivity of those fruits or vegetable. As a result, the negative impact of these changes on quality and quantity and ultimately on commercial production of those fruits must be extricated by adaptation measures. Optimal climatic requirements of the selected fruits and vegetables are shown in Attachment 3.7.1.

3.7.2 Current Confirmed Impact by Climate Changes on Farm

(1) People's perceptions on Climate Change in Horticulture

According to a study (**Press Trust of India, 2010**) the Peak Rainfall Time has shifted from July-August to August-September and winter precipitation extended till February whereas, cloud bursts have become a regular phenomenon in the recent past. In 2010 cloudbursts destroyed 30% of the crops in Uttarakhand. Some anecdotal accounts based on people's or farmer's perceptions of climate change are given below and photos of influences of climate change i.e., damaged by snow, heat, hail, etc. on fruits and vegetables, is shown in Attachment 3.7.2.

Table 3.7.1 People's Perceptions on Climate Change in Horticulture

no.	Category	Precepted Changes
1	Temperature	Increased warming in snowfall period, lower periods of snow on ground
2	Change of season	Shift of monsoon up to October and damage the matured crops which leads decline in yields
3	Influences on cultivation	Less rains during March-May - abandonment of millets like <i>Panicum milliaceum</i> and decline yield of Amaranthus
		Decline in apple yield and upward shift of apple zone due to less snow fall
		Shortening of maturity periods of winter (rabi) crops such as cabbage,
		Successful cultivation of cabbage/pea/tomato in higher elevations
		Shift of winter period delaying the sowing period of winter crops and decline in most of the rabi season crops
		Increased pest infestation

Source: JICA Survey Team

(2) Reported Changes by Climate Changes

Research results in Climate Changes are reported with data on the potential agricultural damages or influences by climate change e.g., damages by heat, wind, rainfall, pests/diseases, etc. on the growth or products, if any:

The data or studies regarding impact of climate change on fruit crops are not yet enough in Uttarakhand. Therefore, it is important to consider the potential of impacts of climate change on fruits farming that communities are facing in Uttarakhand. Point wise the details of damages caused by climate change in past are given as follows:

Table 3.7.2 Reported Influences by the Climate Changes

No.	Category	Precepted Changes	Sources
1	Change in Peak Rainfall Time	Peak Rainfall Time has shifted from July-August to August-September and winter precipitation and extended till February whereas, cloud bursts have become a regular phenomenon in the recent past.	Press Trust of India PTI, 2010
2	Change of season	Hailstorm events in high altitude areas of Uttarakhand are also shifting	The Hindu, 2011

No.	Category	Precepted Changes	Sources
		from March to as late as May and these increase damage to various fruit crops at the flowering and early fruit stage. According to an estimate, around 50-60 per cent of the apple crops in parts of the State were destroyed in the year 2011 due to hailstorms	
4	Recession of Glaciers Change of Hailstorm Season	Studies indicate that glaciers in the Himalayan region are in a general state of recession since 1850's with few exceptions in the Karakoram region, which are advancing. As the glaciers retreat the amount of snow and ice melt may not be enough, especially during the critical summer season and other periods of low flow, and base flows may fall to a level where agriculture and human settlements are very adversely impacted. As the storage capacity of glaciers declines, short-term flood risks would increase. This would be followed by decreasing water flows in the medium and long term. Both these consequences of glacier melt would threaten food production in some of the world's most densely populated regions	Mayewski and Jeschke, 1979; Vohra, 1981; Dobhal et al., 2004; Kulkarni et al., 2007 and Hewitt, 2005
5	Influence on River System	River systems originating from the Himalayan region are fed in part by melting of snow and ice stored in the glaciers and this helps the rivers maintain a healthy level of stream flow all-round the year. Snow and glacier melt together with monsoonal precipitation determines the headwater flow regimes of large parts of the Himalayas, including central and eastern Himalayan tributaries of River Ganga and Brahmaputra. Studies reveal that snow and glacier melt contribution is very significant in many of these Himalayan Rivers. On average, annual snow and glacier melt contribution is estimated to be 60% in Satluj river at Bhakra dam 49% in Chenab river at Akhnor (and 35% in Beas river at Pandoh.	Singh and Jain, 2002, Singh et al., 1997 and Kumar et al., 2007
6	Shifting of Apple Farmland from Low to Up-ward	The study investigated farmers' perceptions of the effects of climate change on apple farming over an altitudinal gradient in Himachal Pradesh, India, and found that when temperatures rise, apple production shifts from low hills to middle and high hills.	Basannagari and Kala (2013)
7	Shifting of Fruits Variety to Other Fruits	Farmers at higher elevation are shifting their producing fruits to others such as peach and plum those requires lesser cold conditions. The crops have been effectively replaced with peach in the famous Ramgarh belt in Nainital district, which is fetching good rates in the marketplaces of Delhi and Mumbai.	ditto
8	Impact on phenology by Climate Change	Time changes of different physiological activities i.e. phenology is one of the most pronounced effect of climate change. In temperate fruits, flower induction is deeply influenced by temperature, especially low temperature, however, strong interaction between genotype, photoperiod and temperature interactively control flowering.	Cleland et al., 2007
		There was an advance in spring phenology ranging from 2 to 8 days for the woody perennials in north-eastern USA during period 1965 to 2001 and a qualitatively consistent and similar phenology shifts with a warming trend have been reported for other mid and high-latitude regions. An earlier date of full bloom of up to 10 days was observed in apple 'Boskoop', 'Cox's Orange Pippin' and 'Golden Delicious' when comparing the last 20 years with the previous 30 years, which is less than the 14 days reported generally for Germany. Advancing trends in bloom dates of many trees indicate that dormancy breaking processes are indeed changing most likely in response to climate change.	As per study conducted by Wolfe et al., 2005

Source: JICA Survey Team

3.7.3 Impact of Different Climatic Parameters on Crops & Agriculture System

The climate change affects not only the winter chilling requirement of fruit crops, but it also affects the other aspects like increase in the incidence of physiological disorders, pollination failure and phenology. The impacts are summarized in following table and Attachment 3.7.3. The effect of climate change is not only productivity but also impaired fruit quality. Loss in plant diversity and area suitability due to climate change will further increase the problem.

Table 3.7.3 Impact of Different Climatic Parameters on Crops & Agriculture System

no.	Parameters	Precepted Changes	Sources
1	Temperature	The studies indicated that the effect of temperature ranged from reduced photosynthetic rates, increased water use efficiency, hastening or delaying phenological events to altering source-sink balance and reduced yield.	Chadha, 2019

no.	Parameters	Precepted Changes	Sources
2	Precipitation and shifting rain time	The rainfall amount and distribution become very important for successful production of rainfed horticultural crops.	Chadha, 2019
3	Phenology	Time changes of different physiological activities i.e. phenology is one of the most pronounced effect of climate change	Cleland <i>et al.</i> , 2007
4.	Dormancy	The plants use the dormancy mechanism to protect its sensitive tissue from unfavorable climatic condition and climate change makes influence on the mechanism.	Rai <i>et al.</i> , 2015
5.	Flowering and pollination	Weather conditions during flowering and pollination and subsequent fruit growth determine the production, quantity and quality.	Chadha, 2019
6.	Yield	High temperature and moisture stress resulted in sun burn and cracking in various kinds of fruits, vegetables, etc.	
7.	Soil Factors	Climate change makes influences of soil factors not only for the chemical factors, also physical factors by erosions.	
8.	Droughts, cold, frost and hailstorms	Such climate changes cause directly quality and quantity of yield of the fruits and vegetables.	
9.	Elevated CO ₂	The impacts on horticultural crops have been studied using several approaches such as open top chambers, free atmospheric CO ₂ enrichment facilities as well as using the simulation models.	
10.	Post-harvest quality	temperature variation can directly affect crop photosynthesis	Moretti <i>et al.</i> , 2010
11.	Pest and Disease	Climate change could alter stages and rates of development of pathogen, modify host resistance and physiology of host-pathogen interactions.	Gautam <i>et al.</i> , 2013

Source: JICA Survey Team

3.7.4 Government Policy and Plan on the Climate Change

(1) Policy and Action Plans in Climate Change

Following four policies and plans for climate change related to agriculture in Uttarakhand State are confirmed, those are mainly led by Forest Department in Uttarakhand.

Table 3.7.4 Policy and Plan in Climate Change for Horticulture

No.	Policy / Plan with Year	Organization	Objective
1.	AGENDA FOR CLIMATE ACTION, Nov 2016: Linking the Vulnerability and Risk Assessment for, Uttarakhand with policy implications for the state,	State Climate Change Centre, Uttarakhand Forest Department, Government of Uttarakhand	The Agenda for Climate Action is targeted primarily at policy makers, but also development partners, civil society organizations, and research institutions looking to include this evidence base in new and existing projects or programmes.
2.	Uttarakhand Action Plan on Climate Change, 2014	Government of Uttarakhand, led by Forest Department, Uttarakhand	This plan is resulted in the evolution of the Action Plan through various versions that were exposed to scrutiny through website, workshops, seminars etc. For a state like Uttarakhand, adaptation has more significance than mitigation, as the contribution of the State to the GHG pool is miniscule compared to the developed states in the country.
3.	Uttarakhand State REDD+ Action Plan (SRAP), 2018	ICFRE, in collaboration with ICIMOD and Uttarakhand State Forest Department	SRAP identified: - Effective implementation of forest legislation/policies and forest working plan prescriptions; - Preparation of comprehensive land use plan; - Deforestation free urbanization and other settlements; - Planning of development activities to avoid biodiversity rich areas and hot spots; - Incentivizing agroforestry and horticulture with appropriate agriculture technologies; - Sustainable management of forest products; - Prevention of forest fire and provision of rewards; - Adaptation to extreme climatic conditions and - Simplified approaches for promoting forest carbon enhancement activities

No.	Policy / Plan with Year	Organization	Objective
4.	National Action Plans on Climate Change, (NAPCC) is a Government of India's programme launched in 2008 to mitigate and adapt to the adverse impact of climate change. The action plan was launched in 2008 with 8 sub-missions. The plan aims at fulfilling India's developmental objectives with focus on reducing emission intensity of its economy.	Prime Minister's Council on Climate Change	The strategies and programmers of actions outlined in the Mission Document, that was accorded 'in principle' approval by Prime Minister's Council on Climate Change on 23.09.2010, aim at promoting sustainable agriculture through a series of adaptation measures focusing on ten key dimensions encompassing Indian agriculture namely; 'Improved crop seeds, livestock and fish cultures', 'Water Use Efficiency', 'Pest Management', 'Improved Farm Practices', 'Nutrient Management', 'Agricultural insurance', 'Credit support', 'Markets', 'Access to Information' and 'Livelihood diversification'. During XII Five Year Plan, these measures are being embedded and mainstreamed onto ongoing/proposed Missions/ programmes / Schemes of Dept. of Agriculture & Cooperation through a process of restructuring and convergence.

Source: JICA Survey Team

(2) Agenda for Climate Action, 2016

Among the policies/plans, Sr. No 1 of Agenda for Climate Action, Nov 2016 and Sr. No 4 NAPCC are depict agriculture. The following tables provide a summary of the suggested areas of action to be undertaken in the agriculture sectors over the next five years based on findings of the top-down Vulnerability and Risk Assessment (VRA), a bottom-up review of community trends, and a review of existing state and national priorities.

Table 3.7.5 Suggested Actions in Agriculture by the Agenda for Climate Action, 2017

No.	Impact Area	Actions
1	Increase in water stress	- Re-evaluate guidelines for irrigation practices in line with the VRA findings - Promote climate smart agricultural technologies
2	Increased risk of flooding	- Raise awareness of insurance schemes at the farm level - Link the VRA findings with weather-based index insurance by Agriculture Insurance Company of India
3	Changes in crop yields	- Assess irrigation strategies and conduct studies on crop yields in line with the VRA findings - Conduct supply chain and market analysis for opportunities for new agricultural enterprises
4	Climate change can undermine development goals	- Focus on an overarching agriculture policy, linking current state objectives and climate vulnerabilities - Build capacity of agriculture extension teams to integrate climate risks and opportunities - Link climate data with Uttarakhand's Agro-Climatic Planning and Information Bank (APIB)

Source: JICA Survey Team

Among NAPCC, the following national mission for sustainable agriculture are depict.

Table 3.7.6 National Mission for Sustainable Agriculture under NAPCC

Objectives of National Mission for Sustainable Agriculture
- Strengthening agricultural insurance, develop a system based on Geographic Information System (GIS) and remote sensing to map soil resource and land use. - Providing information and collation of off-season crops and preparation of state-level agro-climatic atlases. - Strategies to evolve low input agriculture with enhanced water and nitrogen efficient crops. - Nutritional strategies to manage heat stress in dairy animals. - Using of micro irrigation systems. - Promotion of agricultural techniques like minimum tillage, organic farming and rainwater conservation. - Capacity building of farmers and other stakeholders. - Production of bio-fertilizer, compost along with subsidies for chemical fertilizers. - Strengthening of National Agricultural Insurance Scheme.

Source: JICA Survey Team

3.7.5 Adaptation Measures and Expected Impact on Horticulture in Uttarakhand

(1) Current Applied Adaptation Measures in Uttarakhand

Current practice as adaptation measures for climate change on the fields in Uttarakhand are collected and shown in Attachment 3.7.4, such as widely covered slope by hail-net, plastic tunnel etc. The situation could be understood as preparatory or initiating stage for the climate change adaptable horticulture through the related research. The preparatory works for setting up the adaptation techniques have not been started, and the management methods for the techniques have not been disseminated to farmers.

(2) Priority Cultural Adaptation Measures for Climate Change and Expected Effect

To minimize the adverse effect of climate change on horticultural crops, various cultural technologies are suggested by the researchers like changing planting and time of harvesting, choosing crops with brief life cycle, different crop schemes, irrigation technique, crop sequencing (Raza, *et al.*, 2019). As far as the household survey under the JICA survey, current farmers in Uttarakhand would be delayed the application of those cultural techniques in the table below. Grafting technique of tomato, brinjal, or cucurbit varieties are common in a world. Candidate rootstock varieties are in Attachment 3.7.5 as well as new varieties at preceding clause. Application of those techniques by the farmers can be started immediately based on capacity development of the extension staff. Also, the “quality planting material” is one of the most important dimensions for development horticultural clusters with crops resilient to climate change for not only fruits tree, also vegetables. In addition to the planting materials for the temperate fruits, pure and vigorous, and virus free planting materials are very important for pea, garlic, ginger, turmeric, potato. Those crop production farmers can produce the plant materials by themselves but must be supplied the genuine material every 4-5 years or 4-5 times of plant rotations. These technical and manageable adaptation measures will support steady growth of the crops under the climate changeable condition.

Table 3.7.7 Summarized Cultural Adaptation Options for Overcoming Climatic Risks

Targeted to stress	Cultural Adaptation Measures
Flooding	Application of compost, Raised bed cultivation, drainage facility, slow-release fertilizers
Low rainfall condition	Raised bed cultivation, mulching, in situ water harvesting, application of farmyard manure, potassium fertilizers, land levelling with laser levelers, reduce the loss of water in irrigation channels, drip and sprinkler irrigations, use of anti-transpiration chemicals
Heat stress	Micro-irrigation and sprinkler irrigation, applying heat tolerant rootstock and varieties/cultivars,
Dry spell	Mulching, drip irrigation, life-saving irrigation, reduce the loss of water in irrigation channels
Drought and prolonged dry spell	Conducting soil test, applying proper irrigation and fertilization, soil moisture conservation measures such as leaf mulching, coarse compost such as coir pith and husk burial
Frost	Proper irrigation, plastic tunnels, polyhouse, smoking or making wind for frost, mulching, etc.
Hailstorms	Hail nets prevent physical damage, bagging fruits, proper fruit pruning,
Clear chilling requirement	Shade net, wind breaks with net/plant, application of plant hormones or artificial techniques for vernalization, breaking dormancy, etc.

Source: JICA Survey Team

(3) Adaptation Measures by New Varieties for Climate Change

Development of drought, heat or cold tolerant root stocks or varieties/cultivars, combinations of root and scion, short time ripen varieties and vigorous nursery and thus this is one of the most feasible solutions to the problem of insufficient chilling, though it is very difficult and taking time to breed low chill cultivars. Thus, in collaboration with researchers, candidate varieties or cultivars should be adopted for field test and then extend in Uttarakhand. Current candidate varieties for low chill cultivars, List of vegetables varieties and their advance line tolerant to abiotic stress, heat or dry climatic, tomato root-stock varieties are listed in Attachment 3.7.5. As well as the cultural adaptation measures above, this adaptation measure with new varieties must be launched immediately in accordance with examination of the information in Attachment 10 and procurement of the varieties.

(4) Adaptation Measures by Changing Crops or Shifting Land

As per the studies undertaken in the past on impacts of climate change especially for raising temperature on fruits cultivation suggested that in last three decades the fruits cultivation would be getting affected, and the chilling requirement fruits crops have possibility to been declined the production in lower

elevation or in warm area and expected the fruits orchards would be shifted towards higher elevation or cold area. This tendency would be continued since the precise meteorological observation should be continued to confirm the changes for on time recommendations to the farmers i.e., change the crops to lower chilling requirement crops, or the crops matching with warmer climate.

3.8 Supporting System for Farmers

3.8.1 Extension Services

Extension services for horticulture development are provided mainly by Krishi Vigyan Kendra (KVK) and by the horticulture mobile teams of UKDHFP among others. An attempt was made to review these extension systems.

(1) Krishi Vigyan Kendra (KVK)

KVK is an institution that provides agriculture extension services across the state. In Uttarakhand, there are 13 KVKs. In each of the proposed project districts of Uttarkashi, Tehri Garhwal, Nainital and Pithoragarh, KVK has its establishment and extension service. Most of the KVKs are associated either with Govind Ballabh Pant University of Agriculture & Technology (GBPUAT) in Pantnagar or VCSG Uttarakhand University of Horticulture & Forestry, Bharsar, Pauri Garhwal. Two KVKs in Pauri Garhwal and Tehri Garhwal, which are associated with GBPUAT have been merged with Uttarakhand University of Horticulture & Forestry, Bharsar. The specific objectives of KVKs in Uttarakhand are as follows:

- Increasing crop productivity by adopting improved production technology i.e., use of high yielding varieties, use of balance dose of fertilizers including compost and bio-fertilizers, adopting appropriate measures of plant protection, use of agricultural implements, etc.
- Testing and evaluation of various technologies under complex, diverse, and risk prone agriculture system of hilly areas.
- Organize vocational training program on horticulture and nursery management, bee keeping, small animals (angora rabbits), mushroom cultivation, dairy, poultry, off-season vegetable crops, medicinal and aromatic plants, craft work, sericulture, postharvest management and value addition of food crops, and other relevant areas.
- Getting first hand scientific feedback from the field and passing it on to research system.
- Providing training support to state development department.
- Popularization of concept of “Diversification of Agriculture” to make small and marginal holdings more profitable.
- Increasing livestock productivity through improvement in breeds of cattle and buffaloes.
- Increasing green fodder availability and improving nutritional status.
- Popularization of low draft improved agriculture implements.
- To develop production technology for spices, medicinal, and aromatic plants.
- Improving economic level of villagers/farmers by introducing seed production program of European vegetables/varieties and cultivation of low volume high value crops.

(2) Horticulture Mobile Team

UKDHFP has its own extension services focusing on horticulture crops. There are 319 horticulture mobile teams operational in the state. Their main role is to distribute the farm inputs and to disseminate technical information to the horticulture farmers. It seems that they are lacking in terms of transportation and thus, mobility is limited. The JICA Survey Team was also informed by the district officials that many of these positions are left vacant for long while a greater number of horticulture mobile team members are needed where the population density is low and takes time to travel.

(3) State Agricultural Management and Extension Training Institute (SAMETI)

SAMETI was established in Uttarakhand in September 2005 under the Society Act 1860 in August 2006. It is headed by the Director Extension Education in GBPUAT, Pantnagar. Key functions of SAMETI are as follows:

- To provide capacity building support in extension management related areas to the extension functionaries both from public and private sectors.
- To provide need-based consultancy services to ATMA in the areas like project planning, appraisal, implementation.
- To develop and promote the application of management tools for improving the effectiveness of agricultural extension services through better management of human and material resources.
- To organize need based training programs for middle level and grass-root level agricultural extension functionaries.
- To develop modules on management and communication.
- Participatory methodologies as a sequel to the feedback from training programs.

(4) Agricultural Technology Management Agency (ATMA)

ATMA Scheme was launched during 2005-06. It aims at making extension system farmer driven and farmer accountable by way of new institutional arrangements for technology dissemination in the form of an Agricultural Technology Management Agency (ATMA) at the district level to operationalize the extension reforms. ATMA has the active participation of farmers/farmer-groups, NGOs, Krishi Vigyan Kendras (KVKs), Panchayati Raj Institutions and other stakeholders operating at the district level and below. Release of funds under ATMA scheme is based on the State Extension Work Plans (SEWPs) prepared by the state governments. ATMA executes the following activities in accomplishing its objectives in benefitting the farmers:

- Building a reliable Farmer Advisory Committee to acquire and improve their feedbacks provided to the State Agricultural Universities (SAUs) and National Agricultural Research System (NARS).
- Clustering all the non-government organizations functioning in the UTs, states, districts or villages.
- Educating and training the farmers about technological upgradation by involving and encouraging private institutions.
- Certifying and improving technologies through research units in the district and block levels.
- Enhancing the planning procedure to improve productivity.
- Providing further training for the stakeholders and assist them in rendering global competence.
- Creating more farmer's group and reinforcing them with innovative ideas and methodologies.
- Mounting new partnerships between public and private parties.

(5) Agriculture Technology Information Center (ATIC)

ATIC was established in August 2001 with the financial support of ICAR, which act as one-stop-shop for all farmers and other stakeholders. ATIC is functioning with the following objectives:

- To provide greater coordination and intensive interaction between the researchers and technology users beyond individual units of research institutions in contributing towards the dissemination of information.
- To serve as a "Single Window System" with an objective to help farmers and other stakeholders such as farmer-entrepreneurs, extension workers, development agencies, non-government agencies (NGOs) and private sector organizations to provide solutions to their location-specific problems in agriculture and make available all the technological information along with technology inputs and products for testing and utilization by them.
- To build up required confidence among farmers and to strengthen linkage between the university and the farmers.
- To provide diagnostic and advisory services such as soil and water testing, plant and livestock health diagnosis and advisory services accordingly.
- To sale and distribute improved products emerging as a result of research being done at SAU's like seeds, planting materials, livestock breeds, fish seed, poultry grains, and processed products.
- To provide an overview of improved technology through published literatures and other communication materials.

- To overcome technology dissemination loss by providing direct access of farmers to improved expertise as well as technological products.
- To provide an opportunity to SAU to have resource generation through sale of their technologies.
- Participation in state festivals and exhibitions.

3.8.2 Market Information

For the horticulture sector in Uttarakhand, market information is an important part of the business for the farmers. It includes timely availability of information about prices, contacts of the buyers, customers and consumers, distribution channels, trend in the market, rates in different *mandies*, export possibilities, information about competitors, information about grade and standards, postharvest handling advice such as information about the storage and transport costs and various other factors that are required for the transaction in the market.

As per the study report of 2016 “majority of the farmers still receive market information through the traditional sources like regulated markets, traders, and fellow farmers visiting the market yards. New sources of information like newspapers, television, SMSs, etc., are emerging information sources for the farmers. Strong emphasis has been placed in the recent past on providing market information as well as price forecasts to the farmers through many government and private initiatives. Information about market attributes is essential to keep the farmers and traders abreast about existing market prices, domestic and global agricultural supply and demand conditions, policy environment and other relevant factors influencing the prices.”

There have been several efforts from the central government to facilitate farmers in marketing by providing various platforms. These platforms are created under the Ministry of Agriculture and Farmers Welfare. Horticulture is also being dealt through the same ministry.

Table 3.8.1 Government and Other Platforms for Market Information System Applicable in Uttarakhand

S.No.	Platform	Source	Use of the Platform	Details About the Services
1.	Electronic National Agriculture Market	Website and Mobile App (Google Play Store)	Facilitates in accessing - Information about <i>mandies</i> Commodities wise prices Logistics service providers	eNAM is not a parallel marketing structure but rather a device to create a national network of physical <i>mandis</i> which can be accessed online. It seeks to leverage the physical infrastructure of the <i>mandis</i> through an online trading portal, enabling buyers situated even outside the <i>mandi</i> /state to participate in trading at the local level. https://enam.gov.in/web/dashboard/trade-data eNAM-Logistics – It provides information about the service providers of logistic management. https://enam.gov.in/web/eNAM-Logistics-Providers This NAM Portal provides a single window service for all APMCs related information and services. Some of the offerings include commodity arrivals and prices, buy and sell trade offers, provision to respond to trade offers, etc. Although the movement of the agriculture produce continues to happen through <i>mandis</i> , an online market reduces transaction costs and information asymmetry.
2.	AgMarket	Website	Commodities wise price	AgMarket is a government website that provides online details about the prices of commodities in different states, districts, and also specific markets on a particular date. https://agmarknet.gov.in/
3.	Directorate of Economics & Statistics	Website	Retail price information variation	This is a website of the Directorate of Economic and Statistics to get reports on retail price information and price variation of different periods. This is good for the researchers to do analysis of the prices. https://rpms.dacnet.nic.in/Reports.aspx
4.	Mkisan	Website	SMS Portal for farmers	mKisan SMS Portal for farmers enables all central and state government organizations in agriculture and allied sectors to give information/services/advisories to farmers by SMS in their language, preference of agricultural practices, and location. These messages are specific to farmers' specific needs and relevance at a particular point of time and generate heavy

S.No.	Platform	Source	Use of the Platform	Details About the Services
				inflow of calls in the Kisan Call Centers where people call up to get supplementary information. SMS Portal for Farmers has empowered all central and state government organizations in agriculture and allied sectors (including State Agriculture Universities, Krishi Vigyan Kendras, Agromet Forecasts Units of India Meteorological Department, ICAR Institutes, Organization in Animal Husbandry, Dairy & Fisheries etc.) to give information/services/advisories to farmers by SMS in their language, preference of agricultural practices and locations. https://mkisan.gov.in/aboutmkisan.aspx
5.	Kisan Suvidha	Mobile App (Google Play Store)	Market price of commodities in mandies	This is a mobile App which can be downloaded from the Google play store. Farmers can get information about market prices of different commodities including horticulture produce, using this App. https://mkisan.gov.in/downloadmobileapps.aspx
6.	KISAN RATH app	Mobile App (Google Play Store)	Transporters' Information	Government has launched a Mobile App to contact vehicle providers for transportation of produce
7.	IFFCO Kisan	Mobile App (Google Play Store)	IFFCO Kisan sent promotional OBD messages followed by SMS with the app's download link to the Google Store page. The campaigns resulted in 60% unique clicks.	"IFFCO Kisan Agriculture App" is one of the pioneering mobile data driven services in India, providing a 'one-stop-shop' information portal with access to agriculture content. It aims to help Indian farmers make informed decisions through customized information related to their needs. The app, also available through an online portal, is managed by IFFCO Kisan, a subsidiary of Indian Farmers' Fertiliser Cooperative Ltd (IFFCO), the largest organization in India responsible for the production and distribution of fertilizers for farmers through a cooperative network. www.iffcokisan.com
8.	E-Mandi UKAPMB	Internet based	One can login to use e-mandi	Uttarakhand Agriculture Produce Marketing Board has the provision of E-Mandi for facilitating the farmers to login and use the platform. http://emandi.ukapmb.org/Login.aspx
9.	APEDA Agri Exchange	Trade Portal	Provides Latest Sell Offers Latest Buy Offers Exports from India International Trade India Production International Production Import Tariffs	Agri Exchange is the name given to the trade portal. An attempt, first of its kind has been endeavored by APEDA, Government of India, where online trading is the specialty. In its stride, joint collaboration of UNCTAD and the Ministry of Agriculture has given the portal a shape. Globally, buyers and sellers in the agribusiness world have been given a platform to offer, negotiate, and transact a deal. Apart from this, it has been loaded with latest statistics pertaining to India and the world. http://agriexchange.apeda.gov.in/

Source: JICA Survey Team based on various websites and portals of the Ministry of Agriculture and Farmers Welfare, APEDA, UKAPMB and IFFCO

3.8.3 Agriculture Credit

The government and NABARD provide various agriculture credit scheme for farmers. This section provides salient features of major agriculture credit scheme. As per the NABARD Focus Paper 2021-22, Total Farm credit in 2020-21 was INR 118,019.60 million. In 2021-22 INR 126,485.0 million is proposed for farm credit.

Table 3.8.2 Status of Agriculture Credit in Uttarakhand

Farm Credit	2020-21 (Actual)	2021-22 (proposed)
Crop Loan	7,427.52	7,498.03
Agriculture Term Loan	2,861.02	3,174.19
Agri. Infrastructure	289.54	471.18
Ancillary Activities	1,223.87	1,505.10
Total Farm Credit	11,801.96	12,648.50

Source: State Focus Paper NABARD 2021-21 <https://www.nabard.org/info-center-state-focus-papers.aspx?cid=512&id=698>

(1) Deendayal Upadhyay Sahkarita Kisan Kalyan Yojana

The Government of Uttarakhand has introduced a farm loan scheme called Deendayal Upadhyay Sahkarita Kisan Kalyan Yojana as an initiative to assist small and marginal farmers of the state. This scheme will provide loan facilities to strengthen the rural economy and to improve the financial conditions of the farmer. The purpose of the scheme is to increase the cultivation of agriculture by increasing the income of the farmers. Through this scheme, the eligible farmers can improve the livelihood options by establishing small agro-based units in the rural areas.

(2) Kisan Credit Card

The loan amount of INR 3 lakhs is given under the Kisan Credit Card Scheme, in which the loan amount of INR 0.160 million is given to farmers without any guarantee. The farmers get the loan up to 0.30 million through the Kisan Credit Card (KCC). By the end of September 2020, the total KCC issued in the state was 605,072, in which 40,070 were issued in 2020.

Chapter 4 Review of Preliminary Project Report

4.1 Outline of the Uttarakhand Integrated Horticulture Development Project (UKIHDP)

4.1.1 General

Uttarakhand (UK), blessed with its natural condition and proximity to the major market of Delhi, has uncultivated potentials for horticulture development. To develop the sector further, several issues are identified in the survey. Those could be summed up into four: 1) insufficient production capacity of the farmers; 2) inadequate supporting system for production and marketing for the farmers; 3) absence of appropriate institutions for the small/ marginal farmers to access market; and 4) appropriate marketing strategy to promote the Uttarakhand brand. To address these issues, the Uttarakhand Department of Horticulture and Food Processing (UKDHFP) proposed UKIHDP to seek financial assistance from the Japan International Cooperation Agency (JICA). In this section, an overview of the proposed project is provided hereunder.

4.1.2 Project Components

The proposed project is comprised of four components, namely 1) the enhancement of production support, 2) area expansion, 3) supply chain development including integrated post-harvest management, and 4) institutional development. An overview of the project components as stated in the Preliminary Project Report (PPR) are given in the table below.

Table 4.1.1 Project Outlines

Item	Description
Project Name	Uttarakhand Integrated Horticulture Development Project (UKIHDP)
Project Area	Four districts (Nainital, Pithoragarh, Uttarkashi, Tehri Garhwal) of Uttarakhand State
Project Goals and Objective	Goal: To holistically enhance production, productivity, quality of produce, processing, and market linkages for selected horticulture commodities. Objectives: There are 12 specific objectives listed in the PPR. 1. To provide holistic farming salutation through value chain enhancement 2. Empowerment of farmers through FPOs/ FIGs and strengthening their capacities 3. Further advancement of horticulture development in the state through convergence 4. Promoting ancillary subjects including medicinal and aromatic plants and mushrooms 5. Creation of sustainable irrigation facilities 6. Introduction of global good agriculture practices 7. To generate sustainable livelihood opportunities for youth 8. Human resource enrichment 9. Introducing horticulture as a subject in schools up to secondary levels 10. Reduction of human-animal conflict 11. Promotion of gender inclusive and climate adaptation activities 12. To uplift the social-economic status of farming community
Target Population	Small and marginal farmers in Nainital, Tehri Garhwal, Uttarkashi, and Pithoragarh districts
Project Component	1. Enhancement of production support - Establishment of advanced nursery, tissue culture units, aeroponics unit, mother plant garden free from virus, and the center of excellence - Import of planting materials 2. Area expansion - Establishment of new gardens under cost intensive crop, high/ultra-high/normal density planting, mushroom cultivation hut, greenhouse/shade net house for protected cultivation, and custom hiring units (CHU) for farm mechanization - Rejuvenation/Replacement of senile plantation - Promotion of integrated nutrition management (INM) and integrated pest management (IPM) - Water resource development and introduction of micro irrigation 3. Supply chain development including integrated post-harvest management - Establishment of pack house, controlled atmospheric storage (CA storage), and retail outlets for horticulture

Item	Description
	- Development of cold chain including cold storage and refrigerated transport vehicle (RTV) - Improvement of market infrastructure - Development of infrastructures for collection, sorting, grading, and packing. 4. Institutional development - Brand development and promotion - Standardization of parameters of and testing procedure for product quality - Establishment processing unit - Training for entrepreneurship development and post-harvest management - Extension and demonstration for technology dissemination
Target Indicator	1. Center of excellence established: 3 nos. 2. Farm developed - fruit: 2,800 ha, vegetables*: 6,500 ha, spices: 5,000 ha, flowers: 400 ha 3. Farmers group joined: 8 nos. 4. Storage established: 18 nos. 5. Processing facility established: 34 nos. 6. Market facility developed: 16 nos.
Implementation Agency	Department of Horticulture and Food Processing (DHFP) of UK
Supporting Agency	Uttarakhand Agriculture Produce Marketing Board, Uttarakhand Horticultural Marketing, Center for Aromatic Plants, Institute for Medicinal Plants Research, GP Pant University of Agriculture & Technology, Pantnagar & Uttarakhand University of Horticulture & Forestry at Bharsar, VPKAS (Almora), CITH (Mukteshwar), etc.
Project Period	From 2019 to 2024 (five years)

*: "vegetables" including potato: 1,500 ha

Source: JICA Survey Team

4.1.3 Rationale of the Project

In Uttarakhand, marginal and small farmers comprise 65.53%¹ of the total. In the horticulture sector, this also applies and especially, this holds true in the hilly regions of the state. The proposed project has been designed for strengthening their production capacity and improving market accessibility to increase their income and create employment opportunities for them through value addition to the horticulture produce.

4.1.4 Institutional Arrangement

The implementing agency is UKDHFP. A Project Management Unit (PMU) will be established at the state level for the execution of the project activities under the UKDHFP, which is under the Governing Council (GC) chaired by the Chief Secretary of UK. The PMU will be headed by a Project Director and Deputy Project Director who are deputed from the UKDHFP. Seven expert-positions and administrative staff are proposed to operationalize the PMU.

Under the PMU, the District Coordination Committee and District Implementation Units will be established at each district headed by a Chief Horticulture Officer. The Horticulture Mobile Team (HMT) headed by the Assistant District Officer of Horticulture will spearhead the implementation of the field level operation. Currently, HMT is placed in each block and accounts for 319 horticulture mobile teams.

The implementation of this project will solicit support from various stakeholders including the private sector as listed in Table 4.1.1, and in particular, the Uttarakhand Agriculture Produce Marketing Board (UKAPMB) and agriculture and horticulture universities in Uttarakhand.

4.2 Component-wise Review of the Project and Issues

4.2.1 Enhancement of Supporting System for Horticulture Crop Production

The following three state government systems support horticulture crop production in Uttarakhand. Firstly, the Horticulture Mobile Team as stated in clause 3.4.1 Local Administration (2) Horticulture Administration System, where a total of 319 of Horticulture Mobile Teams at block level are working on a ground level. Second, 48 fruit processing and training centers are working to provide training to

¹ Source: Agriculture Directorate/Statistical Diary 2018-19, Uttarakhand, Economic and Statistical Directorate, 2018-19

the farmers and processing facilities and/or tools for their raw fruits, and third, if the previous two supports are suspended by following nurseries of the horticulture crop productions, they will be supported by the nurseries of the state, National Horticulture Board nurseries, and private nurseries. These three existing supporting systems for horticulture crop production are targets for enhancement. Currently, some cooperation work between the mobile team and the fruit processing and training centers could not be confirmed.

On the concept paper, the development of high-tech nurseries, small nurseries, and promotion of private nurseries for perennial crops/fruits seedling production for those scion and root stock and vegetables seedlings, and disease-free potato tuber production are depicted. Also, the following extension plan was described: for extension and monitoring of horticultural activities, the directorate has formed two divisions, namely: Kumaon and Garhwal divisions, headed by the Joint Director Horticulture. There are six district horticulture offices in Kumaon division and seven district horticulture offices in Garhwal division. Each district office is headed by a Chief Horticulture Officer/District Horticulture Officer as well as Potato Development Officers and supported by technical staffs at block offices.

This mobile team, fruit processing and training centers/Center of Excellence (CoE) and the organization headed by the Joint Director of Horticulture, will make a role of first approach to be applied that supports the improvement and extension of (a) production, and (b) productivity capacities of horticulture farmers. In addition, the nursery support would be requested for the enhancement and quality improvement of the productions as well.

(1) Horticulture Mobile Team (HMT)

The HMT will play the main role in the implementation of the Project for the development of the cluster by small and marginal farmers and agro-entrepreneurs in the four districts of Nainital, Pithoragarh, Tehri Garhwal, and Uttarkashi of Uttarakhand. Existing horticulture of Uttarkashi seems to be at a transition period from self-sufficient wheat, millet, or leguminous productions on the terrace farms to intensive market-oriented agriculture on the same terrace. Thus, HMT would support the target farmers/farmers' organizations (FOs) for the series of the following drafted items that are advisable based on observation of existing productions/cultivation and such items are for discussion with the implementation agency. Those drafted items will realize the objectives of the Project on the concept paper.

Table 4.2.1 Outline of Advised Items for Enhancement of Mobile Teams

SN	Items	Current Situation through Photo Interpretation
1	Marketing	Farmers may have limited understanding about market demand of quality and quantity with proper timing.
2	Farm management	Farmers follow conventional farm management. They should renew farm management without continuous cropping failure and employment of F1 seed, or promising varieties of seedling, grafting methods, etc.
3	Soil improvement	Farmers may have little understanding about soil character such as pH, EC, etc., and should conduct soil test that enables essential compost and proper fertilizer application.
4	Agriculture materials	Enabling intensive agriculture and efficient usage of various kinds of agri materials are required such as poly mulching, poly-tunnel, animal repellent or disaster prevention.
5	Agrichemicals	Farmers may have limited understanding about application methods of agrichemicals. They are at the upper stream so that contamination-free intensive agriculture should be conducted.
6	Horticulture techniques	Farmers may have limited knowledge about improved cultivation techniques such as pruning, pollination, fruits thinning, etc., for fruit production, or seedling production, grafting, or proper branch sustaining cultivation for peas, tomato, etc.
7	Post-harvest techniques	Post-harvest based on market demand should be surveyed and conducted for shipping

Source: JICA Survey Team

(2) Center of Excellence (CoE)

As stated in the preceding clause 2.1.4 Local Administration (2), currently, the centers support farmers for preparing a facility for processing raw products and not only function as technical training center for production, but also for providing processing techniques. Thus, the concept paper proposes the development of a CoE where limited functions could be expanded for a series of production techniques as mentioned above in the classroom. The production techniques should be provided for fulfilment of

the market demand. On the concept paper, the following quantity-wise plan is depicted as training centers. For fulfilment of the objective of the centers, a series of training contents, including demonstration, should be planned.

The following are proposed in the “Training, Extension and Demonstration” on the concept paper.

- To train 500 technical field staff, for extension work in the Center of Excellence (CoE).
- Training to the trainers, 50 graduates/postgraduates as extension agents to work with growers to be chosen from the Directorate of Horticulture of the Government of Uttarakhand (GoUK).
- Each CoE will train about 500 farmers in selected clusters. Thus, three CoE will train 1,500 farmers over a period of five years.
- Besides two training centers (one for skill development of mali and departmental employees and another training center for officers, extension functionaries, and farmers from the state and outside the state) at Gaja (Tehri Garhwal) and Dehradun will be established with state-of-the art training facilities.

On the other hand, the concept paper mentioned about the limitation of the state for the development of new varieties for citrus or stone fruits or some of the horticulture techniques such as off-season cropping and looking for collaboration with other countries for the varieties. Sometimes, the quality of certain variety is poor in comparison with other production cluster, because of poor production techniques or different natural conditions. Proper production/cultivation techniques are requested for producing featured characters of the certain varieties or cultivars. In addition, for finding new varieties, as of one of the essential functions of the centers, the cultivation techniques for each variety by adopting to off-season cropping should be provided by the center.

The concept paper also mentions the following activities to be undertaken by the CoE. The Project would support the necessary activities for the cluster development among them avoiding duplication of other missions or supports.

- High-tech nursery
- Demonstration of fertilizer and pesticide and information unit
- Demonstration of farm machinery
- Conduction of training program for farmers, training of trainers (ToT) and officers
- Orientation program of extension functionaries
- Establishment of training infrastructure with hostel and guest house
- Demonstration of planting material
- Demonstration of precision farming
- Demonstration of fruit varieties
- Demonstration of ultra-high-density and high-density plantation
- The whole Center of Excellence will be energized by solar power

(3) Existing Nurseries

Currently, two types of state nurseries and national horticulture board nurseries are reported that support state horticulture productions. Especially, fruits seedling production and planting materials are supplying the following kind of nurseries.

- State nursery operated by the state government/UKDHFP deploying widely in a state at district/block level,
- Center of Excellence (CoE) in Kanatal run by Ranichauri Center of Bharsar University supported by UKDHFP as center for attaining training and extension on techniques for cultivation and post-harvest,
- Nurseries by the National Horticulture Board, and
- Private nurseries.

Current situations of those nurseries are obviously limited for seedling production capacities quality and quantity-wise.

1) The State Nurseries

Under UKDHFP, 93 nurseries have been established. The current production capacity is given in the table below. The data shows that, on the average, only 33.73% of the area is used for production of planting materials. Except in Haridwar and U.S Nagar, nurseries are not operating to their full potential. The government nurseries had been established between 1950 and the 1970s. Most of the nurseries have been operational for nearly 50 years or more and thus, the facilities could be either outdated or dilapidated depending on how well maintenance work had been carried out. According to the district officials, water shortage in the nurseries is also one of the reasons for the underutilization of the nursery area. A complete list of nurseries under UKDHFP is given in Attachment 3.4.1. Further details from UKDHFP are awaited.



Source: UKDHFP, July 2021

Figure 4.2.1 Growing Apple (left) and Walnut Seedling in a Polyhouse and Rooted Cutting Apple Seedling (center), Government Nursery Bhatka, Dharchula Block, Pithoragarh

The above nursery photos represent the current level of government nursery in Pithoragarh, prepared by UKDHFP in July 2021. The photos explain the necessity of improvement of the nursery for quality and quantity. Thus, the necessity of the Center of Excellence would be high for training and extension also.

Table 4.2.2 Uttarakhand Government Nursery Details

District	No. of Nurseries	Total Area of the Nursery in ha	Area Under Use in ha	% of Share of Area Under Use to Total Area
Almora	11	302.1	32.4	10.72
Bageshwer	2	30.05	11.95	39.77
Chamoli	12	77.57	17.84	23.00
Champawat	6	44.14	26.42	59.86
Dehradun	8	55.85	23.38	41.86
Haridwar	1	5.13	4.63	90.25
Nainital	9	184.91	84.51	45.70
Pauri	9	39.3	3.3	8.40
Pithoragarh	15	116.5	70.19	60.25
Rudarpur	3	10.25	5.2	50.73
Tehri Garhwal	6	70.56	25.24	35.77
U.S. Nagar	4	44.77	35.02	78.22
Uttarkashi	7	73.4	15.6	21.25
Total	93	1054.53	355.68	33.73

Source: UKDHFP

The state nurseries in Nainital reported productions during 2019-20 at 68,000 of perennial crop/fruits seedling and seeds of radish, peas, potato, and onion. Pithoragarh nurseries were reported to produce vegetable plants of winter/rainy season crops at 47.37 ha of the production area (it is not yet explained if the vegetable plant is seedling or not at this moment), and there is no report about fruit seedling production. Uttarkashi nurseries reported a production record of 90,785 during the same year and no vegetable seedlings are reported.

Also, UKDHFP reported current seedling production number at each state nursery for the four target districts of Nainital, Pithoragarh, Tehri, and Uttarkashi districts. In addition, the seedling numbers with scion and rootstock variety would be requested. Also, it is needed such as mother trees information with size and

features of the variety, e.g., fruits size, sweetness, color, etc., seedling propagation methods (cutting, grafted, etc.), raising period of seedling, number of skilled labor/engineers, etc. These information are essential for planning horticulture cluster for market.

2) Center of Excellence (CoE)

As mentioned in section 4.2.1, UKDHFP explains that the CoE in the state aims to be an advanced/intensive agriculture farm for knowledge transfer of agro-technology tailored to the local conditions. CoE aims to benefit farmers with a focus on key crops under the Project. The CoE will be comprised of nursery management for planting material, best practices cultivation techniques, irrigation, fertigation, pest and disease control, and post-harvest management. The CoE acts as a meeting point for the academe, government, and farmers to cooperate towards fruitful achievements. The establishment of CoE for temperate fruits will go a long way in improving the economy of the farmers. The proposed CoE will be focused on providing high-quality planting material, trainings, demonstration of agro-technology including the introduction of new varieties. It is necessary to have this CoE for temperate fruits to display and popularize advanced horticultural technology for further commercialization among the farmers of the state with the help of experts in the relevant fields.

3) Nurseries by the National Horticulture Board

In the year 2012, the Uttarakhand Horticulture Marketing Board (UHMB) was established with the objective of providing market and market linkages to the farmers of remote and rural areas of the state so that they are able to improve their income. The headquarters of the UHMB was in Dehradun headed by the departmental Jt. Director/CEO. With the objective to provide partner support to all horticulture producers of the state, the Government of Uttarakhand in the month of December 2020 renamed UHMB to Uttarakhand Horticulture Board (UHB). In this reorganization, the role and responsibilities of the UHB and its objective were defined. Currently, twenty-five of the national horticulture board nurseries are operated by the UHB and the production capacity per year is at around 1.16 million seedlings in total. The production and distribution of the nurseries by each state is shown in Table 4.2.2. More than half of nurseries are located in Nainital and producing more than half of the seedlings.

Table 4.2.3 Production of Fruits Seedling by Districts and Distribution in Uttarakhand

Sr. No	District	No. of Nurseries	No. of Production Capacity	
1	Dehradun	6	306,300	24%
2	Haridwar	1	51,000	4%
3	Nainital	13	479,500	52%
4	Tehri Garhwal	1	12,000	4%
5	Udham Singh Nagar	2	271,000	8%
6	Uttarkashi	2	44,100	8%
	Total	25	1,163,900	100%

Source: Prepared by the JICA Survey Team based on data the of the UK government

Among the 25 national horticulture board nurseries, 11 nurseries are producing apple seedlings in Uttarakhand and the capacity of apple seedling production are reported as more than 220,000 per year. That capacity of apple seedling production is enough for almost 7 ha of new high density apple orchard by 30,000 seedlings per ha in accordance with Japanese standards. More than 30% of apple seedlings are produced by the nurseries in Nainital as far as apple seedling production in Uttarakhand is concerned.

Table 4.2.4 Apple Seedling Production by District in Uttarakhand

Sr. No	Apple/District	Nainital	Dehradun	Uttarkashi	Tehri Garhwal	Haridwar	Total
1	No. of Nursery	4	3	2	1	1	11
2	Capacity	70,800	51,100	37,500	12,000	51,000	222,400
3	Ratio	32%	23%	17%	5%	23%	

Source: Prepared by the JICA Survey Team based on data of the UK government

Among the UHB nurseries, apple seedling production is led by the Indo-Dutch Horticulture Tech Nursery located in Nainital and is focusing apple seedling production as shown below. The nursery has a production capacity of 60,000 apple seedling and currently growing 27 varieties of apple. The nursery would work for research for comparing the varieties and some varieties are for seedling production.

Table 4.2.5 Indo-Dutch Horticulture Tech Nursery at Nainital, Uttarakhand

Nursery Name	Nursery Address	Email-id/Mobile No	Star Rating	Name of Crop	Name of Variety (s)	No. of Mother Plants	Production Capacity
Indo-Dutch Horticulture Tech. Nursery	Vill.- Chakalua, District – Nainital (Uttarakhand)	9917106077	1	APPLE	Breburn Penbra	24	577
					Early Red one	19	456
					Everest	56	1347
					Fauji Aztec	40	962
					Fauji Fubrax	56	1346
					Gala Dark Brown	125	3006
					Gala Decarli	22	530
					Gala Galval	98	2356
					Gala Mema	223	5362
					Gala Schinico	159	3824
					Gala Schnicho Red	209	5027
					Golden Delicious	33	794
					Grainy Smith	25	601
					Hapke	22	530
					Jeromine	214	5146
					King Ramson	47	1130
					Modi	59	1418
					Red Cap	64	1540
					Red Del. Hapke	103	2476
					Red Delicious Campsur	58	1395
					Red Delicious Master	126	3030
					Red Delicious-King Roat	234	5627
					Red Kan	44	1058
					Red Velox	133	3200
					Redlum Gala	67	1611
					Scarlet Spur-II	179	4305
					Top Red	56	1346

Source: UKDHFP

4) Private Nursery

Private nurseries support apple cluster development for seedling supply. The Horticulture Departments of Jammu and Kashmir states are supporting private nursery for producing quality seedling.

4.2.2 Cluster Development/ Production Area Development

(1) Mobilization and Formation of Farmers' Organizations

The PPR has indicated the field level implementation unit to be a Farmers Producing Organization (FPO)/ Farmers Producing Company (FPC), which was a node of cluster. Organizing farmers into collectives have multiple benefits for production and marketing. One is to aggregate the produce. This is particularly important where the connectivity is low and production area of each farmer is small in the hilly areas. Once the produce are aggregated, linking to the market could also be effectively done. The sizable volume of produce could attract the buyers and reduce transportation cost. The FPO/ FPC can also negotiate the prices with the buyer. Not only for the marketing but cluster formation could also have a positive impact on extension services. Once forming the cluster is done, the delivery of extension system would also become more efficient as the extension workers can approach a substantial number of farmers who are cultivating the same crop at once. This also opens up the scope for farmer-to-farmer extension by training the key farmers within the cluster.

In the PPR, Component C-1-B “Mobilization & Formation of FPOs/ FPCs” is budgeted for INR 8 million and “Selection of existing FPO” under C-1-C for INR 4 million. The break-ups of the unit cost will need to be further validated in the coming survey period. Whether to converge with the National Bank for Agricultural and Rural Development (NABARD) or the Mission for Integrated Development of Horticulture (MIDH) or any other scheme for formulating FPOs, this should also be discussed with UKDHFP in the remaining survey period.

The PPR proposes to select eight FPOs, which have been formed under the Uttarakhand State Rural Livelihood Mission (UKSRLM), the Integrated Livelihood Support Project (ILSP) and other schemes.

While forming the new FPOs, the Government of India (GOI) guidelines are proposed to be adopted. However, the selection criteria for the cluster with the existing/ new FPOs was not elaborated. This should also be discussed with the UKDHFP in the remaining survey period. In the case of UKDHFP, no defined guideline exists for cluster development but the cluster is identified by district horticulture officers based on the geographical contiguity and the common crops grown in the area. Village is taken as the lowest unit of selection and approximately 500 to 1,000 ha is considered for cluster development. Once the area is defined, any farmers with land title in the area will be considered as eligible for the interventions implemented for cluster development. So far, the farmers are yet to be organized into a cluster in many of the clusters; however, the farmers emphasize on adopting Good Agriculture Practices (GAP) and aggregation of produces for better competitiveness and higher values in the market. As of now, clusters are formed under the schemes of Horticulture Mission and PKVY. Thus, the interventions for the clusters are implemented accordingly. For instance, in the case of PKVY, there is a provision for INR 50,000 per ha maximum in three years for scientific cultivation and better post-harvest management. Furthermore, under the current circumstances, the Horticulture Mobile Team is often the link between the UKDHFP and the farmers or if the cluster is facilitated by a non-governmental organization (NGO) or supporting organization, although limited in number, the farmers in the cluster will be supported accordingly.

From the above, the cluster selection criteria and inclusion criteria for farmers need to be clearly defined so that the project interventions will be delivered to the farmers in need and thus achieve the project objectives. In addition, the Project also visualizes to work with cluster-based FPO or any other type of farmers' organization. The project implementation system will also need to make provisions for supporting them to gain capacity as a collective entity to maximize the benefit and advantages of collectiveness.

The selection criteria of the cluster and inclusion criteria will be defined after careful review of the criteria adopted by various schemes and other donor-assisted projects. Further, as the main objective of this Project is to enhance the productivity and link the horticulture produce to the market, the elements of spatial dimension of the clusters and supply chain infrastructures, while contemplating on the selection criteria. The JICA Survey Team will attempt to work on the cluster mapping based on the data supplied by the UKDHFP. The process of the cluster mapping is given hereunder.

(2) Cluster Mapping

According to PPR, more than one thousand production clusters have been formulated in the UK and at least 30% of clusters belong to the target districts: Nainital, Uttarkashi, Tehri Garhwal, and Pithoragarh. To efficiently involve these clusters in the supply chain, it is important to identify their distribution on a map. While figures of the cluster in each target district are listed in the PPR, the distribution map of the cluster is not mentioned and is proposed to be developed under the Project. Meanwhile, the map is also helpful in the Survey in order to formulate the Project by visualizing the linkage of supply chains.

Therefore, the JICA Survey Team concluded to develop a draft map of clusters in the target districts under the Survey through the following activities:

- Identify location, at least the village, of each cluster in the target districts where the cluster mainly manages horticulture
- Identify crops produced for each cluster

The map created so far is given in Attachment 4.2.1. Further verification will be done by the JICA Survey Team.

(3) Area Expansion

The components of area expansion are described in "Section 2.8.3 I. Area Expansion/ Establishment of New Gardens under Cost Intensive Crops, Ultra High Density, High Density and Normal Density Planting" of the PPR. Area expansion is considered to be accomplished from replacement of the cropping area of ordinary crops and cereals into cropping area of profitable crops and new orchards with high-yielding dwarf varieties. The outline of the area expansion is summarized in the following table.

Table 4.2.6 Outline of Proposed Plan of Area Expansion

SN	Type	Area (ha)
1	New orchards ¹⁾ with high yielding dwarf varieties under cost intensive crops	400
2	Ultra-high-density plantation	400
3	High-density plantation	2,000
4	Open pollinated vegetables	1,500
5	Potato	1,500
6	Hybrid vegetables	3,500
7	Rhizomatic spices	5,000
8	Bulbous flowers	400
Total		14,700

Source: UKIHDP, UKDHFP

Note: 1) New varieties with profitability and high yield and new technologies for the Project have been confirmed with UKDHFP.

Despite the above proposal, necessary information, such as target areas to be expanded, validity of figures, and logical linkage between proposed components and needs are not explained. Furthermore, the JICA Survey Team and the Department of Horticulture and Food Processing (DHFP) already agreed on the target crop of the Project as mentioned in Section 5. Therefore, the types of area expansion should be reorganized to converge on the target crops. Accordingly, the size of each area expansion is to be scrutinized and to be updated.

On the other hand, the proposed area expansion of non-target crops, such as rhizomatic spices and bulbous flowers, requires further backgrounds to be implemented under the Project.

(4) Integrated Nutrient Management and Integrated Pest Management

Necessity and benefit of Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) are widely acknowledged. The concept of INM aims to increase the efficiency of use of all nutrient sources, like soil resources, mineral fertilizers, organic manures, recyclable wastes or bio fertilizers². Integrated pest management means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment³.

The PPR states the following activities regarding INM and IPM:

- Development of bio-control labs and leaf/tissue analysis labs have been proposed in public sector including State Agriculture Universities (SAUs)/KVKs according to MIDH guidelines to support the promotion of INM and IPM,
- Disease forecasting units (DFUs) and plant health clinics will be established under the CoE,
- Bio-pesticide and nutrients should be managed to cater to demands of tree spray oil, and
- Promote integrated pest management, non-pesticidal management, and integrated nutrient management in over 10,000 hectares in the selected district.

The note refers to the enhancement of farmers' resilience against climate change and reduction of CO² emission as reasons for promoting INM and IPM in the Project. However, it is deemed that the above information is insufficient to assess the eligibility of these activities to be implemented under the Project because necessary information such as the current situation of INM and IPM in UK, farmers' needs on INM and IPM, and the capacity of governments to disseminate INM and IPM are not described.

Therefore, the JICA Survey Team would clarify the following information through the Survey.

- The activities of INM and IPM which have been applied in farmers level and conducted in government or extension level in UK;
- Farmers' knowledge and needs of INM and IPM;
- Capacity of officials relevant to INM and IPM;
- Status of the proposed facilities such as bio-control labs and leaf/tissue analysis labs;
- Activities, achievements, and cost of similar projects which worked on INM and IPM.

² FAO (2006): Plant nutrition for food security

³ <http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/ipm/en/>

(5) Water Resources Development

Water storage is a crucial issue for a hilly terrain occupying approximately 86% of the UK state land as mentioned in the PPR. Therefore, construction of water storage structure with low-density polyethylene (LDPE) in convergence with the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was proposed in the PPR. Since PMKSY is one of the assistances for extending the coverage of irrigation, a water storage with LDPE was proposed by DHFP for securing irrigation water. However, the quantity, the scale, and location or target area of water storage development are not mentioned in the note.

On the other hand, construction of water harvesting structure in convergence with Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and the National Watershed Development Project for Rainfed Areas (NWDPA) is also proposed by DHFP. Although the size of the water harvesting facility is mentioned, the quantity and location or the target area are not written on the note.

Taking into account the current situation of water resources in UK described in Section 2.5 and the result of selection of target area mentioned in Section 6.4, the following information must be clarified through the Survey:

- Distribution of water resources including traditional water sources in/around the target area;
- Necessity, quantity, specification, and location of water resources facility to carry out the farming plan to be applied under the Project;
- Applicable schemes including subsidy programs by governments to assist water resource development.

(6) Irrigation Development

Irrigation facilities have been constructed and are distributed unequally across the state. While 47% of net sown area is irrigated, 86% of which locates in the plain area and, therefore, only 14% is in the hilly area, even though 86% of the state land belongs to the hilly area.

The introduction of irrigation system with high water use efficiency, namely, micro irrigation, is promoted by the Indian government through subsidizing programs, e.g., PMKSY, and proposed by DHFP in the PPR. Although irrigation methods of drip irrigation and sprinkler irrigation are specifically mentioned and proposed in the note, the quantity, and location or target area are not specified. In addition, the coverage of sprinkler irrigation to be installed under the Project is quantified as 13,500 ha without specific types of sprinklers, such as micro, mini, portable, etc., and distribution among the target districts.

The JICA Survey Team would clarify the following issues in accordance with the above information:

- Necessity of irrigation systems in the target area for farming as planned under the Project;
- Specification of necessary irrigation systems to be introduced in the target area;
- Estimate quantity, cost, and financial allocation to be burdened by the Project and subsidy from the government programs.

Since the programs and activities related to irrigation are mainly managed not by DHFP but by the Irrigation Department of Uttarakhand, close coordination with the department would be necessary.

(7) Farm Protection

The PPR repeatedly mentions that the farmers in the state have suffered from attacks by wild animals such as monkey menace and proposes to provide protective equipment to target farmers under the Project as one of the outputs. However, although the note proposes various activities of protected cultivation such as covering polyhouse and anti-hail net, there are no activities relevant to protection against wild animal attacks. Furthermore, any information of damages, e.g., places, crops, and reduced benefits, are not figured in the note.

To provide protective facilities and equipment to the target farms under the Project, the following information must be identified.

- Current situation of wild animal attacks such as species of animals, suffering places, and damaged crops;
- Activities to protect farms from wild animal attacks conducted by governments and NGOs
- Measures for protecting farms applied by farmers traditionally or recently.

The threat of human-animal conflicts is and becomes more serious in the state not only for farmers but also for the human society. This issue must be discussed from the aspects of farm development as well as environmental and social considerations. Since issues on wild animals are mainly managed by the Forest Department of Uttarakhand, the JICA Survey Team would closely cooperate with them to collect the related information and to plan the activities of farm protection under the Project.

(8) Conclusion

The PPR brings up issues and problems on horticulture in the state and proposes necessary activities to settle the problems and to improve the situations. However, in terms of farm development including irrigation, INM/IPM, farm protection, etc., the JICA Survey Team understands that PPR does not provide enough information to formulate the Project and it is essential to clarify current situation of horticulture farm and to collect information of related activities to farm management. According to these clarification and information collected, more practical plan of the Project can be developed. The necessary information to be studied by the JICA Survey Team are summarized below:

Table 4.2.7 Necessary Information for Planning Farm Development Activities under the Project

SN	Subject	Necessary Information
1	Area Expansion	- Types and sizes of area expansion for each selected crop - Needs and eligibility of area expansion for the crops not selected as target of the Project
2	INM/IPM	- Current practices of INM and IPM which have been applied in farmers level and conducted in government or extension level - Farmers' knowledge and needs of INM and IPM - Capacity of officials relevant to INM and IPM - Status of the proposed facilities such as Bio-Control Labs and Leaf/Tissue Analysis Labs - Activities, achievements, and cost of similar projects which worked on INM and IPM
3	Water Resources Development	- Distribution of water resources including traditional water sources in/around the target area - Necessity, quantity, specification, and location of water resources facility to carry out the farming plan to be applied under the Project - Applicable schemes including subsidy programs by governments to assist water resource development
4	Irrigation Development	- Necessity of irrigation systems in the target area for farming as planned under the Project - Specification of necessary irrigation systems to be introduced in the target area - Estimate quantity, cost, and financial allocation to be burdened by the Project and subsidy from the government programs
5	Cluster Mapping	- Location, at least village, of each cluster in the target districts where the cluster mainly manages horticulture - Producing crops of each cluster
6	Farm Protection	- Current situation of wild animal attacks such as species of animals, suffering places, and damaged crops - Activities to protect farms from wild animal attacks conducted by governments, NGOs, etc. - Measures for protecting farms applied by farmers traditionally or recently

Source: JICA Survey Team

4.2.3 Improvement on Post Harvest Processing Infrastructure

Development of post-harvest management and marketing infrastructures as shown in Table 4.2.8 are listed in the concept paper of UKIHDP.

Table 4.2.8 Post-harvest Management and Marketing Infrastructures Proposed in UKIHDP

No	Facility	Number	Expected Ownership and O&M	Incentives	Remarks
1	Pack house	8	Farmer groups/ coops/, private entities and public entities	Subsidy 50%	With equipment for cleaning, sorting, grading, packing, etc.
2	CA Storage (1000 + 200 MT)	2	Ditto	Ditto	For apple
3	Cold Storage (30 MT) at field level	16	Ditto	Ditto	With solar micro cold storage rooms
4	Refrigerated transport vehicle (9 MT)	16	Ditto	Ditto	-

No	Facility	Number	Expected Ownership and O&M	Incentives	Remarks
5	Rural Markets/Apni Mandies (farmers' own market)/Direct Markets	Not stated	Farmer groups/coops/entities and Private entities	Subsidy 55%	With cold storage facilities
6	Cold Storage (30MT) at market level	16	Uttarakhand Agricultural Produce Marketing Board (UKAPMB)/APMC	Not stated	With solar micro cold storage rooms
7	Outlets of horticulture products (fresh and processed)	8	Ownership: DHFP of UK O&M: FPOs	PPP funded by UKIHDP	Building and necessary equipment

Source: UKIHDP, UKDHFP

Sixteen FPOs/FPCs (eight new development and eight existing) are planned to be established in the concept paper of UKIHDP. However, no plan is shown in the concept paper on how the FPOs/FPCs themselves will relate to the planned infrastructures. Ideally, specifications of the infrastructures and the construction schedule shall be examined after the FPOs/FPCs present the real picture. It is advisable that UKIHDP strategically furnish the planned infrastructures to facilitate and empower the FPOs/FPCs.

Economic feasibility must be a critical consideration point to move forward the plan of post-harvest management and marketing infrastructures in UKIHDP. These facilities continuously require a certain operation and maintenance costs which might be a heavy burden on the expected beneficiaries with the following reasons. A realistic development plan of the infrastructures should be made after careful examination on the feasibility of beneficiary's business plan.

- 1) Small volume of horticultural produce to be handled;
- 2) High costs for fuel, electricity, water supply, working force, etc.;
- 3) Unstable and unfavorable market circumstances of horticultural produce to be handled.

Market infrastructures are not developed well within the reach of farmers especially in hilly regions in Uttarakhand. As mentioned before, the farm-household survey of the JICA Survey Team revealed that rural markets are the most popular marketing place of agricultural produce for farmers in the target four districts, since a permanent regular market is far distant from most of the farmers in remote areas. In rural areas in India, traditionally/voluntary emerged markets are held weekly, every two weeks, etc. depending on the local circumstances in a certain open space in rural hub villages/towns. Such markets get called in different names depending on the area and the function. They are usually managed by a community council, a cooperative or trusted individual entrepreneurs, while an administrative facilitation is provided in some cases. It is advisable that such existing markets familiar with members of FPOs to be supported by the Uttarakhand Integrated Horticulture Development Project (UKIHDP) should be expanded and improved in the rural markets/apni mandis/district markets development component so that farmers in the project area will be able to enjoy easy access to alternative marketplaces.

4.2.4 Improvement on Food Processing Infrastructure

Table 4.2.9 shows food processing infrastructures listed in the concept paper of UKIHDP. Similar to the post-harvest management and marketing infrastructures, no explanation is made in the concept paper on how to leverage the food processing infrastructures in supporting the FPOs/FPCs in UKIHDP. A comprehensive strategy to align FPOs/FPCs facilitation with infrastructure development should be defined through additional examination. It is also advisable to pay serious attention to economic feasibility of the infrastructures as described above.

Table 4.2.9 Food Processing Infrastructures Proposed in UKIHDP

No	Facility	Number	Expected Ownership and O&M	Incentives	Remarks
1	Primary/Mobile/Minimal processing unit	16	Farmer groups/coops/entities and private entities	Subsidy 55%	-
2	Fruits and vegetable packing unit	16	Ditto	Ditto	-
3	Juice concentrate plant	2	Private entities	Subsidy 50%	4 (MT/hr)

Source: UKIHDP, UKDHFP

4.2.5 Promotion of Marketing

A technical cooperation to UKAPMB including international experts on the following subjects are envisaged in the concept paper of UKIHDP.

- 1) Brand development and promotion
- 2) Standardization and procedure of quality testing

Branding of agricultural produce must be an integrated concept with various aspects in breeding, farming technology, crop cluster, food logistics and supporting industries, under a definite branding policy of target produce to accommodate the present market circumstances. Branding must also be never-ending attempts combining a constant review mechanism in accordance with a change of market circumstances. Only UKDHFP, therefore, cannot shoulder the heavy responsibility of branding of horticultural produce. It is advisable that UKIHDP should place priority on outlining a specific branding strategy and streamlining the state administration system to implement the strategy by integrating respective isolated stakeholders into one team, so that UKIHDP will contribute to establishing a solid foundation of the branding implementation system in Uttarakhand.

4.2.6 Strengthening Implementation System - Capacity Enhancement of Implementation Agency

Under the capacity enhancement of the implementation agency, two main components will normally be considered. One is the institutional arrangement including the deployment of officers and staff from the state level management to day-to-day operation at the field level. The other is the capacity enhancement of human resources, farmers, and farmers' organizations, and the infrastructure required to support them to execute the project activities.

In the PPR, a broad institutional arrangement for implementation was proposed. However, the TORs, the number of positions required, and the nature of interactions between the establishment of each level of implementation unit were not clearly defined. These are to be revisited once the project activities and modus operandi are refined in the latter stage of the survey. In this section, points that need to be clarified and the necessary capacity enhancement for effective implementation arrangement are identified. The JICA Survey Team still waits for the information on the roles and responsibilities of various departments/sections and staff strengths of UKDHFP, composition of Horticulture Mobile Team (HMT), and current status of their technical capacity. Furthermore, the details of activities and unit cost basis for the proposed Component 6: Training and Capacity Development will need to be confirmed with UKDHFP. In this section, preliminary review is attempted on the institutional arrangement and "Component 6".

(1) Institutional Arrangement

1) State-Level Institutional Arrangement

At the state level, three levels of entities are to be established. These are the Governing Council, Executive Body, and PMU. The Governing Council of the Project will be established as "the highest decision-making body" and will be headed by the Chief Secretary of the state. Its members will comprise of the secretaries from various departments such as finance, horticulture and food processing, agriculture, animal husbandry and livestock, rural management and development, forest, and planning. Below the governing council, the Executive Body is to be established, which role and composition are not defined in PPR. Below is the PMU, which is in charge of day-to-day management of the project implementation and M&E. Nodal Agency is indeed UKDHFP, which role was not defined in the PPR. The PPR further proposes that the nodal agency and PMU are to be assisted by supporting institutions such as the central and state institutes, and international experts, and private sectors.

The PMU is proposed to be led by the Project Director and the Deputy Project Director who will be deployed among the senior officers of the UKDHFP. The technical wing of the PMU is comprised of 1) horticulturalist, 2) financial management experts, 3) processing experts 4) quality expert, 5) community development expert, 6) marketing expert, and 7) M&E expert. The PMU will also engage administrative staff. However, the number of positions, TORs, mode of recruitment, and duty stations were not defined in the PPR.

2) District Level

At the district level, a District Coordination Committee (DCC) and District Implementation Units (DIUs) will be established. These are headed by the Chief Horticulture Officer stationed at each district. The roles and responsibilities of DCC and DIU and their composition and staffing were not defined in the PPR. To facilitate the field level implementation of project activities, the JICA Survey Team will discuss with UKDHFP whether to engage Pilot Project Implementation Consultant (PPIC) and how such entity can be effectively engaged for project implementation.

3) Block Level and Below

The existing Horticulture Mobile Team (HMT) at the block level will be engaged to spearhead the project implementation. HMT is headed by the Assistant District Officer of Horticulture (ADO). Information on the composition of HMT, their training records, and capacity are reviewed in Chapter 2 (section 2.1.3 (2)). From the review, the capacity of HMT is limited to the production of horticulture crops and supporting the farmers in applying various government schemes. So far, the JICA Survey Team has been informed that some HMT members are full time staff and others are staffs from NGOs that have been outsourced by UKDHFP⁴. With this understanding, the Project would need to provide the full capacity building interventions for HMT members especially on post-harvest processing and value addition, marketing, and capacity building for farmers' organizations. At the same time, to closely work with HMT, PPIC engaged by the Project will provide on-the-job training for the HMT members so that they can sustain the activities after the phase out of the Project.

The farmers' organization was visualized as the field level implementation unit. However, in the preliminary discussion with UKDHFP, not all product clusters have a farmers' organization for the horticulture crops or still at the infant stage. As the newly formed farmers' organization will encounter many challenges not only with the aggregation of the produce, processing, and marketing but also for organizational management, it is likely that UKIHDP will need to have an extensive capacity building and support system for the farmers' organization. The elaboration on the capacity building and supporting system for farmers' organization will be critical for the effective implementation of the Project, which will be discussed with UKIHDP in the remaining survey period.

4) Field Level

This Project assumes that FPO/FPCs comprised of the farmers who are growing selected crops and constituting the cluster already existing or are ready to be organized. The survey findings so far revealed that such organizations may not exist in the cluster or may be found in nearby location, which may not handle the crops that the farmers in the cluster are growing, or may have been established for some other purposes. It was also understood through interaction with the district horticulture officers that the existing organizations in most cases are newly formed.

Considering the abovementioned field situation, there is a need for the Project to include activities in the project implementation plan such as 1) mobilization of farmers and establishment of farmers' organizations, 2) capacity development, and 3) operational support.

5) Supporting Agencies

As the strengthening of supply chain of horticulture produce will require concerted efforts of both public and private actors, UKIHDP will assume various entities to take part in the project implementation. These include the KVK, GB Pant University of Agriculture & Technology, Uttarakhand University of Horticulture & Forestry at Bharsar, Uttarakhand Agriculture Produce Marketing Board, Uttarakhand Horticulture Board (UKHB)⁵, and Center for Aromatic Plants.

Under UKDHFP, there are training processing centers cum training centers established in the proposed project districts. However, they suffer chronic deficiency of human resources and lack of equipment to demonstrate various processing technologies. UKHMB is still at the early stage of its operation and their role in this project still needs to be clarified.

⁴ The terms of employment of the HMT members are yet to be confirmed by the UDHFP.

⁵ Uttarakhand Horticulture Marketing Board (UKHMB) has changed its name to Uttarakhand Horticulture Board (UKHB) in 2020.

(2) Component 6: Training and Capacity Development

Under the component, training of farmers and strengthening of existing infrastructure, technology demonstration, and dissemination are proposed with a total budget of INR 3,679.333 million.

1) Sub-Component A: Training of Farmers

Under the training of farmers, strengthening of the infrastructures of the training centers in Nainital, Tehri Garhwal, and various training activities to be carried out for the farmers and staff members of the UKIHDP.

Table 4.2.10 Outline of the Sub-Component: Training of Farmers and Further Points for Clarification

Proposed sub-component	Proposed Cost	Current Status and Proposal	Points for further clarification/ discussion
1. Training center for farmers, officers, and extension functionaries at Nainital	INR 50 million	Within Nainital, there are four fruits preservation and training centers. UKDHFP proposed to renovate the existing building, equipment for processing, and training.	- All institute are understaffed. The training programs offered to the farmers are yet to be reviewed. Thus, the equipment proposed to be procured can be effectively utilized is questionable. Further, the budgetary arrangement should be confirmed for operation and maintenance of these equipment that are proposed and building infrastructure. - Unit prices for each of the proposed equipment are to be validated in the remaining survey period. - Site verification of the present condition is to be scheduled in the second field survey period.
2. Skill Development Center for gardens (mali), and employees at Tehri Garhwal	INR 40 million	Detail of the proposal is yet to be confirmed.	- Detail of the proposal to be confirmed along with the unit cost. - Site verification of the present condition is to be scheduled in the second field survey period.
3. Training of farmers (outside state)	INR 28 million	In the PPR, the training requirements are briefly mentioned.	Based on the supply chain survey including the farmers' and FPO surveys, training needs shall be identified to formulate broad training contents. Thereafter, the potential training institutions/ arrangements will be identified in the remaining project period.
4. Training of trainers of training outside state	INR 8 million		
5. Training for officials and farmers outside India	INR 30 million		
6. Training of farmers in post-harvest management	INR 75 million		
7. Training of FPO leaders in business management	INR 2 million		
8. Creating FPO cadres for supply chain management of fruits vegetable floriculture, etc.	INR 20 million		

Source: JICA Survey Team

2) Sub-Component B: Strengthening of Existing Infrastructure

Under this component, INR 99.5 million was proposed for strengthening of Horticulture Mobile Team (HMT) in the project districts, which comprised of 129 teams and post-harvest and food processing centers in Uttarkashi and Pithoragarh, and upgradation of infrastructure at the Food Science Training Centers. The summary of training infrastructures available in the four project districts is given in Attachment 4.2.2.

Table 4.2.11 Outline of the Sub-Component: Strengthening of Existing Infrastructure

Proposed sub-component	Proposed Cost	Current Status and Proposal	Points for Further Clarification/ Discussion
1. Strengthening of Horticulture Mobile Team	INR 64.5 million	- HMTs deployment (Total 129 teams): - Nainital: 31 teams	The conditions of the HMTs are yet to be understood in totality.

Proposed sub-component	Proposed Cost	Current Status and Proposal	Points for Further Clarification/ Discussion
		• Pithoragarh: 24 teams • Tehri: 42 teams • Uttarkashi: 32 teams • The qualitative assessment revealed the following: 1) many of the teams are understaffed; 2) their role has been to deliver the farm inputs and provide technical information to the farmers; 3) they are lacking means of transportation and many of them often move on their feet, thus, the geographical outreach has been limited especially in the hill districts.	• From PPR, the activities proposed under this sub-component are not clearly understood. • The JICA Survey Team will further seek information on the HMT to validate the requirement. • Focus group discussion shall be carried out in the second field survey period.
2. Strengthening of Post-Harvest and Food Processing Centers	INR 10 million	• Post-Harvest and Food Processing Centers are situated in three centers in Uttarkashi (Uttarkashi, Bhatwari, Nogaun) and three centers in Pithoragarh (Pithoragarh, Didihat, Baluwakot). • Uttarkashi: outdated equipment and two centers in Bhatwari and Nogaun are lacking building and equipment. All of them are not fully equipped to process the produce to comply with FSSI standards. • Pithoragarh: The facilities are reported to be dilapidated and lacking facilities for conducting training and testing of the foods. The infrastructure and equipment are not available to carry out processing that comply with the FSSI standards.	• Field verification of the facilities are required. • Training program, staffing, and budgetary arrangement for operation and maintenance are to be verified.
3. Upgradation of Food Science Training Center	INR 25 million	• Principal Food Science Training Center is situated in Ramnagar, Nainital District, providing a one-year diploma program in food processing, bakery, confectionary, and food production. It also functions as a technical resource center for those starting food processing unit. • It has been reported that the basic infrastructure and modern equipment are lacking to demonstrate the latest food processing and production technology for the students.	• Field verification of the current situation needs to be carried out. • The unit rates of the equipment are to be validated. • Budgetary arrangement for operation and maintenance is to be confirmed.

Source: JICA Survey Team

3) Technology Demonstration and Dissemination

The total cost of INR 7.2 million was proposed for technology demonstration and dissemination. These activities are proposed to be carried out in the proposed project districts. Especially for the technical demonstration, it is proposed to be undertaken by KVK and SAUs. Thus, the modus operandi and fund flow need to be further clarified.

4.2.7 Consulting Services

The PPR prepared by UKDHFP has stated that the PMU will employ the Consultants to assist “UKIHDP PMU” and “District Coordination Committees and District Implementation Units” in management and operation of the Project including the implementation of specific organizational development plans to strengthen the project management capacity of the Directorate of Horticulture, SAUs, Centers of Excellence, as well as infrastructure development through open bid basis. The Terms of Reference (TOR) for the consulting services has not been prepared yet. For drafting TOR, the following items shall be prepared in reference to the management and technical capacity of the executing agency, scope of the project, and overall implementation schedule.

- ✓ Objectives of consulting services
- ✓ Scope of consulting services
- ✓ Expert requirement and assignment schedule
- ✓ Qualification of experts
- ✓ Reporting

Chapter 5 Situational Analysis of the Proposed Project Area Based on the Preliminary Findings from the Supply Chain Survey

5.1 Outline of the Survey

(1) Background

A supply chain survey was planned to be carried out to extract the preliminary findings and make assessment for the current situation of value chain of main horticulture crops in the state of Uttarakhand. The survey was conducted between July and August 2021 and data entry and analysis were done by the Japan International Cooperation Agency (JICA) Survey Team in September 2021.

(2) Objectives

To carry out data collection on the key horticulture crops specified by the Uttarakhand Department of Horticulture and Food Processing (UKDHFP) and the JICA Survey Team on the following:

- 1) Actors on the supply chain
- 2) Issues concerning value addition and its enhancement in each stage of the supply chain
- 3) Benefit sharing mechanism between actors on the supply chain
- 4) High-end market needs/ requirement

5.1.2 Survey Area

The survey area is Dehradun and other four districts, namely: Nainital, Tehri Garhwal, Uttarkashi, Pithoragarh districts, which is the project target area.

5.1.3 Target Crops

The target crops for this survey were determined by UKDHFP and the JICA Survey Team.

For a start, the JICA Survey Team conducted the preliminary screening on major agricultural produces in Uttarakhand using the data of yearly district-wise production status (production, cultivated area, and production trend), transaction volume in wholesale markets, and status of cluster presence. The result of analysis is given in Attachment 5.1.1.

The analysis result was proposed by the JICA Survey Team. Based on the proposal, UKDHFP and the JICA Survey Team discussed closely for final selection. Considering with UKDHFP's request, the target crops were finalized, as shown in the following table.

Table 5.1.1 Target Crops for Supply Chain Survey

Crop Group	Nainital	Pithoragarh	Tehri	Uttarkashi
Fruit	Peach (ODOP) Litchi	Apple Citrus (Sweet Orange)	Plum	Apple (ODOP) Kiwi Walnut
Vegetable	Tomato	-	Potato, Pea	Potato
Spice	Garlic	Turmeric, Garlic	Ginger	-
No. of Crops	4	4	4	4

Source: JICA Survey Team

Note: ODOP means One District One Product program promoted by the Ministry of Food Processing Industries.

5.1.4 Target Clusters

The target clusters to be surveyed were listed up by UKDHFP, based on the decided target crops shown in Table 5.1.2. Details of each cluster such as location and existing Farmers Producing Organizations (FPOs) and other cooperatives/federations are shown in Attachment 5.1.2.

Table 5.1.2 Target Clusters for Supply Chain Survey

No.	District	Crops Name	Cluster Name
1	Nainital	Peach	Ramgarh
2		Litchi	Ramnagar
3		Tomato	Alchouna
4		Garlic	Kuwarpur
1	Pithoragarh	Citrus Sweet Orange	Udhyari
2		Apple	Bhilot to Baman
3		Turmeric	Koteshwer
4		Garlic	Kuntola
1	Uttarkashi	Potato	Gorsali
2		Apple	Aarakot
3		Walnut	Gangtadi
4		Kiwi	Dunda
1	Tehri Garhwal	Plum	Chopriar Gaon
2		Potato/Pea	Batwaldhar
3		Pea/ Potato	Jwarana
4		Ginger	Khadi

Source: UKDHP

5.1.5 Methods of the Survey

(1) Interview with Farmers and Farmers' Organization

Semi-structured interviews with the individual farm household and key informant interviews with Farmers' Organizations have been carried out using the questionnaires and checklists prepared by the JICA Survey Team. The indicative survey items are shown in the table below. Questionnaires are given in Attachment 5.1.3.

Table 5.1.3 Survey Items for Interview with Farmers and Farmers' Organization

Informants Category	Sample Size/ Location	Survey Item	Survey Method
Farmers	- Up to three product clusters in Nainital, Tehri Garhwal, Uttarkashi, Pithoragarh - The clusters will be identified taken into consideration their proximity to the market. - Representative 20 farm households from each product cluster will be interviewed. (Gender balance of informants shall be ensured.)	a) Financial aspect: Status of farm budget access to the agriculture credit b) Farm management: cropping area, farm budget c) On-farm facilities: status of farm development and management, access to irrigation d) Market: access to market/ market information e) Institution: extension services, eNAM, government schemes f) Technology: Volume of production, cost and profit, access to farm input, utilization of farm implements/ equipment/ machineries, postharvest processing, grading & quality management, utilization of agri-tech, certification for quality/ brand/ organic, knowledge of GAP, etc. g) Economics: Selling parties and price h) Intention of Farmers: Whether having interests in transforming own agricultural practices for more profitable farming, participation to farmers' organization i) Livelihood profile	Semi-structured interviews; Group discussion may be carried out if probing is necessary.
Farmers Organization (Farmer Producer Organization/ Farmer Producer Company)	Five farmers organizations from each product cluster in each district (1 FPO/ FPC and 4 member organizations)	a) Finance: Financial status, access to financial services and utilization b) Market: ways to identify the market, access to market information, issues in identifying the potential market/ buyers c) Technology: Roles in supply chain and services provided for the members, access to the extension services and market information d) Infrastructure: Aggregation facilities, status of own grading facilities and equipment including their operation and maintenance and requirements e) Organizational management: Issues in organizational	Group interviews using check list

Informants Category	Sample Size/ Location	Survey Item	Survey Method
		management f) <u>Supporting</u> mechanism: <u>governmental/</u> <u>non-</u> <u>governmental</u>	

Source: JICA Survey Team

(2) Interview with Supply Chain Stakeholders in the Four Districts and Uttarakhand

Interviews with the identified stakeholders engaged in transportation, trading, wholesale, storage, and processing have been carried out in the four districts of the project target area. Questionnaires for the interviews were prepared by the JICA Survey Team, given in Attachment 5.1.3.

(3) Interview with the Stakeholders in the High – End Market (Hospitality and Food Industries, Major Retailers and Stakeholders Engaged in Interstate Marketing)

Major retailers, hotels, restaurants, food manufacturers, major retailers (i.e., Big bazaar, Reliance Fresh, etc.) and other stakeholders engaged in interstate marketing in Uttarakhand have been interviewed using the questionnaires prepared by the JICA Survey Team (Attachment 5.1.3). The potential informants were listed up and have been interviewed by the JICA Survey Team. Under curfew and lockdown in Uttarakhand and other states, interviews have been carried out through phone and online tools.

(4) Interviews with the Supporting Actors (Financial Institutions, Farm Inputs Providers, Agri-tech, etc.)

Interviews with the financial institutions, farm inputs suppliers, agri-tech working with the horticulture farmers in Uttarakhand have been carried out by the JICA Survey Team with the preliminary list of informants and questionnaire (Attachment 5.1.3) prepared by the JICA Survey Team.

5.2 Results of the Survey

The details of survey results are shown in Attachment 5.2.1.

In addition, the survey on current situation of gender and nutrition was also conducted to the blocks surveyed in the supply chain survey. The details of the result are presented in Attachments 5.2.2 and 5.2.3.

Chapter 6 Outline of the Proposed Project Scope

6.1 Background

The Government of Uttarakhand expects an official development assistance (ODA) funded by Japan International Cooperation Agency (JICA) to implement the Uttarakhand Integrated Horticulture Development Project (hereinafter referred to as “UKIHDP” or “Project”). The Project intends to improve the supply chain of horticultural crops in the target four districts of the state of the Uttarakhand (hereinafter referred to as “UK”). The outline of the Project is as follows:

(1) Executing Agency

Uttarakhand Department of Horticulture and Food Processing (hereinafter referred to as “UKDHFP”) in the state of UK.

(2) Location of the Project

The target area of the Project is the four districts in the state of UK, namely: Uttarkashi, Tehri Garhwal, Pithoragarh, and Nainital.

(3) Impact and Outcomes Expected at Project Completion

The Project will contribute to economic and social development in the state of UK by enhancing the market competitiveness of UK horticulture crops and increasing the farmers’ incomes, through the horticulture crop supply chain development.

(4) Scope of Works

The project component is broadly divided into i) area expansion and production enhancement, ii) supply chain development, and iii) institutional development for project management. Under the project components, the scope of works is arranged as shown in Table 6.1.1 below.

Table 6.1.1 Scope of Works

Component	Scope of Works
1. Area Expansion and Production Enhancement	1.1 Climate change adaptation 1.2 Infrastructure development 1.3 R&D support (pre-harvest) 1.4 Provision of farm equipment and materials 1.5 Capacity development for farmers
2. Supply Chain Development	2.1 Infrastructure development 2.2 FPO development 2.3 R&D support (post-harvest) 2.4 Promotion of private sector collaboration
3. Institutional Development for Project Management	3.1 Procurement of equipment and materials 3.2 Strengthening of PMU/DIU and HMT 3.3 Capacity development for R&D 3.4 Branding and marketing development 3.5 Exposure visits 3.6 Baseline survey and mid-& end-line surveys

Source: JICA Survey Team

6.2 Framework of the Project

The Detailed Project Report (DPR) is under preparation. To share the awareness of the Project, a draft Project Design Matrix (PDM) has been created by the JICA Survey Team making minor modification to the Preliminary Project Report (PPR) as follows.

Table 6.2.1 Draft Project Matrix (PDM)

Project Outline (Narrative Summary)		Important Assumption
Overall Goal (Project Impact)		
	Economic and social development in Uttarakhand state.	▪No decline in demand for horticultural crops
Project Purpose (Outcomes)		
	- Market competitiveness of Uttarakhand horticulture crops is enhanced. - Farmer's income is increased.	▪UK state government's horticulture and agriculture clustering strategy continues.
Outputs		
1	Horticulture crop production is increased.	▪Infrastructure for training/research, irrigation, production to post-harvest and markets will be used effectively and continuously. ▪A system to provide continuous support for strengthening FPOs and their marketing will be established and enhanced. ▪Horticultural technology and knowledge will be continuously provided to farmers. ▪Liberalization of horticultural crop distribution will be promoted and private investment will increase. ▪Market information networks will be strengthened and made more accessible.
2	Supply chain system of horticulture crops is strengthened.	
3	Project management system is strengthened to establish the models of horticulture crop supply chain development in UK.	
Activities		
1	Area Expansion and Production Enhancement	
1.1	Climate change adaptation	▪Proper maintenance (manpower and budget) of the established facilities ▪Trained FPOs to continue own operation for marketing and business activities
1.2	Infrastructure development for irrigation and production facilities	
1.3	R&D support (pre-harvest)	
1.4	Provision of farm equipment and materials	
1.5	Capacity development for farmers	
2	Supply Chain Development	▪Trained officials continue their work
2.1	Infrastructure development	
2.2	FPO development	
2.3	R&D support (post-harvest)	
2.4	Private sector collaboration promotion	
3	Institutional Development for Project Management	Pre-condition
3.1	Procurement of equipment and materials	▪Farmers in the target cluster area agree to promote horticultural crops.
3.2	Strengthening of PMU/DIU and HMT	
3.3	Capacity development for R&D	
3.4	Branding and marketing development	
3.5	Exposure visits	
3.6	Baseline survey and mid-& end-line surveys	

Source: JICA Survey Team

The project framework has been designed in due consideration of points to note developed based on the Department of Agriculture and Cooperation (DAC) five evaluation criteria as shown in the table below. Therefore, it can be said that the Project will be rational.

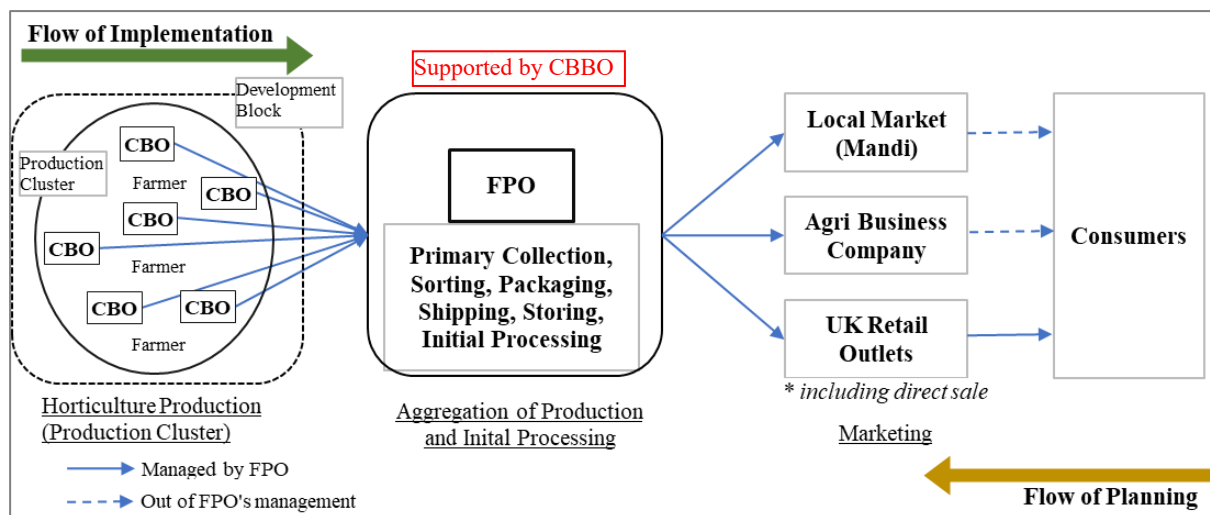
Table 6.2.2 Verification of Project Rationale

Criteria	Points to Note
Relevance	Set "project purpose" and "overall goal" based on the policies and needs of the government, implementing agencies, and target groups.
Effectiveness	Establish an integrated horticultural development model in the four target districts.
Efficiency	Establish appropriate quality, quantity, method, and timing of inputs to achieve outputs.
Impact	Correctly assess the environmental and social impacts resulting from project implementation.
Sustainability	Propose a mechanism to sustain the project effects even after the project ends.

Source: JICA Survey Team

6.3 General Approach to the Project

Typical supply chain proposed under the cluster approach is depicted in Figure 6.3.1. The Farmers Producing Organizations (FPOs) will play an important role including backward linkage with community-based organizations (CBOs) and farmers in the production cluster area for joint activities in the purchasing of farm inputs and sales of farm outputs, and forward linkage with players for processing and marketing of horticulture produce. The FPOs will prepare an annual production plan in consideration of production capacity of the member-farmers and support the member-farmers in horticulture production including purchasing farm inputs and selling farm outputs in order to maintain quality and quantity of produce at the production stage, and also support in the initial processing such as sorting, grading, packaging, shipping, and/or storing at the marketing stage.



Source: JICA Survey Team

Figure 6.3.1 Typical Supply Chain under Cluster Approach

Under the general approach of the Project, there are three components as discussed in Section 1.1(4). First for the area expansion and production enhancement, the Project Management Unit (PMU)/District Implementation Unit (DIU) will act as technical agency to increase horticulture production in collaboration with the Indian Council of Agricultural Research (ICAR), State Agricultural Universities and Krishi Vigyan Kendras (SAU/KVK) and Uttarakhand Department of Horticulture and Food Processing (UKDHFP). Research and Development (R&D), production of planting materials (seeds and seedlings), horticulture extension services and climate change adaptation will come under this component. Secondly, for supply chain development, FPO development will be outsourced to a Cluster Based Business Organization (CBBO) by PMU/DIU, which will be implemented in convergence with a central sponsored scheme “Formation and Promotion of 10,000 Farmer Producer Organizations (FPOs). Other activities will be managed by PMU/DIU in consultation with UKHB. Thirdly, for project management, proper management system will be established by the Project Management Consultant (PMC) and supporting institutions for the successful implementation of the Project including capacity development of the government staff, branding and marketing including exposure visits, and baseline survey and impact assessment.

6.4 Target Districts for the Project

According to the report from UKDHFP, UKDHFP first divided the state into two administrative regions; Garhwal and Kumaon, and then selected Uttarkashi district and Tehri district out of 7 districts in Garhwal region, and similarly Pithoragarh district and Nainital district out of 6 districts in Kumaon region, taking into account the demonstration effects, area balance in east and west, potential climate change impact as well as major horticulture growing belts in hilly area. Table 6.4.1 shows the general features of all districts of Uttarakhand State. As shown in the table, the state can be broadly divided into two: plain and hill. Dehradun, Haridwar, and Udham Singh Nagar districts are categorized as plain with

less forest coverage and mostly fallen into agro-climate zone A (less than 1,000 m). These three districts are rather industry-based economy. Other districts are hilly topography and depend on agriculture-based economy.

Table 6.4.1 General Features of All Districts in Uttarakhand State

Region	District	Population 2011 Census	Geographical Area	Population Density	Per Capita Net DDP	Marginal and Small Farmers	Povert Rate (%) in 2017	Long Term Migrant HH	Forest Coverage	Geographical Feature	Agro-Climatic Zone
		(persons)	(km ²)	(persons/km ²)	('000 in Rs.)	(%)	(%)	(%)	(%)		
Garhwal Region	1 Uttarkashi	330,086	8,016	41	89.2	90.1	9.9	23.0	90.0	Hill	B, C, D
	2 Chamoli	391,605	8,030	49	118.4	93.1	27.5	35.2	63.0	Hill	A4, B, C, D
	3 Rudraprayag	242,285	1,984	122	83.5	92.9	18.3	47.9	90.9	Hill	A4, B, C
	4 Tehri Garhwal	618,931	3,642	170	83.7	95.1	13.0	28.0	88.3	Hill	A3, A4, B, C
	5 Dehradun	1,696,694	3,088	549	195.9	88.5	7.1	3.7	65.4	Plain & Hill	A2, A3, A4, B
	6 Pauri Garhwal	687,271	5,329	129	110.0	95.3	14.8	21.5	72.3	Hill	A2, A3, A4, C
	7 Haridwar	1,890,422	2,360	801	254.1	89.3	15.3	5.5	35.7	Plain	A1
Kumaon Region	8 Pithoragarh	483,439	7,090	68	101.7	98.7	13.0	34.5	76.2	Hill	C, D
	9 Bageshwar	259,898	2,246	116	100.1	99.6	11.8	33.6	49.0	Hill	A4, B, C
	10 Almora	622,506	3,139	198	96.8	95.6	30.7	37.2	75.2	Hill	B, C
	11 Champawat	259,648	1,766	147	90.6	94.8	35.2	35.7	74.9	Hill	A3, A4, B, C
	12 Nainital	954,605	4,251	225	115.1	87.4	13.7	14.1	70.2	Hill & Plain	A2, A3, A4, B, C
	13 Udham Singh Nagar	1,648,902	2,542	649	187.3	79.2	18.7	2.2	36.9	Plain	A1
	Uttarakhand	10,086,292	53,483	189	157.4	91.7	15.6	25.1	71.3	-	-

Source: JICA Survey Team

In addition to the above general features, eight items related to horticulture/agriculture of all districts of Uttarakhand State are summarized with recommendation by the Uttarakhand Department of Horticulture and Food Processing (UKDHFP) in Table 6.4.2. As seen in the table, hill districts are heavily dependent on horticulture although they yield small production and have poor irrigation facilities and road networks.

Table 6.4.2 Horticultural Features of All Districts in Uttarakhand State

Region	District	Employment in Agriculture	Net Cultivated Land	Vegetable Production	Fruit Production	Spice Production	Total No. of Clusters	Net Irrigation Ratio	Road Density	Recommended by DHFP
		(%)	(ha)	(ton)	(ton)	(ton)	(no.)	(%)	(m/km ²)	
Garhwal Region	1 Uttarkashi	72.3	30,597	75,446	34,484	5,613	212	15.9	109.4	✓
	2 Chamoli	62.9	32,831	18,495	12,831	2,759	27	4.7	73.1	
	3 Rudraprayag	72.3	20,673	12,703	2,550	2,365	80	12.2	209.7	
	4 Tehri Garhwal	49.8	51,626	113,345	28,909	16,642	21	14.4	468.6	✓
	5 Dehradun	15.1	36,655	90,001	42,560	9,726	65	53.4	304.7	
	6 Pauri Garhwal	52.9	49,731	62,530	35,738	5,888	94	10.0	274.9	
	7 Haridwar	27.9	114,124	126,682	104,136	10,883	60	94.2	171.2	
Kumaon Region	8 Pithoragarh	60.4	40,409	121,557	49,592	5,577	100	10.2	116.4	✓
	9 Bageshwar	71.9	24,405	13,516	12,744	3,547	34	20.7	152.3	
	10 Almora	56.1	73,405	99,525	176,847	9,591	157	7.4	481.4	
	11 Champawat	68.3	16,888	32,981	13,698	4,645	127	9.8	288.2	
	12 Nainital	24.4	43,464	87,089	109,107	8,901	30	60.3	160.2	✓
	13 Udham Singh Nagar	23.3	137,722	160,410	54,173	10,145	43	97.2	195.9	
	Uttarakhand	39.0	672,530	1,014,279	677,370	96,282	1,050	47.2	192.5	

Source: JICA Survey Team

Based on the general situation of each district, the analysis of the current horticulture situation, and the reasons for the recommendation by UKDHFP, the four districts (Uttarkashi, Tehri Garhwal, Pithoragarh and Nainital) are confirmed to be a reasonable setting for improving the horticulture supply chain in UK State as a pilot. The State Government of UK has an idea to expand the pilot to other districts in the medium and long-term plan.

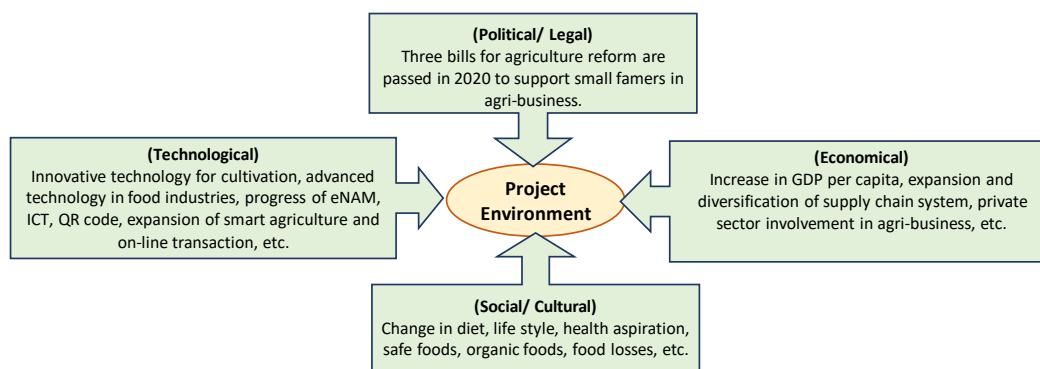
6.5 Implementation Approaches - Overall Marketing Strategy

6.5.1 Overall Marketing Strategy

The direction of the overall marketing strategy for Uttarakhand has been analyzed as shown below.

- (1) Overall environment surrounding supply chain development for horticulture produce in Uttarakhand has been roughly analyzed by PEST using the secondary data and information discussed in Chapter 2 and 3 as shown in Figure 6.5.1. Thus, it can be said that the Government

of India as well as the Government of Uttarakhand have placed development priority on the agriculture/horticulture supply chain.



Source: JICA Survey Team

Figure 6.5.1 PEST Analysis for Overall Environment surrounding Supply Chain Development for Horticulture Produce in Uttarakhand

- (2) Current problems being faced by Uttarakhand have been assessed by means of interview to the respected Chief Horticulture Officers (CHOs) of the target four districts.

Table 6.5.1 Issues in Horticulture Supply Chain from the Viewpoint of UKDHFP

Stage	Emerging Issues	Background of the Issues
Production	➤ Mainly marginal and small-scale farmers in mountainous areas ➤ Mainly subsistence farming using traditional farming methods ➤ Difficult to obtain high quality seeds, seedlings, and agricultural chemicals ➤ Inadequate horticulture extension activities ➤ Low irrigation coverage ➤ Crop damage caused by wild animals ➤ Lack of mechanization in the field ➤ Lack of farmer organization	➤ Difficult to secure large tracts of flat land in mountainous areas. ➤ Low productivity due to low cultivation technology of farmers ➤ Farmers have little financial resources, so their agricultural management strategy is more focused on stability (low-input agriculture, focusing on grains and livestock). ➤ Neglect of practical, problem-solving agricultural research based on farmers' needs (breeding and introduction of new varieties, cultivation techniques, etc.) ➤ Lack of sufficient number of highly qualified extension workers ➤ Lack of transportation for extension workers ➤ Difficulty in securing a stable source of irrigation water ➤ Farmers' organizing is left to farmers/NGOs, and there is limited continuous government guidance and support (no department in charge) ➤ Change in natural environment due to climate change
Processing and Marketing	➤ Road density is low ➤ Farm roads are not well developed ➤ Long distance from field to market ➤ No post-harvest processing facilities nearby ➤ UK horticultural products are not well known or branded.	➤ Of the four target districts, except for Nainital, no major markets have been established (distribution of agricultural products is low in mountainous areas) ➤ High costs due to inefficient operation of post-harvest processing facilities (low production volume, unstable supply of electricity and water) ➤ Farmers lack experience and knowledge of post-harvest processing and distribution. ➤ Even with post-harvest processing, quality is not reflected in the price (farmers' bargaining power, quality standards, market information, collusion among distributors) ➤ Low distribution of surplus produce outside the province (lack of presence in major markets) ➤ Lack of defined state/district strategy for branding (crops, varieties, quality standards, brand image)

Source: JICA Survey Team

It is expected that the production and distribution volumes will be limited due to the issues that have emerged as shown in Table 6.5.1. To proof it, the data of distribution volume to Delhi market shall be obtained with support from UKHB.

- (3) Direction of the overall marketing strategy has been analyzed by SWOT using the interview data and information obtained at APMC (Azadpur) in Delhi.

Table 6.5.2 Strategic Direction of the Supply Chain Development for Uttarakhand Horticulture Produce Based on the Market Survey at APMC (Azadpur)

		External Environment Analysis	
		Opportunity	Threat
		✚ Demand for temperate fruits and vegetables is increasing due to change in people's diet. ✚ UK government puts higher priority on horticulture development.	✚ Jammu and Kashmir (J&K) and Himachal Pradesh (HP) are competitor of UK, being ahead of UK in horticulture development.
Internal Environment Analysis	Strength	1. Aggressive Offensive	3. Differentiation Strategy
	✚ UK has comparative advantage for growing temperate crops by making good use of hilly topography and climate. ✚ UK is ranked as No. 1 in India in terms of production of peach, plum, apricot, and pear. ✚ UK is located closer to capital Delhi than HP and J&K.	(1) Acceleration of a supply chain development for UK selected crops targeting Delhi market.	(1) Promotion of a prompt cultivation of selected UK crops for early shipment. (2) Promotion of game-changing crops such as kiwi (to start with R&D)
	Weakness	2. Step-by-step Measures	4. Self-defense or Withdrawal
	✚ UK has poor basic infrastructure (roads, irrigation, water, power supply) due to hilly topography. ✚ Only a few UK crops are famous such as litchi from Ramnagar and mango from Dehradun. ✚ UK crops are limited in supply in quantity and period. ✚ UK crops are second choice in quality after J&K and HP produce.	Raising of presence/ reputation of selected UK crops in the market through: (1) Increase in production of selected crops (new variety seeds, cultivation technology, irrigation). (2) Improvement in quality of selected crops (freshness, color, size, taste). (3) Improvement in aggregation and distribution of selected crops (road improvement, system for aggregation and distribution). (4) Creation and propagation of brand strategy for selected UK crops.	(1) Rejuvenation/ replacement of senile plantations with recommended crops when the time comes.

Source: JICA Survey Team

The priority order of strategic direction will be in descending order: 1) Aggressive Offensive, followed by 2) Step-by-step measures, 3) Differentiation strategy, and 4) Self-defense or withdrawal. In other words, the Government of Uttarakhand shall accelerate the supply chain development of horticulture crops targeting the Delhi market, by taking the step-by-step measures and adopting the differentiation strategy.

6.6 Area Expansion and Production Enhancement Component

6.6.1 Climate Change Adaptations

(1) Survey on Climate Impact/Climate Adaptation Measure

Recently, climate change has become a serious factor to impact agricultural production all over the world. The impact is varied such as increase of temperature, change of water resources, increase or decrease of rainfall depending on agro-climatic and geological area. Especially for fruits, once a fruit tree is transplanted on the ground, tree replacement has been done every 20 to 40 years and tree plant would get negative effects gradually for a long period compared to vegetables and cereal crops which could be replaced every year.

From this point of view, the impact assessment of climate change to fruits is quite important for sustainable agriculture. In the Project, the survey on current situation will be conducted for assessment of climate impact on fruits production in the target area, and the necessary climate change adaptation measure will be proposed by PMU/DIU supported by PMC in collaboration with research institutions such as a university in Uttarakhand (GB Pant University).

(2) Development and Dissemination of Proper Farming Techniques

The adaptation measure proposed based on the survey result would be categorized to i) improvement of cultivation techniques, ii) development of tolerant varieties, and iii) conversion of crops (such as apple to walnut or any other suitable species). Although the measure i) is the easiest for farmers and PMU/DIU to undertake out of the three, it is required to identify the specific techniques to be applied for adaptation to climate change. PMU/DIU and PMC will conduct analysis carefully with advice of the relevant institutes, and to disseminate the proper techniques to farmers.

(3) Development of Varieties

The adaptation measure also will be proposed such as the development of tolerant varieties and it is necessary to do research and conduct trial for the long term. Generally, it takes more than ten years to develop and register new crop varieties. The project duration is eight years which is too short to complete to generate new varieties. Therefore, the Project could target to establish and manage the research system through this activity, and expect to conduct the research and monitoring for identification of adaptation measure continuously in Uttarakhand.

6.6.2 Infrastructure Development

The target area for expansion will be selected by taking into account the following points.

- Target Crop

Interventions by the Project should be converged on the target crop, although various crops are proposed in the PPR as mentioned in Chapter 4. Considering the proposed components for expansion and target crops in each district, the type of area expansion and the area should be reorganized.

- Target Crop

Area expansion means expansion of irrigation area in the Project. Among the farm cultivated by the member farmers of the selected FPOs, the area currently not irrigated is to be identified and recognized as the target of area expansion. Size of the target area of area expansion is estimated by the JICA preparatory survey based on the current status of irrigation in the target districts and land holding size of farmers in each district as shown in the table below.

Table 6.6.1 Irrigation Status and Scale of Area Expansion

District	Irrigation Rate ¹⁾	Average Land Holding Size (ha) ²⁾	Target of Area Expansion (ha)
Nainital	92.31%	1.43	90
Pithoragarh	23.47%	1.05	650
Tehri Garhwal	34.47%	1.50	790
Uttarkashi	13.97%	0.81	560
Total			2,090

Sources: 1) Supply chain survey conducted by JICA Survey Team, 2) Statistical abstract of Uttarakhand 2015-16

- Farmers' Capacity

The proposed components of area expansion require technical skills and knowledge, e.g., "New orchards with high yielding dwarf varieties under cost intensive crops" and "Ultra-high-density plantation". Therefore, the components should be selected after prudent assessment of farmers' capacity.

- Sustainable Availability of Necessary Input

To sustain the effect of the intervention by the Project, sustainable supply of the essential input is necessary, such as hybrid seedlings for "Hybrid vegetables" component. In addition, since the Project aims to strengthen the effective linkage among supply chain based on enhanced agricultural production, continuous application of farm input is also important. In this connection, availability of the farm inputs should be ensured.

(1) Water Source Facility

To introduce micro irrigation system under the Project, water source shall be confirmed in advance. As shown in Table 6.6.1, the area of 2,090 ha is planned to be newly irrigated under the Project. Water source facilities will be a tube well or dug well for groundwater, box for spring, small pond for rain

water harvesting other than canals/pipelines developed by Irrigation Department (ID)/ Minor Irrigation Department (MID). To make sure water sources for micro irrigation, cost provision for wells, boxes, small ponds per individual or group are inclusive in the Project. At the initial stage of the Project, DIU along with Cluster-based Business Organizations (CBBOs) will assess the water resources, land availability, topography, etc. through the site investigation.

For long-term and efficient use of water source facility, proper O&M is essential. If the Project will develop the facility directly or indirectly, necessary trainings for the proper O&M should be planned and conducted by the Project.

(2) Micro Irrigation (RWHP, Spring, Groundwater)

In the same manner as stated in (1) Water Source Facility, the necessity of irrigation at the target site would be firstly examined by DIU along with CBBO. Only after confirmation of water source availability, on-farm irrigation development can be implemented under the Project. Complying with the policy of Indian Government, irrigation system to be installed to the farm under the Project will be limited to water saving irrigation, e.g. drip irrigation and micro-sprinkler irrigation. Therefore, if the necessity of irrigation and availability of irrigation water at the site at present or in near future during the Project period are confirmed, the Project will provide the irrigation facilities. Tentatively, it is planned to develop drip irrigation for 1,545 ha and micro-sprinkler for 545 ha.

All farmers under the selected FPOs without micro irrigation facilities are eligible to be provided the irrigation facilities if the farmers have or will obtain irrigation water source. Actual situations whether the farmers have irrigation facilities or existing/planned water sources are to be confirmed by DIU along with CBBO through site visit and interview with the farmers. If the farmers are selected as beneficiaries of this component, they have to make contribution of a part of the cost of the irrigation facilities in terms of corpus fund.

The Project will provide micro irrigation facilities to farmers having an accessible water source. The facilities must be properly managed by the farmer. Necessary training will be provided by the supplier of the facilities. The farmer can purchase necessary materials for maintenance, such as spare parts of the equipment, from the supplier.

(3) Farm Machinery Bank

For the improvement of farming practice, agricultural machinery is effective measure for farmers. Appropriate machinery shall be introduced for marginal farmers of target hilly area in Uttarakhand. The rental system of machinery at reasonable price shall be introduced and the unit will be established on the basis of FPO's demand including capacity of facility and kind/ quantity of machinery. After handing over of the unit, the unit will be run by FPO and the operation / management shall be supported and monitored by DIU. O&M cost shall be generated by the rental charges (refer to the sample table below) from users who will be members of FPO as well as non-members close to the unit facility. Proper how-to of O&M will be guided by suppliers as their maintenance service periodically with support and monitoring by DIU/PMU.

Table 6.6.2 Charges for Farm Machinery Bank

Estimates of Output and Value of Output					
Particulars	Unit	Rental/Charge	Hiring Unit	Area (Acres)	Output value in Rs.
Tractor (35 hp)	INR	200	per acre	0	-
M.B plough	INR	1400	per hour	350	4,90,000.00
Disc plough	INR	1400	per acre	350	4,90,000.00
Tyne Type cultivator	INR	900	per acre	350	3,15,000.00
Disc Harrow	INR	900	per acre	350	3,15,000.00
Power tiller operated rotary tiller	INR	900	per acre	350	3,15,000.00
Rotavator	INR	1400	per acre	350	4,90,000.00
Pneumatic multi-crop planter	INR	1200	per acre	350	4,20,000.00
Vegetable transplanter	INR	1200	per acre	350	4,20,000.00
Self-propelled Power Weeder	INR	800	per acre	350	2,80,000.00
Knapsack sprayer	INR	150	per acre	350	52,500.00
Motorized knapsack mist blower cum duster	INR	180	per acre	350	63,000.00

Source: UKDHFP

(4) Outline of training

The preliminary outline of the O&M training on facilities are summarized as follows.

Table 6.6.3 Indicative Quantity of Training on Facilities

Facility	Qty.	Implementation/ Monitoring	Trainee	Duration/ Frequency	Description
Water Source Facility	-	Responsible Agencies	Owner	1day, Once a year before rainy season	Training will be provided by the agencies responsible to water source facility.
Micro Irrigation	-	Supplier	Owner	1 day after installation. 1 day once a year before dry season.	Training will be provided by the supplier based on their own manual. PMU/DIU should check and, if necessary, advise on their training contents and materials.
(3) Farm Machinery Bank	-	Supplier	Owner	1 day after installation. 1 day before high season of animal attack	Training will be provided by the supplier of farm machinery. PMU/DIU should check and, if necessary, advise on their training contents and materials.

Source: JICA Survey Team

(5) Quantities of Infrastructure to be Developed under the Project

The quantities of infrastructures to be developed under the Project are estimated as follows:

Table 6.6.4 Indicative Quantity of Infrastructure to be Developed under the Project

Infrastructure	Quantity	Description
Water Source Facility	1,886 nos.	Condition - 1 no./HH - If the farmer is eligible to receive irrigation facility, he/she is also eligible to receive water source facility. Assumption - Nos of Household in one FPO: 200 HH/FPO - Farm size is applied from statistic data of Uttarakhand 2015-16 - If a farmer does not have irrigation access, he/she does not have irrigation water source.
Micro Irrigation	2,090 ha (Drip: 1,545 ha, Micro Sprinkler: 545 ha)	Condition - Ratio of farmers accessible to irrigation system coincide with HH survey conducted by JICA Survey team. Assumption - Nos of Household in one FPO: 200 HH/FPO - Farm size of one household: 1.0 ha/HH - 100% farmers can irrigate after development
Farm Machinery Bank	16 units	Assumption - 1 unit/FPO, 16 units for 16 FPOs - Procurement of farm machinery shall be included into this infra. development.

Source: JICA Survey Team

6.6.3 R&D Support (Pre-harvest)

Current conventional horticulture of Uttarakhand could be innovated for a new era based on the essential state facility below in the table. Presently, agriculture products of Uttarakhand have limited marketability at major markets in terms of selling price or quality. The location of Uttarakhand has an advantage than the adjacent west Himalayan states. However, the agri-products have limited market competitiveness. Deployment of the following R&D facility will support the enhancement and improvement of horticulture in Uttarakhand. The outlines of infrastructures for R&D for pre-harvest to be developed under the Project are shown as follows.

Table 6.6.5 Outline of R&D Support for Pre-harvest

Items	Qty. of PPR	Qty. of proposed project scope	O&M Organization	Remarks
(1) Hi-tech Nursery				
Hi-tech Nursery (4 ha), Public Sector	2 nos.	2 nos.	UKDHFP / Private sector (PPP mode)	Govt Garden-Ramgarh, Nainital, and Govt Garden Dwari, Uttarkashi
(2) Planting materials (nursery)				
Import of planting materials (fruits)	5,000 nos.	40,000 nos.	UKDHFP	To be conducted at Government Gardens/
Establishment of virus free mother block for fruits	2 no.	1 no.	UKDHFP	To be conducted at Government Garden Chaubatia, Almora/
Rejuvenation and replacement of senile orchards	500 ha	500 ha	UKDHFP	In all project districts
(3) Integrated Center of Excellence (CoE)				
Integrated COE for Kiwi	1 unit	1 unit	UKDHFP/Private sector (PPP mode)	Narendranagar Tehri,
Integrated COE for off-season/ exotic vegetables	1 unit	1 unit	UKDHFP/Private sector (PPP mode)	Govt Garden- Dhanaulti
Area Expansion for Ultra High Density-Apple	400 ha	120 ha	UKDHFP/ Farmers	Integrated package with drip and trellis
New Area expansion for KIWI-Integrated package with drip and trellis	400 ha	300 ha	UKDHFP/ Farmers	Integrated package with drip and trellis
Area Expansion for Other Plantation fruit crops (Litchi and Citrus)	2000 ha	100 ha	UKDHFP/ Farmers	Integrated package with drip and trellis
(4) Upgrading of food science training center	1 unit	1 unit	UKDHFP	To be established at Ramnagar Nainital
(5) Leaf/ Tissue analysis lab for IPM	2 units	1 unit	GBPUAT, Pantnagar	Chaubatia

Source: JICA Survey Team

Note: 1) RFP: Bidding from Private sector as 40% subsidy (borne by the Project) and 60 % payment from Private sector. Ownership belongs to private sector. Land acquisition /Transfer the Gov land. Provision of Licence from UKDHFP to private sector under Nursery act. To be supported by UKDHFP (visit for monitoring)

Details of each facility are shown below:

- **Hi-tech Nursery**
 - To plan the enhancement of seedling production based on the state strategy and plan for promotion/development of target crops and clusters. Based on the cluster development strategy/ plan, the seedling production plan will be depicted. Current state seedling production is not enough for promotion of new clusters aiming at production and shipping competitive horticulture products to the adjacent major markets.
 - To design and implement a nursery and seedling production enhancement plan based on the cluster development strategy and plan of the state. The Hi-tech Nursery will play seedling production center, hi-tech nurseries, planting material, training and capacity building of farmers for marketing and implementation through the FPOs, institutional development of FPOs, creating cadres for managing supply chain, developing MIS system, geotagging of the assets created, GIS mapping of horticulture resources, and Aadhar linking to prevent duplication of beneficiaries.
- **Integrated Center of Excellence (CoE)**
 - Two CoE are planned for training of officials and Horticulture Mobile Teams (HMTs) at block level at each district and farmers / FOs, or state nursery, for development and support of clusters. Member of HMTs would attend the training at CoE every month in accordance with cropping events for items of a) to g). CoE will be crowded so far, because the training will not be completed on a certain period and should be continued for crop season. Those trainees will

- attend the trainings for each event of the crop period. Then the training of farmers / FOs will be moved to their farmland after the training at CoE. Such training plan relayed from CoE to HMTs will be planned during the stage.
- CoE would be developed for improving block level HMTs and farmers /FOs, then the extended knowledge and techniques are expected to be transferred to their group members or family like cascade. Training activities of CoE should be conducted in a classroom, demonstrated in a CoE, and the farmlands of trainers or FOs also for items of a) to g).
 - Effective HMT support work for horticulture production must be achieved based on relay among CoE, HMTs, and FOs. It is advised that trainings by CoE and district HMTs should work together with the block HMTs on-the-job training at the farmland together with farmers/FOs, because market demands are varying year by year and contents of the trainings should be reviewed every year when close the crop season.
 - Upgrading of food science training center
 - To plan the strengthening of existing food science training center for support on secondary food processing, e.g., pickles, fermented food, juice, puree
 - Food science training center shall be developed for the products that are not available for sale fresh because of its bad appearance or out of size or shape, but of the same quality (taste, sugar contents)
 - New Setting Bio Control Lab for IPM
 - To be planned for new setting of Leaf/Tissue analysis lab for Integrated Pest Management (IPM), etc. IPM would cover the farmland soil analysis, planning fertilizer design, etc., for improving current state agriculture without soil test. Without soil test, farmer cannot apply proper fertilizer and the situation causes not only pest and disease, also less yields or low quality of products
 - Farmers usually do not know about their farmland fertility such as Nitrogen, Phosphorus, Potash, CEC or pH except farmers supported by NGO for soil lab activities. Farmland soil should be analysed for producing competitive products, so that the state government or HMTs should start soil test in collaboration with the lab.

6.6.4 Provision of Farm Equipment and Materials

The outlines of farm equipment and materials for farmers to be provided under the Project are shown as follows.

Table 6.6.6 Indicative Quantity for Farm Equipment and Materials

Items		Qty. of PPR	Qty. of proposed project scope	Objectives	Remarks
(1) Equipment and materials for protected cultivation	Poly house	140,000 m ²	90,000 m ²	To apply vegetables such as tomato, pea, etc for control growth and harvest.	- For Tehri, Nainital, Uttarkashi and Pithoragarh -
	Plastic mulching (fruits and vegetable crops)	2,000 ha	2,000 ha	To apply plastic mulching for apple, sweet orange, tomato and pea.	- Tehri, Nainital, Uttarkashi and Pithoragarh - The project aims more than 3750 ha of those crop production.
	Anti hail net	4,200,000 m ²	1,500,000 m ²	To apply hail net for apple, peach and Plum.	- Tehri, Nainital, Uttarkashi and Pithoragarh - The planned fruits area under the project will over 470 ha.
(2) Planting materials (farmers)	Planting material and cultivation of flowers under poly house	50,000 m ²	32,000 m ²	To promote the improved quality of flowers cultivation	- All project districts
	Planting material and cultivation of vegetable under poly house	90,000 m ²	58,000 m ²	Tomato grafted seedling will be started production in the Hi-tech nursery or CoEs	- Tehri, Nainital, Uttarkashi and Pithoragarh - Calculated as 10 % of total tomato target area spacing by 0.75 x 0.6 m or 23000

Items		Qty. of PPR	Qty. of proposed project scope	Objectives	Remarks
					seedlings/ha
	Open Pollinated Vegetable Seeds (Peas, etc.)	1,500 ha	1,540 ha	Pure and vigorous peas seed will be applied for pea production	- Tehri, Nainital, Uttarkashi and Pithoragarh - Calculated as spacing by 0.2 x 1.1 m, 400 pc/litter or 46000 seedlings/ha
	Potato Seed	1,500 ha	1,000 ha	Virus free potato seed would be prepared by the project in the concept of seed village as well	- Tehri, Nainital, Uttarkashi and Pithoragarh - Calculated as spacing 0.4x1.0m or 1 mt of potato seed /ha
	Hybrid Vegetable Seeds (Tomato, etc)	2,000 ha	2,000 ha	Hybrid F1 tomato seed would be applied for the production under the project	- Calculated as spacing by 0.75 x 0.6 m or 23000 seedlings/ha
	Rhizomatic Spice Seeds (Ginger, Garlic, Turmeric)	2,500 ha	2,500 ha	The project estimated the area for Garlic: 173 ha Turmeric: 133 ha Ginger: 155ha in the concept of seed village as well	- Calculated by spacing and weigh of seed per piece: Garlic 0.15 x 0.75, 7g/piece Turmeric 0.4 x 0.8, 50g/piece and Ginger 0.3 x 1.2, 40g/piece
	Bulbous Flower Seeds (Lilium, Tulip, Carnation, Gerbera)	100 ha	100 ha	To promote flower production meeting market needs	- All project districts
	Aromatic Plant (Damask rose)	-	100 ha		-
(3) Promotion of INM and IPM		14,700 ha	7,775 ha	To promote integrated pest management and nutrient management.	- As per area expansion of fruits, vegetable, potato, and spices
(4) Materials for livelihood improvement and nutrition improvement	Mushroom: Production unit under natural condition (Button, Shiitake and Oyster), Private	330 units	330 units	To promote mushroom and bee keeping supplementary livelihood	-
	Mushroom: Production of Ganoderma species, - Pilot basis (R&D), Private	55 units	55 units		-
	Bee Keeping: Production unit under natural condition	-	330 units		-

Source: JICA Survey Team

Farmers selection for provision of materials is conducted by DIUs based on application mode to be submitted by individual farmers. The application form shall include the criteria checklist for confirmation of farmers' willingness and practical / financial capacity. The criteria for selection is shown as below.

Table 6.6.7 Criteria for Farmers Selection for Provision of Materials

Inclusion Criteria	Priority Criteria
➤ Members of FPO or non-members who live in the same cluster at which the FPO is located. ➤ Able to pay 20% contribution of the material price ➤ Submit cropping and land use plans with utilization of the material	➤ In case that No. of application is more than quantity procured by the Project, - FPO members will be given priority. - Farmers who have not been provided any material yet will be given priority.

Source: JICA Survey Team

The selected farmers will be trained for practicing how to operate and maintain the equipment and materials at farms or CoEs. As for equipment such as polyhouse, farmer will be given guidance and instruction on O&M by suppliers. Regarding other materials, the guidance on proper keeping (clean, and safe) will be carried out with technical training for crop production by DIU and HMT in each district,

which programmes are shown in next clause 6.6.5. The training will be supported by KVK, university and PMU/ PMC, and be monitored periodically by PMU/PMC.

6.6.5 Capacity Development for Farmers

(1) Training on Farm Planning and Management

The farmers are engaging in conventional horticulture based on their own historical experience succeeded by cascade of generations so far. The Project aims at deploying improved horticulture equipment and materials, which will be effectively utilized based on the proper farm management.

1) SHEP Approach

The concept and experience of JICA initiative of Small Horticulture Empowerment Project (SHEP) will be introduced on pilot basis. The concept of SHEP approach is thinking from the economic theory "grow to sell" and based on a psychological theory "a mechanism for unlocking farmer motivation".

Key points for these steps are: a) participatory baseline survey carried out by farmers and extension officers together, b) stakeholder forum for farmers to contact and discuss with actors from agricultural industry sector, c) demand -driven technical training for farmer's requirement identified in market survey. The essence of SHEP approach is farmer's decision making based on their own collecting information and analysis on the potential market for conducting agricultural business.

In the Project, farm management for beneficiary farmers shall be integrated by following items of a) awareness of market demand by access to market information and competitors, b) identification production techniques and products to be applied, and c) continuous updating the farm management and techniques to meet market demands. Training contents could be setup based on SHEP approach in the Project. SHEP approach can encourage farmers to make decision for their agricultural activities and to generate ownership and business mind.

In the Project, recommended crops for each target district have been considered by UKDHFP as target crops for supply chain survey in JICA survey as below. Although these crops will be recommended for beneficiaries, at the initial stage of the Project, baseline survey will be conducted by third party for identification of current agricultural produces and market demands for each district and cluster. The result will be shared with farmers for further detail planning. In the training programme for farmers market survey will be conducted by farmers themselves for awareness to market needs, and action plan will be formulated, which is business plan including cropping pattern, varieties and techniques to be applied. Training for SHEP approach will take place targeting farmers in target 16 blocks. The target farmers in the blocks will be provided with training course for SHEP approach as below¹ prior to Training cum method demonstration on Cultivation Practice of vegetable and fruits. Training for SHEP will be conducted at the first cropping season and the second cropping season for each target group. The detailed programme should be prepared in accordance with "SHEP Handbook for Extension Staff" published by JICA.

2) Environment and Capacity of Farmers

Current surrounding environment and capacity of farmers have been confirmed through the JICA Survey as shown in the table below.

Table 6.6.8 Estimated Current Surround Environment and Capacity of the Farmers

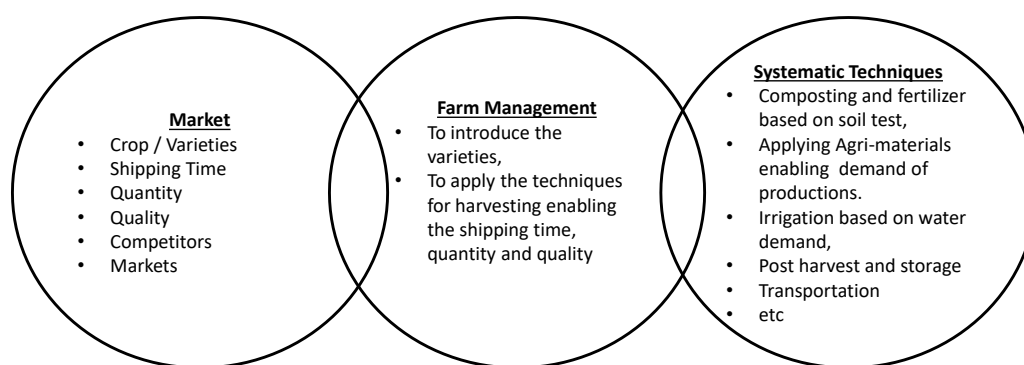
Viewpoints	Current Situation
Customers (Market)	• Diversified markets based on improving transportation or • Diversified products based on improvement of storage, varieties, etc. • Improved products based on preferences of customers e.g., safety, sweet, big, good outlooking etc., of horticulture products • High demands on genuine quality or delicious products
Farmers	• The farmers receive limited market information for horticulture products such as differences of prices by season, • The farmers receive limited information for horticulture farming e.g., new crop, varieties, agri-equipment or materials, agri-machines, chemicals, or farm techniques and management

¹ https://www.jica.go.jp/english/our_work/thematic_issues/agricultural/shep/concepts.html

Viewpoints	Current Situation
	The horticulture products of the farmers have limited yield, quality, or not well graded, since falling into less marketability. Some leading farmers at Uttarakhand are being newly started improved agriculture such as high-density apple. Meanwhile almost all ordinary farmers in Uttarakhand are practicing conventional horticultures and not introduced improved horticulture techniques such as new varieties, improved farming techniques, application of agri-equipment and materials, integrated nutrition management, or pest and disease management including agri-materials, or machines. Those are the reason of limited yield and quality, etc.
Competitors (J&K, HP, etc.,)	- The competitor farmers at adjacent states are engaging in the farm management based on the government generous supports such as information of advantage varieties, genuine seedlings, or agri-material, depend on the government home page information. As a result, the farmers at Himachal Pradesh and Jammu & Kashmir are achieved high yield of apple such as 5.1mt/ha and 11.42mt/ha respectively, instead the yield of Uttarakhand is stayed at 2.4mt/ha. - The horticulture productions by competitors are rather bigger and high quality.

Source: JICA Survey Team

For improvement of the abovementioned situation, firstly the farm management shall be introduced based on market information as the figure below. Under consideration for planning of farm management to meet market needs, necessary and systematic techniques will be identified. Then the techniques from seed sowing, land preparation, pre-harvesting up to post-harvesting will be shared to beneficiary farmers.



Source: JICA Survey Team

Figure 6.6.1 Farm Management based on Market

Training for farm planning and management will contain the above contents for the fulfilment of market demand, which could improve farmers' benefit. The following number of trainings should be conducted.

Table 6.6.9 Indicative Training Outline for Farm Planning and Management

Subject Area	Topics	Duration/ Frequency	Implementation/ Monitoring	Target
Marketing/ SHEP	➤ Ways to identify the market ➤ Understanding the market needs (site visits/ key informant interviews) ➤ Action Plan (exercise cum synthesis)	1 day visit to the market 1 day workshop for action planning Twice a year (Total: 4 days per Year)	By CBBO with support of DIU, HMT, PMU/PMC	FPO members (10 FPO members x 16 FPOs=160 FPO members) x 2 times per year x 5 years = 1,600 FPO members
Production	➤ Land preparation ➤ Seed quality and selection ➤ Planting materials and cultivation methods ➤ Options for Crop Protection ➤ Maintenance Works ➤ Record Keeping ➤ Optimum usage of agro-chemicals for insect/pest management ➤ Fertilizer application and composting	3 days Twice a year (prior to each cropping season) Training can be scheduled intermittently. (Total: 6 days per year)	By DIU/HMT with support of KVK, university and PMU/PMC	Same as above

Subject Area	Topics	Duration/ Frequency	Implementation/ Monitoring	Target
Post harvest handling	➤ Importance of aggregation of produces ➤ Quality of produces and market preferences ➤ Cleaning, drying, storing ➤ Grading & Packing	2 days Twice a year (before harvest seasons) Training can be scheduled intermittently. (Total: 4 days per year)	By DIU/HMT with support of KVK, university and PMU/PMC	Same as above
Irrigation	➤ Water Management (FPO)	1 day Twice a year (prior to each cropping season) Training can be scheduled intermittently. (Total: 2 days per year)	By DIU/HMT with support of PMU/PMC	Same as above

Source: JICA Survey Team

(2) Technical Training on Cultivation and Post-Harvest Handling

Technical training on cultivation and post-harvest should cover the items in the table above. Details of the items should be refined based on market demand and the selected crop/varieties.

(3) Livelihood Improvement

In the project area, 74.1% of the households are marginal farmers having the land of less than 1 ha and farmers grow multiple varieties of crops for household consumption and for sale, while 33.1% of the households supplement their income from the agriculture labor. This suggests that the farm households require to have alternative means of livelihoods. Especially in the small agriculture land, production is small. Once the crop fails, it threatens not only the household food security but also the cash income with which they can buy food from the market. Furthermore, the small scale farmers often show less tendency to take up new crops as they cannot take the risks of crop failure or due to lack of financial capacity to sustain until the yield gets stabilized.

To minimize such shocks to the farm households, diversifying income sources can enhance resilience of the farm households towards livelihood shocks. Thus, under this project, two activities of mushroom cultivation and bee keeping are selected because these activities are work duty of UKDHFP, which also have good market potential. Beekeeping, in particular, has a dual objective of livelihood improvement as well as pollination in the orchard area. The outline of the activities is given as below.

1) Objectives

- To minimize the livelihood shocks deriving from the crop failure
- To supplement the income while the income from the newly introduced crops is stabilized

2) Indicative Inclusion Criteria and Procedure of Household Identification

The beneficiaries will be identified among the members of FPOs participating in the project. To aggregate the produce for better market outreach and efficient and effective technical guidance, SHGs or any other groups under the project FPOs having maximum 5 members meeting the following inclusion criteria will be given priorities in taking up the activities. The final selection will be given to the groups having the highest number of women head of households including de-facto women headed households.

Table 6.6.10 Beneficiary Inclusion Criteria within SHG or Any Other Groups in the Project FPOs

Inclusion Criteria	Priority Criteria
➤ Members of the group indicated the interest in implementing the activity ➤ More than 70% of the members belong to BPL ➤ Beneficiary member have less than 1 ha of agriculture land.	➤ In case, more than 5 members are interested in the activities, the women headed household including de-facto women headed household will be given priority.

Source: JICA Survey Team

3) Outline of the Activities

The details of the activities are as below.

Table 6.6.11 Details of Livelihood Improvement

Work Item	No of Farmers	Preparation	Implementation	Implementation and Monitoring By
a) Mushroom cultivation	330	1) Identification of farmers through awareness workshop 2) Procurement of materials 3) Scheduling of training	1) Provide equipment and material of mushroom for 320 farmers (about 20 farmers per FPO x 16 FPO =320) 2) Provision of necessary training on cultivation management and marketing	CBBO and UKDHFP mushroom officer
b) Bee Keeping	330	1) Identification of Farmers through awareness workshop 2) Procurement of materials 3) Scheduling of training	1) Provide equipment and material of honey bees for 400 families (10 colony apiary per unit / 25 farmers per FPO x 16 FPOs =400 farmers (units)) 2) Conduct necessary training on apiculture and marketing	CBBO

Source: JICA Survey Team

(4) Nutrition Improvement

According to the survey findings, nutritional imbalance has been identified as an issue in the project area. Women in the project area had limited access to information on nutrition and tend to cook food from the items available within their reach. This means that if the food items are not available, they are less likely to be included in their meals. In addition, statistical data suggests that anemia remains relatively common in the project area. With this background, three types of activities are visualized under nutrition improvement: 1) school nutrition garden; 2) promotion of kitchen garden; and 3) awareness programme for nutrition. While contributing to the improvement of national status and well being of the rural population, the change in the diet may also lead to the increased demand of the various horticulture crops. The activities are outlined as under.

1) Objectives

To improve the availability of vegetables and other nutrition rich crops within easy access for women
To improve the knowledge on nutrition among the youths and women

2) Selection Criteria and Procedures of Beneficiaries

Selection criteria and producers for 1) establishment of school nutrition garden; 2) promotion of kitchen garden and 3) awareness programme are as under.

Table 6.6.12 Selection Criteria and Procedures of Beneficiaries

Activity	Eligibility Criteria	Procedure
a) Establishment of School Nutrition Garden	1) Having sufficient area to establish garden. 2) Teachers agree to take up the programme including maintenance of the garden	1) Short list of the schools (upper primary and higher) out of the schools within the cluster will be created by DIU in consultation with the District Education Officer, District Medical and Health and Family Welfare officer and KVK. 2) Site verification and consultation with the schools will be conducted by DIU and CBBO to confirm the fulfilment of the eligibility criteria. 3) Out of the short listed schools, 2 schools from each cluster will be selected by DIU in consultation with the District Education Officer, District Medical and Health and Family Welfare officer and KVK.

		4) MOU will be exchanged between DIU and school for undertaking the activity.
b) Promotion of Kitchen Garden	1) Member household of FPO 2) Have sufficient area within the household compound or within easy access to set up a kitchen garden 3) Family members understand the need of kitchen garden.	1) CBBO will conduct awareness programme for FPO members. 2) CBBO will create the list of eligible households out of the participants to the awareness programme. 3) FPO confirms the list of participating households and submits the list to DIU for approval.
c) Awareness Programme	1) Being a member of project FPO	The activity will be conducted with FPO members and thus, no selection of participants will be required.

Source: JICA Survey Team

3) Outline of the Activities

The information dissemination materials used during the project will be prepared by jointly by CBBO and the project. The outline of the activities is as under.

Table 6.6.13 Outline of Nutrition Improvement

Work Item	Quantity	Preparation	Implementation	Implementation and Monitoring by
a) Establishment of School Nutrition Garden	32 schools	1) Identification of schools through consultation by CBBO and DIU 2) Procurement of materials 3) Preparation of information dissemination materials 4) Scheduling of training	1) Set up of the nutrition garden in the school with technical support of the CBBO 2) Maintenance works by pupils/ students 3) Regular class on nutrition and farming conducted by CBBO	CBBO in collaboration with schools, KVK, District Education Officer, District Medical Health and Family Welfare
	Contents:	- Vegetables to balance nutrition (i.e. amaranth, beetroot, carrot, green leafy vegetables, etc.) will be planted in the school garden. - Children will be guided to plant and take care of the nutrition garden. The guidance will be provided by CBBO. - Linkage between agriculture and nutrition will be explained to the children. Cooking and tasting event of various crops will also be organised by CBBO. - Awareness materials (poster, leaflet and etc.) will also be developed by the project and provided. - CBBO will provide the regular guidance.		
b) Promotion of Kitchen Garden	3,200 HHs	1) Identification of households through awareness workshop 2) Procurement of materials 3) Preparation of information dissemination and start up kits 4) Scheduling of training	1) Conduct demonstration cum training with the participating households 2) Provision of start-up materials for kitchen garden 3) Regular follow up conducted by CBBO	CBBO in collaboration with KVK, ICDS, District Medical Health and Family Welfare
	Contents	- Start up kit including the seeds of crops like amaranth, beetroot, carrot, green leafy vegetables, etc. will be prepared and distributed to the SHG members by the project. - Awareness materials (i.e. leaflet and etc.) will also be developed by the project and provided. - CBBO will conduct public information drive to promote kitchen garden and balanced diet.		
c) Awareness Programme for Nutrition	16 FPOs	1) Identification of SHGs through awareness workshop 2) Procurement of materials 3) Scheduling of training	1) Conduct awareness programme will be conducted with FPO member households (3 times a year)	CBBO in collaboration with KVK, ICDS, District Medical Health and Family Welfare

Work Item	Quantity	Preparation	Implementation	Implementation and Monitoring by
	Contents:	- CBBO will conduct regular awareness session with FPO members. - Awareness materials (i.e. leaflet, recopies and etc.) will also be developed by the project and provided.		

Source: JICA Survey Team

6.7 Supply Chain Development Component

6.7.1 Infrastructure Development

The post-harvest processing development is planned in accordance with the following principles as stated below.

- Synergy effects in developing FPOs
Sixteen FPOs (eight new development and eight existing) are planned to be established and empowered in UKIHDP. The supply chain development should be organically linked with facilitating and empowering the FPOs. The component aims at diversifying distribution channels of the FPOs/FPCs through improvement of their bargaining power with the following strategies.
 - To promote joint marketing
 - To market quality produce after primary processing
 - To accelerate partnership with private agribusiness operators in advancing value addition
- In line with the Government of India (GOI) market reform policies
Facilities to be developed will contribute to enhance supply chains of horticultural produce after understanding the principle of GOI's policies and the role-sharing between the public sector and the private sector. GOI expects that the public sector steps down from a business operator in the supply chains and changes its roles in providing supporting services to the private sector including farmers who are going to play a main role in the supply chain.

The following table shows the comparison of the proposed project scope with the project contents in the concept plan of UKIHDP.

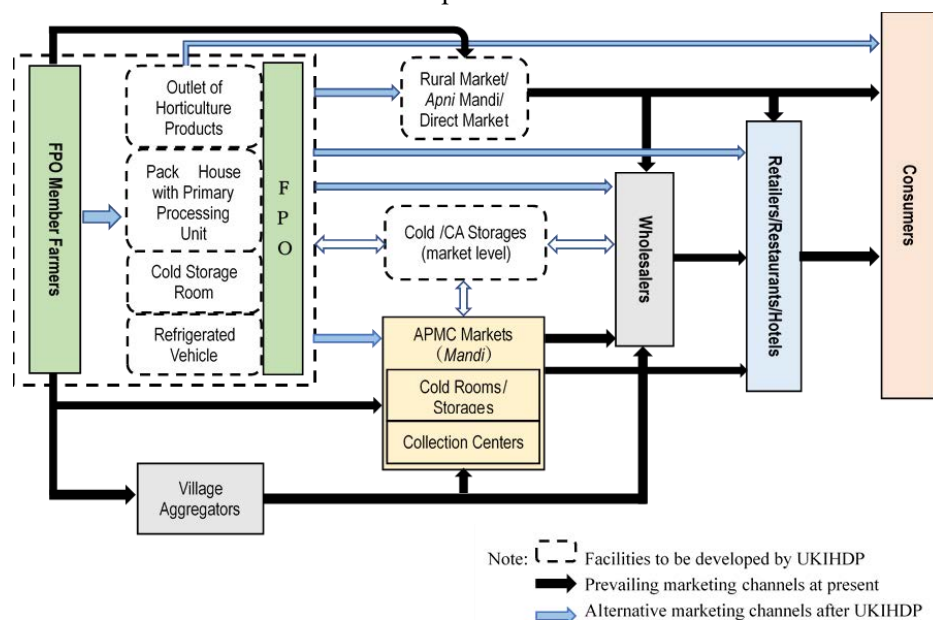
Table 6.7.1 Proposed Project Scope

Table 6.7.1 Proposed Project Scope					
No	Proposed Project Scope Facility/Components, Number		Remarks	Operation & Management	Proposed Location
1	Pack House with Primary Processing Unit	16	• 1 pack house/target FPO • With equipment for cleaning, washing, grading, weighing etc.	FPO	04 in each district.
2	Cold Storage (30 MT) at field level	16	Incorporated into the Pack House	FPO	04 in each district.
3	Refrigerated Transport Vehicle	16	Incorporated into the Pack House	FPO	04 in each district.
4	Cold Storage (30 MT) at market level	4	1 storage/target District	Market intermediary (commission agent, wholesaler, etc.) closely working with target FPOs	01 in each district.
6	Rural Markets/ <i>Apni Mandies</i> (farmers' own market)/Direct Markets	8	• 1 market/target FPO • Improvement of the existing rural market facilities	Market committee (community council, cooperative or trusted individuals) managing the rural market being familiar with target FPO members	1. Pithoragarh 2. Jauljivi-Pithrogarh 3. Bhimtal (Nainital) 4. Okhalkanda(Nainital) 5. Chamba (Tehri) 6. Nainbagh (Tehri) 7. Purola(Uttarkashi) 8. Uttarkashi
7	Outlets of Horticulture Products	2	• 1 outlet/Division (selected FPOs)	FPO	1. Muni ki Reti-Tehri 2. Nainital
8	Basic Food Processing Equipment (furnished in the Pack house)	2	• Advanced FPOs (pilot trial)	FPO	

No	Proposed Project Scope Facility/Components, Number	Remarks	Operation & Management	Proposed Location
		• Depending on FPO's business plan		

Source: JICA Survey Team

Upgradation of post-harvest centre to be clubbed with Apni mandi, wherever possible. Technical training to staff of nursery to be done at Gaja and Chaubatia Post-harvest facilities to be developed by UKIHDP and anticipated supply chain are illustrated in the figure below. Farmers will be able to have several alternative distribution channels of horticultural produce after UKIHDP.



Source: JICA Survey Team

Figure 6.7.1 Post-harvest Facilities by UKIHDP and Supply Chain

(1) Pack House with Primary Processing Unit

A facility for washing, sorting, grading, and packing of horticultural produce shall be established for the FPOs so that they will be able to achieve diversification of distribution channels of the produce and increased income as envisaged in GOI's policies. A partner private entity to operate and manage the facility shall be considered, if necessary. Every equipment to be furnished with the pack house should be simple and multipurpose from the following standpoints.

- To allow a flexible operation, in accordance with crops and their volume, to prolong the operating season (members of FPOs grow a variety of horticultural crops in addition to target crops of the cluster development);
- To allow anyone who is a member of FPOs to operate when necessary;
- To slash unnecessary operation costs and spending; and
- To save energy for CO₂ reduction.

A basic module of the facilities and equipment to be furnished are shown below, while the components and specifications shall be determined in accordance with the business plan of the respective FPOs.

• Office room with office furniture	• Conveyers (for grading)
• Operation hall	• Packing machine
• Handling tables	• Storage room
• Washing machine	• Cold storage room
• Weighing machine	• Computer set
• Refrigerated transport truck	• Access road
• Toilet	• Drains

(2) Cold Storage at Market Level

A cold storage shall be established in every target district of UKIHDP as a hub of cold chain system in the area. A private entity, e.g., commission agents and wholesalers, including their cooperative closely working with the FPOs, shall operate and manage the storage for providing necessary service to the FPOs and other private entities for a charge. The private entity shall be selected from applicants for a public invitation of UKIHDP based on a business plan, including a partnership work with the FPOs. Location and capacity of the storage shall be determined after careful examination of economic feasibility in accordance with the business plan of the private entity.

(3) Rural Markets/Apni Mandies (Farmers' Own Market)/Direct Markets

Market infrastructures are not well developed within a reach of farmers especially in hilly regions in Uttarakhand like the target four districts. The farm-household survey of JICA Survey Team revealed that rural markets are the most popular marketing place of agricultural produce for farmers in the target 4 districts since permanent regular markets like APMC *Mandies* are far distant from most of the farmers in the areas. Generally, in rural areas in India, there is provision of weekly market in an open area for direct marketing of fruits & vegetables and other agriculture commodities. Farmers in the area enjoy minimum cash incomes by selling their produce directly to consumers, local retailers, etc. Such kind of market is called as “*Haat*” in local language. *Haats* are voluntarily emerged and usually managed by a community council, a cooperative or trusted individual entrepreneurs, while an administrative facilitation is provided in some cases. Existing *haats* recommended by the FPOs shall be renovated and expanded to facilitate direct marketing of the FPOs’ member farmers. The following simple facilities shall be installed by UKIHDP while detailed renovation plan shall be prepared by the management body of respective *haats*. The market facilities shall be managed by the existing management body without change.

- Office cum storage room
- Boundary wall/fence
- Market platform (under shed)
- Toilet & water facility
- Access road

(4) Outlets of Horticulture Products

Two outlet stores managed by the selected FPOs shall be installed in Kumaon Division and in Garhwal Division as a pilot. The selected FPOs could have an opportunity to advertise their produce including processed products. New crops, new varieties or new processed products produced by the FPOs shall be displayed in the outlet stores. Location of the outlet stores can be attached with the above-mentioned rural markets or other strategic place in accordance with a business plan of the FPOs. The two FPOs shall be selected from the 16 FPOs based on their business plan.

(5) Basic Food Processing Equipment

Basically, a full-scale food processing facility attached to the FPOs is not considered in UKIHDP, since a food processing business would be a heavy burden for the FPOs to manage, especially during the early development stage before accumulating their business experience and operating capital. A low-grade produce taken out after grading shall be sold to the existing processing industries nearby for a certain period.

Instead of a full-scale food processing facility, a set of basic equipment for simple food processing shall be furnished to advanced FPOs as a trial. Members of the FPOs interested in food processing, especially women, shall utilize the equipment to develop products from their produce in expectation of additional income in the future. Similar to the outlet store as mentioned above, two FPOs shall be selected from the 16 FPOs based on their business plan and experience in food processing. The selected FPOs shall install a working room for food processing attached with the pack house with necessary equipment. A basic module of the equipment to be furnished are shown below, while the components and specifications shall be determined in accordance with a plan of respective FPOs.

- Food processing tables
- Steam jacket pan
- Kettle
- Cooking machine
- Dehydrator
- Pulper
- Electric grinder
- Sealing machine

- Fruit mill
- Electric juicer
- Vegetable slicer
- Source pan
- Packing machine
- Electric weighing machine
- Refrigerator
- Storage rack

6.7.2 FPO Development

(1) Selection of Target Crops, Blocks, Clusters, and FPOs

PMU with assistance of PMC will select in the order of (i) target crops, (ii) target development blocks, (iii) target development clusters, and (iv) target FPOs within selected four districts with the following procedures shown in the table below.

Table 6.7.2 Selection Procedure of Project Target Area

Step	Item	Description
Step 1	Selection of Crops	- Four (4) priority crops have been selected in each target district for the supply chain survey conducted in the preparatory survey of the Project considering the comparative advantage of Uttarakhand in the view point of consistency with existing policy such as One District One Product (ODOP), Production potential, recognition in the markets as per the next table. - The final list of target crops will be determined based on the result of horticulture market research to be conducted during the initial stage of the Project.
Step 2	Updating the Production Clusters in 4 districts	- List of production clusters in present in target districts is as per Attachment 6.7.1. List of production cluster will be updated by PMU.
Step 3	Selection of Development Blocks	- List of candidate development blocks in target four district is as per Attachment 6.7.1. - PMU / PMC in consultation with Horticulture Offices in the target districts will select the development block to promote FPOs for supply chain development of horticulture crops in consideration of criteria shown in Table 6.7.4.
Step 4	Selection of Development Clusters	- PMU in consultation with DIUs in the target districts will select the target development clusters in consideration of criteria shown in Table 6.7.4.
Step 5	Selection of FPOs	- After the selection of development block, PMU/PMC will search and evaluate the existing FPOs in the selected clusters to select as targets for the capacity enhancement as well as the development of business activities by CBBO. - In case that no existing FPOs are selected, new FPOs will be formed by CBBO according to the operation guideline for formulation and promotion of 10,000 FPOs published in July 2020 by Ministry of Agriculture & Farmers' Welfare, Government of India. - CBBO with assistance of PMU/PMC will select target FPOs in the selected blocks with the following evaluation criteria shown in the Table 6.7.5.

Source: JICA Survey Team

Table 6.7.3 Target Crops for Supply Chain Survey

Crop Group	Nainital	Pithoragarh	Tehri	Uttarkashi
Fruit	Peach (ODOP) Litchi	Apple Citrus (Sweet Orange)	Plum	Apple (ODOP) Kiwi Walnut
Vegetable	Tomato	-	Potato, Pea	Potato
Spice	Garlic	Turmeric, Garlic	Ginger	-
No. of Crops	4	4	4	4

Source: JICA Survey Team

Note: ODOP means One District One Product program promoted by the Ministry of Food Processing Industries.

Table 6.7.4 Evaluation Criteria of target Development Blocks / Clusters

Evaluation	Criteria
Selected crops	The block which selects the target crops for cluster development
Comparative advantage /Potential of cluster development	Cultivation area, yield of target crop and volume of the shipping in the development block.
Agro-climatic conditions	Suitability of climatic condition for cultivation of selected crops.
Avoidance of overlap	The development block shall not be overlapped with those (to be) implemented by other similar scheme and assistance of donors.

Source: JICA Survey Team

Table 6.7.5 Evaluation Criteria of FPOs

Evaluation	Criteria	
	Newly Established FPOs	Existing FPOs
Incentive/Motivation	- Members of Farmer's groups or FPOs are strong-willed and incentivized. - Strive to become competitive in the market and willing to expand the business beyond the district or the state.	
Leadership/ Ownership	- Farmer's groups or FPOs have a leader and multiple sub leaders dedicated for leading the activities of FPOs. - The leader and sub leaders actively provide appropriate guidance and coordinate with relevant stakeholders in and out of the organization to promote the activities of FPOs.	
Management	- There is a member with experience of starting business or managing FPOs	- FPO operation period is over three years. - Obtained the consensus of the members.
Basic infrastructure	- Asphalt road is available. - Electricity supply is stable. - Piped water supply is stable. - Land for infrastructure development is provided by FPOs.	
Accessibility to markets	A good accessibility to market in Uttarakhand (Dehradun and Haldwani) or /in mega cities such as Delhi.	
Environmental and social issues	Less adverse impact on environmental and social through FPOs activities.	
Overlapping	Less support from other FPO promotion project/program.	

Source: JICA Survey Team

During the survey, four districts namely Uttarkashi, Tehri Garhwal, Pithoragarh and Nainital have been tentatively selected. It is tentatively planned to select 16 no. of FPOs representing production clusters under the Project; i.e., 4 FPOs per target district, which will be decided during the initial stage of the Project.

FPOs shall be formulated and strengthened for development of supply chain of horticultural crops with utilization of the related infrastructure to be established in the abovementioned subcomponent in the Project. For the development of FPOs, the central government scheme for FPO promotion will be referred to as convergence activity. There are several organizations, namely Cluster-based Business Organizations (CBBOs) which are engaged by the implementation agencies under the central scheme for FPO promotion. Four implementation agencies have worked in Uttarakhand currently: NABARD, SFAC, NCDC and NAFED. For the effective and efficient implementation of FPO development in the Project, these CBBOs can be mobilized for development and promotion of FPOs in the Project as well, and will operate according to the guidelines² which have been prepared and disseminated by implementation agencies based on the guideline of central government.

At the initial stage of the Project, UKDHFP shall start the procurement of CBBOs on basis of district level with accordance of the guideline of central scheme. CBBOs to be hired shall have the appropriate person having knowledge and experience to formulate and promote FPOs. One CBBOs shall be allocated to support 4 FPOs for one district, so 4 CBBOs will be hired in the Project.

The cost for employment of CBBOs has included all of direct cost and remuneration necessary for FPO development with reference to the government schemes.

Table 6.7.6 Indicative Quantity of CBBOs to be Employed

Item	No.	No. of FPOs to be Supported	Remarks
Employment of CBBOs	1 CBBO/ District	4 FPOs / CBBO	- Procurement of CBBOs shall be conducted with accordance with the procedure of central scheme. - TOR of CBBOs shall be considered according to the operation guideline of central scheme. - The financial amount of employment contract shall include all of expenses of CBBOs activities. - The contract duration shall be 5 years basically.

Source: JICA Survey Team

² Guideline for FPO development by Ministry of Agriculture & Farmers' Welfare: https://agricoop.nc.in/sites/default/files/English%20FPO%20Scheme%20Guidelines%20FINAL_0.pdf. In addition, each CBBOs have disseminated manuals and handbook.

(2) Cluster Identification and Baseline Survey

After employment of the CBBOs, CBBOs will start to be engaged for the identification of clusters as well as located blocks, target crops and existing FPOs and CBOs (Community Basis Organization) through conducting baseline survey. CBBOs need to identify the gaps and issues to be resolved for the areas of production, infrastructure and technology, post-harvest management, marketing/ value chain and organizational management of FPO. These locations will be plotted on a map along with the road network and marketing facilities. In addition, current situation of management and operation of the FPOs and facilities will be assessed also. CBBOs will carry out baseline survey supported by PMU/DIU for three months approximately.

Based on the result of baseline survey, CBBOs and PMU/DIU shall select the clusters and blocks to be supported by the Project (selection criteria is shown in Project Strategy). In addition, as next step, the target FPOs will be screened, and the selective CBOs will be listed for setting new FPOs along with selection criteria.

(3) Orientation for CBBO Engaged at DIU level

Since the CBBOs engaged at the district level (DIU) will be required to execute the works to achieve the project objectives, the PMU/ PMC will provide orientation for them. This orientation will be given as soon as the CBBOs sign the contract with PMU. The contents and duration of the orientation are as follows:

Table 6.7.7 Indicative Training Outline – Project Management

Outline of the Training	Duration and No. of Participants
➤ Outline of the Project ➤ Role of CBBO in the Project ➤ Activities to be carried out by CBBOs for FPO development ➤ Coordination with other stakeholders ➤ Record keeping ➤ Reporting ➤ Financial Management	- 1 day upon deployment - 1 person from each CBBO

Source: JICA Survey Team

(4) Community Mobilization and Registration of FPOs

Mobilization of the farmers will be undertaken as soon as the target clusters and blocks are identified. At this stage, for the cluster where the FPO already exist, awareness sessions and consensus building towards their participation to the Project will be undertaken by CBBOs to the selective FPOs screened by selection criteria.

In the clusters where no FPOs are operational, new organizations will be formed from existing CBOs and individuals who live in the clusters and have willingness and understanding of supply chain development in the Project. They will be selected by selection criteria. In this case, the awareness sessions and consensus building among the farmers will be undertaken to motivate them to be organized into an organization in addition to obtain their consent to take part in the Project. The mobilization of farmers and awareness program can be conducted and facilitated by the CBBOs in charge of the district with support from the PMU/DIU and PMC expert.

Eventually existing FPOs and CBOs to be transformed into FPO could be identified and CBBOs will take further actions to next step. For registration of new FPOs, CBBOs shall confirm the procedure and requirement, and make necessary arrangement with the concerned local office. The durations of community mobilization and registration are expected at six months for existing FPOs and 12 months for new FPOs.

(5) Organizational Capacity Building for FPOs

1) Preparation

During the 1st year when the participating FPOs are selected, the training needs assessment shall be conducted by the CBBOs advised by the Subject Matter Specialist (SMS) at DIU to plan the training activities. Based on the training needs assessment, the CBBOs will prepare the Annual Training

Source: JICA Survey Team

Figure 6.7.2 Schedule of Implementation of FPO Development

(8) Technical Training on Post-Harvest Handling and Processing

a) Pack House with primary processing and packaging unit, b) Cold Storage Room, c) Refrigerated Transport Vehicle, d) Outlet of Horticulture Products and e) Basic Food Processing Unit will be established or procured as the purpose of FPO activities by the Project. The facilities will be handed over to FPOs after construction and procurement, so that FPOs will have the responsibility to operate and maintain the facilities properly. As the same mode of O&M for production infrastructure, periodical guidance and maintenance of facilities and equipment shall be conducted by suppliers as their regular maintenance services with support of PMU/DIU and PMC.

Table 6.7.9 Indicative Quantity of Training on Facilities

Facility	Implementation/ Monitoring	Trainee	Duration/ Frequency	Description
Pack House with primary processing and packaging unit	Supplier	FPO members	1 day after installation 2 days, twice a year (prior to each cropping season)	Training will be provided by the supplier based on their own manual. PMU/DIU and PMC should check and, if necessary, advise on their training contents and materials.
Cold Storage Room	Supplier	FPO members	1 day after installation 2 days, twice a year (prior to each cropping season)	
Refrigerated Transport Vehicle	Supplier	FPO members	1 day after installation 1 day, once a year	
Outlet of Horticulture Products	Supplier	FPO members	1 day after installation 2 days, twice a year (prior to each cropping season)	
Basic Food Processing Unit	Supplier	FPO members	1 day after installation 2 days, twice a year (prior to each cropping season)	
Follow-up by PMU/PMC	PMU/PMC	FPO members	2 days, twice a year (prior to each cropping season) Training can be scheduled intermittently.	Contents will be selected by DIU according to demand of FPO related to facility usages.

Source: JICA Survey Team

As for facilities for public market and private companies, these owners have to responsibility to manage the operation and maintenance with suppliers after handing over. For FPOs, the trainings will be conducted under convergence with the agencies/suppliers responsible to the facilities and equipment and PMU/DIU should undertake necessary arrangement for the collaboration.

(9) Corpus Fund Management

The project cost in principle will be covered 100% by JICA loan and the government loan. However, the sustainability of the FPO operation relies on the financial strength and sustainability. Thus, the project will provide the seed fund to facilitate the initial stage of the operation of FPO and will support each FPO to establish the “Cluster Development Fund”. The latter will serve as corpus fund and revolving fund to be used primarily by the FPO members.

1) Seed Fund

As indicated above, seed fund is a set amount of fund provided by the Project to each FPO to facilitate the initial stage of its operation. The fund can be used for procurement of raw materials, farm inputs, or minor infrastructure/ assets that are required for FPO operation. FPO general body and executive committee shall take the relevant decision as per their by-laws. The guideline for utilization of the seed fund will be prepared by PMU/ PMC prior to the release of fund to each FPO which will depict 1) purpose of utilization; 2) decision making process before fund utilization; 3) record keeping; and 4) how to conduct social audit. The respective CBBOs will guide FPOs on the process of seed fund utilization based on the guideline.

2) Cluster Development Fund

While the project cost is fully met by the Project, the contribution from beneficiaries will be considered in the work items of infrastructure, equipment and material to enhance their sense of ownership. The beneficiaries' contribution tentatively be set at 20% of the cost of selective work items, which shall be modified during the initial stage of the Project as required. These contribution from beneficiaries, which are tentatively called as "Cluster Development Fund (CDF)". One part of the proceeds from the beneficiary contribution will be set aside as corpus fund of the FPO so that it will remain intact for the set duration as the financial asset and can be utilized for the major fund requirement. The remaining part of the fund can be used as revolving funds in the same work items and/or O&M funds to ensure the sustainability of the facilities and equipment.

PMU/DIU and PMC will establish the systems and operation rules of the Cluster Development Fund and operation manual will be developed. The CBBOs in charge will guide FPOs based on the CDF operation manual. The following points shall be covered in the Operation Manual to operate CDF by FPOs.

Table 6.7.10 System and Rules for Corpus Fund Management

Item	System and Rules
Implementation Structure	FPO will establish the CDF committee for the management of the Funds. Committee members and their roles, jurisdiction of the committee, and executive committee and general body of FPO, authorization process, etc. shall be defined.
Rules concerning Deposits	FPO will determine how to collect, deposit, use the beneficiaries' contribution in detail. Record keeping and rules for the dormant/ non-paying members are to be set.
Operation of Revolving Fund	Loan application procedure including templates, eligibility, dealing with defaulters, penalties, interest rates, loan utilization/ purpose, repayment period, record keeping, and etc will be defined in the CDF manual. (Interest rates, eligibility and etc, may be adjusted in each FPO under the guidance of CBBO as per the local specificity.)
Operation of Corpus Fund	The amount to be set as corpus, retention period, conditions of the withdrawal, approval/ decision making process and etc. are to be defined in the operation manual.
Audit/ Monitoring and Evaluation of the Funds	FPO will establish the monitoring and evaluation system in reference to those of financial institution such as NABARD. The CDF account will be audited as per the requirement of FPO guideline of NABARD. Social audit will also be conducted on an annual basis to disclose all the financial transactions. The procedure to be followed for statutory audit and social audit will be depicted in the CDF operation manual. The monitoring of the accounts shall be done by the FPO executive committee on a monthly basis. The report shall be submitted by CDF committee to the FPO executive committee.

Source: JICA Survey Team

6.7.3 R&D Support (Post-harvest)

The outlines of R&D support for post-harvest under the Project are shown as follows.

Table 6.7.11 Outline of R&D Support for Post-harvest

Items	Qty.	Remarks
Upgrading of post-harvest and food processing centers	8 nos.	2 nos. for each target district: Tehri, Nainital, Uttarkashi, and Pithoragarh

Source: JICA Survey Team

6.7.4 Promotion of Private Sector Collaboration

(1) Matching FPOs with Agribusiness Companies

UKIHDP is planning to provide a matching opportunity for agribusiness companies to connect to local partners in Uttarakhand with necessary information and assistance include, but not limited to, organizing investment seminars, intermediating FPOs and agribusiness operators, introducing available government schemes, etc. through the Single Window Clearance System for intended investors operated by the Investment Promotion and Facilitation Cell (IPFC) of the Directorate of Industries of Uttarakhand (Attachment 6.7.2). A staff hired by PMU in charge of branding and marketing (see Table 3.4.2) promotes the marching services in close collaboration with IPFC.

(2) Facilitation of Pilot Business Trial

Effective involvement of the private sector is a major project approach of UKIHDP. UKIHDP will encourage the private sector to intervene in the whole supply chain development through a pilot demonstration of innovative technologies and/or a joint venture operation in collaboration with local partners, such as private firms, farmers groups, and government agencies. According to questionnaire survey, since five companies have interest in conducting business in collaboration with the Project, PMU/PMC will contact them on pilot business trial in the Project. Details of each company are shown in Attachment 6.7.3. The intervention in the following areas is expected.

- 1) Agri-inputs production/supply
Seeds/seedlings/saplings (promising varieties), fertilizers, pesticides, packing materials, and polyhouse.
- 2) Farm machinery provision (including custom hiring services)
- 3) Contract farming
- 4) Food logistics and processing
Cold chain system (facilities/equipment and services), primary processing (grading/sorting and packing), food processing, logistics management
- 5) Digital agriculture services
Providing digitally collected and analyzed data and information along the whole supply chain (before, during and after on-farm production), such as yield mapping, GPS guidance systems, weather forecasting, e-commerce platforms, e-extension services, warehouse receipt systems, and food traceability systems.
- 6) Agricultural financing including agricultural insurance.

6.8 Institutional Development for Project Management

6.8.1 Procurement of Equipment and Materials

(1) ICT Related Equipment and Establishment of MIS and GIS and Monitoring System

The Project will be covering 16 FPOs mainly for supply chain development and beneficiaries under the FPOs which will be 3,200 farmers in the target area. In addition, collaboration with various stakeholders for the supply chain and convergence activities will be planned for the Project, so that it is necessary to correctly grasp the progress of project activities. In addition, it must be required to carry out the preparation, follow-up and troubleshooting for every activity.

Therefore, in the Project MIS system will be introduced for project management efficiently. The desired functions are (1) showing progress of overall project implementation and each FPO, (2) identification and mapping of clusters and FPOs with use of GIS, (3) display of photos and the project documents and (4) use of Aadhar system (personal ID number cum bank account) for project implementation and monitoring. The MIS systems with these functions will be developed newly for the Project.

After MIS and GIS establishment by suppliers, they will be handed over to PMU and DIUs with basic guidance and instructions. Suppliers will provide maintenance and adjustment for the Project within warranty services and the personnel of PMU/DIU in charge of MIS/GIS operation can be trained in their work duty by suppliers. MIS/GIS expert of PMC also will support and monitor them to operate the system.

Table 6.8.1 Necessary Equipment for ICT related equipment

Category	Item	Unit	No.	Remarks
Procurement of general use I.T equipment	1 PC (Laptop/Desktop)	Nos.	63	All staffs 1 PC per user for office work
	2 Printer	Nos.	5	PMU, DIU To be attached with PCs
	3 Multi Function Printer (MFP) Centrised print station	Nos.	5	PMU, DIU Common use Print, Scan, Copy
	4 UPS	Nos.	5	PMU, DIU
	5 Camera	Nos.	10	each 2 for PMU, DIU for documentation of Events/ meetings
	6 Projector	Nos.	5	PMU, DIU for presentation in meetings/workshops
	7 Projector Screen	Nos.	5	PMU, DIU

Category	Item	Unit	No.	Remarks
				for presentation in meetings/workshops
	8 Audio System	Nos.	5	PMU, DIU for meetings/events/workshops
	9 Video Wall	Nos.	1	PMU For conference hall
	10 Digital Signage Board	Nos.	1	PMU For highlighting the information and field activities
	11 Tablet (Smart devices)	Nos.	12	each 3 for DIU for live reporting & online data collection
	12 Data Storage Device (external hard discs)	Nos.	5	PMU, DIU External hard disks for data storage and transfer
	13 Internet (Wide Area Network)	LS	5	PMU, DIU Leased line/optical fiber line for SPMU & DPMUs
	14 Ethernet (Local Area Network)	LS	5	PMU, DIU for local connectivity and document sharing
	15 PDF Software - Adobe Acrobat	Nos.	15	each 3 for PMU, DIU creating and editing PDF documents
	16 Documentation Software (Office)	Nos.	63	1 per PC for all staff for document creation (word, excel, powerpoint)
	17 Digital Weather System	Nos.	20	to be placed at selective location for weather data collection
Procurement of Engineering Survey Equipment	1 GPS (Hand held)	Nos.	15	3 per office for field survey, data collection
	2 DGPS Set	Nos.	4	DIU Field Survey
	3 Total Station	Nos.	4	DIU Field Survey
	4 Auto level	Nos.	4	DIU Field Survey
	5 CAD Application	Nos.	5	1 per office Survey data processing, designing of drawings
Establishment of GIS/MIS Cell (New)	1 Workstation	Nos.	1	PMU Processing of spatial data
	3 Printer	Nos.	1	to be attached with WS printing of documents
	4 Plotter (A0 size)	Nos.	1	Large format printer printing of engineering drawings, Maps
	5 Scanner (A0 size)	Nos.	1	Large format scanner Scanning of large size drawing and Maps
	6 UPS	Nos.	1	DIU power backup
	7 Operating System	Nos.	1	PMU for field survey, progress monitoring
	8 Document Processing Software	Nos.	1	PMU base application for PC/WS
	9 GIS Software	Nos.	1	1 per PC (word, excel, powerpoint) for document creation
	10 PDF Software - Adobe Acrobat	Nos.	1	1 per PC Processing of Spatial data
	11 Data Storage Device (external hard discs)	Nos.	1	1 per PC creating and editing PDF documents
Hiring of services for GIS survey, preparation of base spatial	1 Preparation of spatial database layers (pre intervention)	No.	16	Base spatial data base of land use, elevation, slope, transport, drainage, agro-ecological zones, mandis etc., to be prepared by outside agency
	2 Geo Referencing of revenue maps	No.	16	control point survey, georeferencing of revenue maps, linking of revenue records to be prepared by outside agency
Hiring of Services for Development of software application	1 Development of Agro Information system	LS	1	Designing, Development, Customization & Maintenance To be outsourced /Inhouse
	2 Development of App for value chain and marketing of FPOs	Nos.	1	Designing, Development, Customization & Maintenance To be outsourced /Inhouse
	3 Website	Nos.	1	Designing, Development, Customization & Maintenance To be outsourced /Inhouse
	4 Customized application for Tablets	Nos.	1	Customization of web app and troubleshooting For data collection, live reporting, communication

Source: JICA Survey Team

(2) Equipment and Tools for PMU and HMT

The equipment including office, furniture, and vehicles for project implementation by PMU/DIU is considered tentatively as shown in the following table. In addition, equipment for 34 offices of HMT, which will be expected to conduct extension activities to farmers even in the Project is also required from UKDHFP. The expected equipment and tools are also tentatively listed as shown below.

Table 6.8.2 Equipment and Tools for PMU and HMT

Items	Amount	Remarks
Rented accommodation for office space for PMU	84 months	1 PMU, 7 years
Rented accommodation for office space for DIU	336 months	4 DIUs, 7 years
Furniture & office-equipment for PMU	1 office	Required furniture for PMU staff
Furniture & office-equipment for DIU	4 offices	Required furniture for DIUs staff
50% procurement and 50% rent of vehicles & motor cycles ,hiring up of vehicles including operational cost.	L.S.	-
Publicity events, public awareness materials, inaugural ceremonies of sub projects	LS	-
Hiring of support services	LS	-
Project Operational expenses	L.S	-
Equipment and tools for HMT	34 offices	Nainital (31), Pithoragarh (24), Tehri (42), Uttarkashi (32)

Source: JICA Survey Team

6.8.2 Strengthening of PMU/DIU and HMT

This activity mainly aims to strengthen the capacity of PMU that is necessary for project implementation. The contents are employment and capacity building of PMU staff, procurement of necessary materials and equipment, and planning and monitoring the introduction of ICT and MIS system.

(1) Recruitment of PMU/DIU Staff (Outsourcing)

PMU/DIU will hire qualified and experienced personnel from external agency on contractual basis. The selection of the external agency is done through open local competitive bidding. The draft plan of recruitment is shown as below.

Table 6.8.3 Recruitment of PMU.DIU staff

No.	PMU			DIU per district		
	Name of Post	No. of Personnel	Duration	Name of Post	No. of Personnel	Duration
1	Horticulturist	1	7	Project Operation and Management	1	7
2	Food Processing and Quality Control	1	7	Horticulture Extension Services	1	7
3	Branding and Marketing	1	7	Marketing and Quality Control	1	7
4	Financial Management	1	7	Institution and FPO Development	1	7
5	Monitoring and Evaluation	1	7	Infrastructure Engineer	1	7
6	Tender and Procurement	1	7	Office Manger cum Accountant	1	7
7	Infrastructure Development	1	7	Computer Assistant	1	7
8	Institution Development	1	7	GIS/MIS Operator	1	7
9	Livelihood Improvement	1	7	Office upkeep	1	7
10	Accountant	1	7			
11	Computer Assistant	1	7			
12	Drivers	2	7			
13	Office Attendant	1	7			
14	Office upkeep	1	7			
15	GIS/MIS Operator	1	7			
	Total	16		Total (4 DIUs)	9 (36)	

Source: JICA Survey Team

(2) Project Management Including Planning and Implementation

Upon creation of PMU as a society, the Project Operation Manual will be prepared by PMU. As the project will be implemented by an Autonomous Society and engage personnel and entity of various nature, the Project Operation Manual shall be prepared by PMU as a guiding document of project implementation. In the document, roles and responsibilities of project personnel, budgeting, accounting and reporting system of the project, internal control, external audit, procurement modalities and etc. shall be depicted. To establish common understanding on project implementation modalities, the project

staffs of various levels will be given training as below. The training will be carried out by the PMU officials and PMC at the initial stage of the project.

Table 6.8.4 Indicative Training Outline – Project Management

Outline of the Training	Target/ Participants, Modus Operandi	Duration and No of Participants
➤ Project Operation Manual ➤ Project components and activities ➤ Monitoring & Evaluation System of the UKIHDP ➤ Reporting System ➤ Financial Management ➤ Stakeholders and Convergence	• Target/ Participants: PMU, DIU, HMT, and UKDHFP. • It will be undertaken by the PMU officials and PMC. • The training will be scheduled annually with an anticipation of the turnover of 20-30% and for update the knowledge. • Training can be scheduled intermittently.	5 days (Intermittently) No of Participants is as per the no of project staff including HMT and UKDHFP, subject matter specialists, technical agencies and etc.

Source: JICA Survey Team

(3) Preparation, Monitoring, and Updating of Annual Action Plan

The Project requires action plan implementation, monitoring and evaluation for project activities, and the action plan shall be updated annually from assessment of the progress and review of present action plan. The schedule for preparation, monitoring, and updating of annual action plan is shown in the table below.

Table 6.8.5 Action to be Taken and Schedule for Annual Action Plan

Steps	Action to be Taken and Schedule
Preparation	- Preparation of first annual action plan before the Project
Monitoring	- Submission of monthly and quarterly reports including physical and financial progress
Review	- Review of annual action plan based on monitoring in September
Updating	- Updating annual action plan for next year based on review in December
Planning	- Finalizing next-year annual action plan with budgeting

Source: JICA Survey Team

(4) Technical Training to DIU and HMT

For capacity development of DIU/HMT, the training will be planned based on the capacity assessment of farmers and FPOs and demand of target crops and markets. COEs and training centers could be utilized for the trainings. The training curriculum must compose for fulfilment of the contents as below. The trainees will be expected to extend their knowledge and experience learnt from trainings to colleagues and to practice it on the job training of extension activities for farmers and FPOs in the districts in charge, which shall be monitored periodically by DIUs.

Table 6.8.6 Outline of Technical Training to DIU and HMT

Subject	Topics	Participants, Duration/ Frequency	Implementation
Farm planning (SHEP) and management (GAP)	- SHEP approach (basic four steps and each detail) - GAP (Good Agriculture Practice): introduction of proper management of farm practice	1 day for 2 times/ year, for 5 years 10 trainees for 1 time / district Participants: 400 no.	By PMC/PMU
Soil improvement	- Soil analysis - Composting and rotation	1 day for 2 time/ year, for 5 years 5 trainees for 1 time / district Participants: 200 no.	By KVK, ICAR and university with support of PMU/PMC
Agriculture materials	- Agricultural material and equipment: 1) installation of poly-house and usage, 2) usage of poly film mulching, 3) usage of agri-nets including anti hail net etc.	1 day for 1 content / year, for 5 years 5 trainees for 2 time / district *Including on-site training. Participants: 200 no.	By KVK, ICAR and university with support of PMU/PMC
Agrichemicals and insect/pest management	- Standard agri- chemicals - Safety application methods - Advantage of safety crops - Record keeping for safety crops by chemical application	1 day for 2 time/ year, for 5 years 5 trainees for 1 time / district *Including on-site training. Participants: 200 no.	By KVK, ICAR and university with support of PMU/PMC
Horticulture production	- Production techniques for planting materials such as seed and seedlings	1 day for 1 time, 3 times (considering season and crop)/ year, for 5 years 5 trainees for 1 time / district *Including on-site training.	By KVK, ICAR and university with support of PMU/PMC

Subject	Topics	Participants, Duration/ Frequency	Implementation
		Participants: 300 no.	
	- 1) Planting techniques, spacing, setting trellis or plant support stand, fertilizer, planting, etc. - 2) Pruning, training, techniques, - 3) Weeding, Insect & pest - 4) Animal or hail/wind management up to harvesting	1 day for 1 content, 3 times (considering season and crop)/ year, for 5 years 5 trainees for 1 time / district *Including on-site training. Participants: 1200 no.	By KVK, ICAR and university with support of PMU/PMC
Post-harvest handling	- 1) Basic post-harvest handlings (cleaning, drying, storing) - 2) Grading criteria and grading - 3) Transportation of harvested crops without damage	1 day for 1 content, 3 times (considering season and crop)/ year, for 5 years 5 trainees for 1 time / district *Including on-site training. Participants: 900 no.	By KVK, ICAR and university with support of PMU/PMC
Irrigation management	- Water Management (FPO)	1 day for 2 times/ year, for 5 years 5 trainees for 1 time / district *Including on-site training. Participants: 200 no.	By PMU/PMC

Source: JICA Survey Team

6.8.3 Capacity Development for R&D

(1) Technical Training to Staff of Nursery, Training Center and Labs And,

(2) O&M Training on Facilities to Government Staff

The government staff of nurseries, COEs, training centers, and laboratories shall be trained for technical capacity building, since the facilities would be used for strengthening of DIU and HMT for the project implementation. In addition, the facilities could be the location for pilot activity by private companies as well. Technical trainings will be conducted periodically by KVK and university supported by PMU/PMC. Training contents will be clarified based on capacity assessment of the relevant staff.

As for O&M training, it shall be provided by suppliers as their maintenance service. Proper documents and manuals with instructions shall be shared with facility staff by suppliers, which shall be taken care of and monitored by DIU/PMU.

Table 6.8.7 Indicative Quantity of Training on Facilities

Facility	Trainee	Duration/ Frequency	Implementation
Nurseries (public and private) Contents assumption: use of equipment and materials, techniques of seed/seedling production	Facility staff Total 10 no.	1 day, twice a year, for 5 years	By Supplier, KVK, ICAR and university with support of PMU/PMC
COEs Contents assumption: use of equipment and materials, techniques of crop production	Facility staff Total 10 no.	1 day, twice a year, for 5 years	By Supplier, KVK, ICAR and university with support of PMU/PMC
Food science training center Contents assumption: use of equipment and materials, related techniques of food science	Facility staff Total 10 no.	1 day, twice a year, for 5 years	By Supplier, KVK, ICAR and university with support of PMU/PMC
Postharvest and processing training center Contents assumption: use of equipment and materials, related techniques of postharvest and processing	Facility staff Total 10 no.	1 day, twice a year, for 5 years	By Supplier, KVK, ICAR and university with support of PMU/PMC
Bio control lab/leaf/tissue lab Contents assumption: use of equipment and materials, techniques of bio testing	Facility staff Total 10 no.	1 day, twice a year, for 5 years	By Supplier, KVK, ICAR and university with support of PMU/PMC

Source: JICA Survey Team

6.8.4 Branding and Marketing Development

(1) Horticulture Market Research at Major Mega-cities

Market research of horticultural produce covering major cities in Uttarakhand and the whole India shall be organized at the beginning stage of UKIHDP in order to elaborate its implementation plan. The PMU of UKIHDP shall organize a research survey by hiring outside source personnel.

(2) Branding Promotion

The market promotion of horticultural produce shall be carried out in UKIHDP by re-establishing a shared understanding of all stakeholders under a branding strategy in accordance with the crop cluster development policy of the state government. While the branding promotion should be facilitated by mutual interaction between farmers, the private sector and the government, government intervention shall be systematically implemented under the re-established strategy mainly through capable farmers' groups like FPOs taking the leading role in crop clusters.

The branding strategy should be comprehensive but realistic considering available resources in Uttarakhand without chasing a far-off dream in a short time. Stepwise development of farmers skills in production and marketing shall be the main approach of the branding strategy. The branding strategy shall gradually shift its development focus in accordance with the local farmers' ability and market circumstances, as shown below.

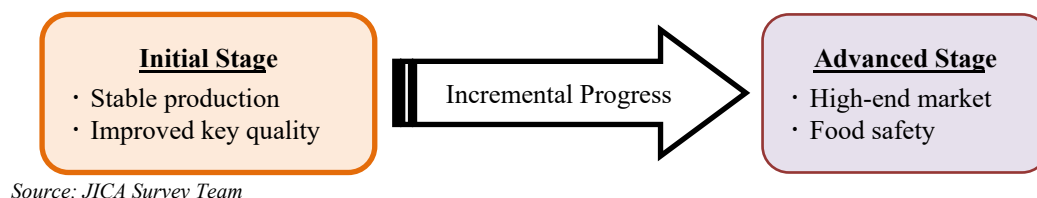


Figure 6.8.1 Image of Branding Strategy

UKDHFP has drafted the following branding strategy for further discussion of all stakeholders. Branding promotion should be a permanent attempt combining a constant review mechanism in accordance with a change of market circumstances. UKDHFP aims at establishing a solid foundation to implement the branding promotion in Uttarakhand in anticipation of long-lasting endeavors of the stakeholders.

Table 6.8.8 Branding Strategy Drafted by UKDHFP

1. Image of the Brand	A Gift from the Himalayas (Blessed land rich in water and forests at foothills of the Himalaya Mountain ranges)
2. Commercial Logo (existing)	
3. Horticultural Produce	Fruits (Apple, Peach, Plum, Citrus, and Kiwifruit)
4. Markets & Consumers	Middle class in Delhi and other big cities in the whole India
5. Appeal Value	• Early ripening (can be marketed in an early season) • Fresh and healthy (Eco-friendly) • Stable supply (availability and volume) • Quality equalization
6. Process and Measures	
6.1 Institution	To set up a State Branding Promotion Committee for Horticulture Crops consisting of the following stakeholders as general headquarters to implement and coordinate necessary policy-measures under the branding strategy (All different stakeholders shall be united in one team) 1. Nodal agency: UKDHFP (Uttarakhand Department of Horticulture and Food Processing) 2. Members:

	• UHB (Uttarakhand Horticulture Board) • UKAPMB (Uttarakhand Agricultural Produce Marketing Board) • Uttarakhand Organic Commodity Board (UOCB) • Representative of FPOs/CBBOs • PMU/DIUs
6.2 R&D/ Production	• To develop/introduce new varieties (promising varieties in terms of productivity, resistance to pests and diseases, local applicability, quality requirements from the market) • To multiply and distribute seedlings/saplings of the new varieties • To allocate several production areas in a planned manner (successive harvesting in the state) • To develop and disseminate standardized cultivation methods/technique from soil management to harvesting (high productivity, equalized quality, eco-friendly, etc.) • To develop and disseminate food processing technology applicable to FPOs including training hygiene management to farmers • To develop farm infrastructures and facilities (access roads, micro-irrigation system, anti-hail net, and animal protection fence)
6.3 Quality Control	• To develop and disseminate standardized post-harvest handling practice • To promote joint post-harvest handling and marketing with furnishing necessary facilities and equipment • To develop and implement a simple quality-standard system of the brand including a certification and labelling system • To develop and disseminate an applicable cold-chain technology covering the total supply chain
6.4 Marketing	• To standardize packaging including labelling and the logo • To implant know-how of marketing business in FPOs through promoting a joint business management with local traders • To facilitate FPOs/local traders to form a partnership with capable traders in major consumer markets
6.5 Sales Promotion and Backup	• To carry out a periodic market research at major marketplaces to understand market requirements and customers' demands and relay them to FPOs/local traders. • To advertise the fruits on FM radio, SNS, etc. • To organize a fruits competitive fair in Uttarakhand every year (Top performers will be awarded) • To run a booth at exhibitions to be organized in the whole country • To match up FPOs/local traders and agribusiness operators for promoting a technical innovation related to the branding • To protect the commercial logo, a brand name, etc.

Source: JICA Survey Team

(3) Food Fairs/Exhibitions

The PMU shall organize food fairs or exhibitions annually in order to promote horticultural production mainly focusing on crops produced in clusters supported by UKIHDP. The fairs or exhibitions shall provide good opportunity not only to advertise the crops, but also to match up FPOs/local traders and agribusiness operators, as well as to exchange market information between various stakeholders.

(4) Branding Development and Quality Management

Two expertized staff shall be assigned in the PMU to facilitate the branding promotion as mentioned above. They shall perform the daily operation under technical support and supervision of agriculture business experts assigned as the Project Management Consultants (PMCs). Expected qualifications and the Terms of Reference (TOR) of the staff are shown below.

Table 6.8.9 Expected Qualifications and TOR

Staff of Branding and Marketing		
1	Academic Qualification	Master of Business Administration
2	Professional Experience	20 years or more in agribusiness sector

Staff of Branding and Marketing		
3	TOR	• To provide secretarial support to UKDHFP to manage a State Council of Branding Promotion to be established • To review the present horticulture development policy • To finalize the drafted branding strategy in consultation with all stakeholders and based on the horticulture development policy • To support related agencies to make and review an action plan in line with the branding strategy (breeding research, on-farm technology research, post-harvest technology research, technology dissemination, standardization and inspection, and advertising the brand) • To work with the Investor Facilitation Center (IFC) operated by the Investment Promotion and Facilitation Cell (IPFC) of the Directorate of Industries of Uttarakhand in matching FPOs with agribusiness operators for promoting technical innovation in accordance with the branding strategy • To organize a food fair/exhibition to promote the branding of horticultural produce in Uttarakhand
PMU Staff of Food Processing and Quality Control		
1	Academic Qualification	Master of Food Processing
2	Professional Experience	15 years or more in agribusiness sector
3	TOR	• To formulate simple and applicable quality standards of major horticultural produce in accordance with the crop cluster development policy of the state government. The standards shall initially prevail only among members of the FPOs to be developed by UKIHDP and shall be gradually disseminated to outer areas • To formulate a procedure of sorting and grading in accordance with the quality standards applicable at farm level (mainly by visual confirmation) • To establish an inspection and arbitration system about the quality standards • To disseminate the standards among the FPOs, local aggregators, commission agents and wholesalers including a practical methodology of sorting and grading • To build a workable standardization system in a coordinated manner of stakeholders, so that marketed produce from the FPOs will be fairly valued in the local market in accordance with the quality standards

Source: JICA Survey Team

6.8.5 Exposure Visits

(1) Domestic Training

Exposure visits within and outside of the state will be organized twice a year in the neighboring districts and states. The places of visits will be identified by the PMU and DIU Subject Matter Specialist as per the requirement and the crops to be grown in the cluster. The farmers along with HMT members, DIU, and PMU officers will also join. The duration of the visit within the state of two days and that for outside of the state of five days will be budgeted.

(2) Overseas Training

The overseas training will be planned for PMU, DIU, FPO members, and progressive farmers. The purpose of overseas training is to provide the participants an opportunity to be exposed to various farm management technologies and methods as well as to how the farmers and farmers' organizations work on production, post harvesting, and marketing. To meet the learning objectives, Thailand and Japan may be considered as possible destinations. In case the overseas training is not feasible, on-line study tour will be organized. Ten days overseas training will be budgeted.

6.8.6 Baseline Survey and Mid- & End-line Surveys

The baseline survey and impact assessment is required for the implementation, monitoring, and evaluation of the Project. The target households to be surveyed shall be same from baseline survey to end-line survey for comparative evaluation. The contents of baseline survey and impact assessment are as follows.

Table 6.8.10 Outline of Baseline Survey and Mid- & End-line Surveys

Type of Survey	Contents	Remarks
(1) Baseline survey	Household survey in approximately 10% of farmers in target blocks in four districts, samples in each site would depend upon the number of households in each cluster.	• Survey to be carried out by resource agency, supervised by DIUs under overall coordination of PMU with technical and managerial support by the project consultant for TOR preparation, selection of survey contractors, field execution, analysis and evaluation, report preparation, dissemination. Through the process of these activities, capacity of PMU will be strengthened.
(2) Mid-line survey	Household survey in Community-based Impact Assessment (CBIA) for capturing indicators of change in 10% of farmers in implemented clusters.	• Survey to be carried out by resource agency, supervised by DIUs under overall coordination of PMU. Through the process of these activities, capacity of PMU will be strengthened.
(3) End-line survey	Household survey in Community-based Impact Assessment (CBIA) for capturing indicators of change in 10% of farmers in implemented clusters.	• Survey to be carried out by resource agency, supervised by DIUs under overall coordination of PMU. Through the process of these activities, capacity of PMU will be strengthened.

Source: JICA Survey Team

6.9 Convergence

As several government schemes and donor-supported projects are implemented in the state, there is a high likelihood of overlapping of interventions as well as geographical coverage. Thus, the JICA Survey Team has attempted to map out the government schemes and other projects that are implementing similar activities. In the table below, the concerned departments, schemes and projects are listed.

Table 6.9.1 Summary Table of Potential Convergence Partners

Scope	Key Project activities	Scheme (Central government (CSS)/ State government / District level) (provide financial assistance)	Potential partner (provide Technical know-how)	Donor Assisted Projects
1.2 (1), (2)	Water Source Facility Micro Irrigation	MIDH, HMNEH (CSS)/UKDHFP as State Nodal Agency (SNA) PKVY (CSS)/ UKDHFP MKSP (CSS)/ UKDHFP	-	ILSP-2 Gramya-3 JICA UK Forest Resource Management Project - 2
1.3 (1)	High Tech Nursery	MIDH/ HMNEH (CSS) / UKDHFP RIDF / NABARD	UKHB GB Pant/ Bharsar University KVK ICAR/ CSIR Institutes	ILSP-2 Gramya-3
1.3 (2), 1.4 (2), (3)	Fam inputs (promotion of INM/ IPM, planting materials (seeds and seedlings)	MIDH/ HMNEH (CSS) / UKDHFP PKVY (CSS) / UKDHFP MKSP (CSS)	KVK ICAR/ CSIR Institutes DRDO/DIBER, Pithoragarh	ILSP-2 Gramya-3 JICA UK Forest Resource Management Project - 2
1.5	Training and Demonstration	ATMA	KVK ICAR/ CSIR Institutes GB Pant/ Bharsar University	ILSP-2 Gramya-3 JICA UK Forest Resource Management Project - 2
1.5 (3)	Mushroom, Bee Keeping	MIDH/ HMNEH (CSS) MKSP (CSS)	NCDC DRDO/ DIBER, Pithoragarh	ILSP-2 Gramya-3 JICA UK Forest Resource Management Project - 2
1.5 (4)	Nutrition Improvement	Anganwadi (CSS)	Department of Education Department of Medical Health and Family Welfare ICDS DoA	-
2.1 (1)	Pack house with primary processing unit	MIDH/HMNEH (CSS) NABARD- RIDF, MOFPI	UKHB, Community-based Organization Private firms	ILSP-2 Gramya-3 JICA UK Forest Resource Management Project - 2
2.1 (1)	Cold storage, refrigerated transport vehicle, outlet for horticulture products	SAMPADA, MOFPI MIDH/ HMNEH	UKHB, Community-based Organization Private firms	-

Scope	Key Project activities	Scheme (Central government (CSS)/ State government / District level) (provide financial assistance)	Potential partner (provide Technical know-how)	Donor Assisted Projects
2.1 (1) 2.3	New and Upgrading of Post Harvest Centre/ Facilities	MIDH/ HMNEH RKVY (CSS) SAMPADA, MOFPI PMFME / UKDHFP	UKHB, Community-based Organization Private firms	ILSP-2 Gramya - 3
2.4	Entrepreneurship/ Private Sector Engagement	DOI MSME / DOI	Private firms	-
3.4	Branding & Marketing	MIDH/ HMNEH PKVY (CSS) PMFME (CSS)-ODOP /UKDHFP	UKHB Private firms	ILSP-2 Gramya-3 JICA UK Forest Resource Management Project - 2

Source: JICA Survey Team

Depending on the project activities, the PMU and DIU shall identify the department, government schemes, and projects to work with or to avoid duplication. The detailed modality and fund flow will vary depending on the identified department, schemes, and projects; however, the following should be followed to facilitate the convergence.

(1) Policy Decision To be Taken by the Governing Council

To facilitate the convergence, the Governing Council shall discuss the policy of convergence and issue a letter to all the concerned departments to converge with the project during the initial stage. This will give basis for other departments in the state to work with the Project.

(2) Taking Part in the District Monitoring Meeting Chaired by District Magistrate

At each district, the District Magistrate will hold the meeting with all the departments to follow up with the work progress. This provides a good opportunity for the CHO/ DHO to raise the requirement for convergence. In this meeting, the potential departments/ schemes can be identified, and DIU will begin negotiation with the officers concerned.

(3) Direct Consultation with Projects and Other Organizations

In the case of projects assisted by donor organizations, the PMU will directly approach the respective projects for consultation.

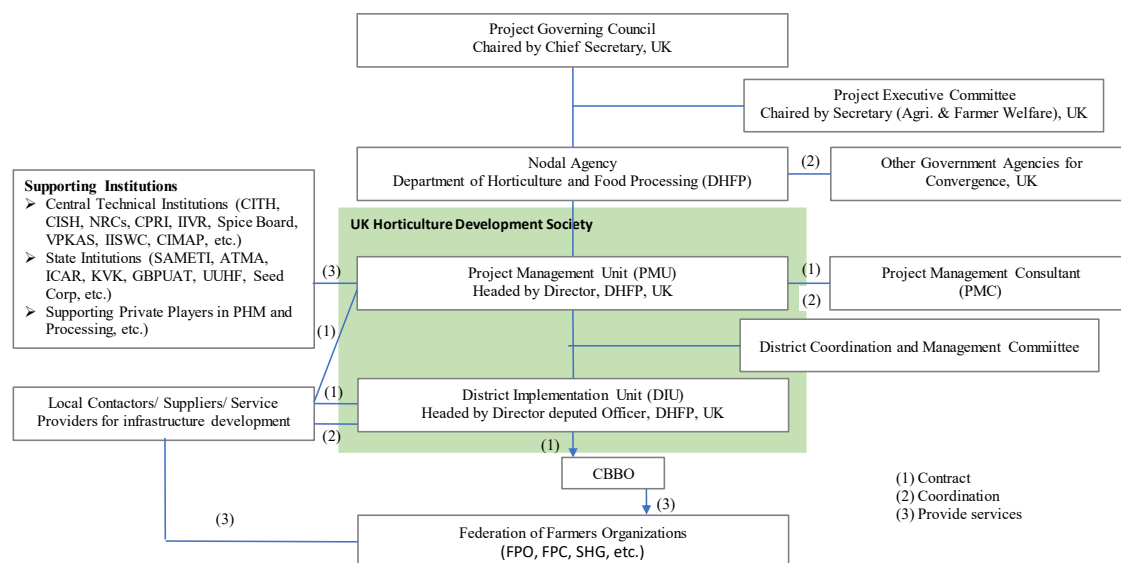
Chapter 7 Implementation Plan

7.1 General

This chapter deals with the implementation plan of the Project, Uttarakhand Integrated Horticulture Development Project (UKIHDP), which is comprised of the project organizational structure, implementation procedure, fund flow, procurement plan, and implementation schedule.

7.2 Overall Project Organizational Structure

The overall project organization structure is proposed as shown below.



Notes: CITH: Central Institute of Temperate Horticulture, CISH: Central institute for Subtropical Horticulture, NRCs: Nutrition Resource Centres, CPRI: Central Potato Research Institute, IIVR: Indian Institute of Vegetable Research, VPKAS: Vivekanand Parvatiya Krishi Anusandhan Sansthan, IISWC: Indian Institute of Soil and Water Conservation, CIMAP: Central Institute of Medicinal and Aromatic Plants, SAMETI: State Agriculture Management & Extension Training Institute, ATMA: Agriculture Technology Management Agency, ICAR: Indian Council of Agricultural Research, KVK: Krishi Vigyan Kendra, GBPUAT: Govind Ballabh Pant University of Technology and Agriculture, UHF: Uttarakhand University of Horticulture and Forestry, PHM: Post Harvest Management

Source: JICA Survey Team

Figure 7.2.1 Overall Organization Structure for Project Implementation

(1) Project Governing Council

The Department of Economic Affairs will be the nodal agency at the GOI level to review and monitor the project progress of the JICA-funded UKIHDP. The Government of Uttarakhand will establish a state-level Project Governing Council (PGC) chaired by the state Chief Secretary. The state Secretary of Agriculture and Farmers Welfare (also serves as Horticulture) will be the Secretary of this Committee. The PGC will meet once in six months to review progress, provide overall guidance and policy support, and facilitate inter-departmental coordination. The members of the PGC will include the: (i) Finance Secretary; (ii) Secretary, Forest and Environment (iii) Secretary, Cooperatives (iv) Secretary, Rural Development; (v) Secretary, Irrigation, (vi) Secretary, MSME (vii) Secretary, Industry; and (viii) Project Director of UKIHDP.

The Special Invitees to the PGC will include the Chief General Manager- National Bank for Agricultural and Rural Development (NABARD), National Cooperative Development Corporation (NCDC) regional office, representatives of Uttarakhand Agriculture Produce Marketing Board (UKAPMB), Uttarakhand Horticulture Board (UKHB) and other state level federations. Department of Horticulture and Food Processing (DHFP) will be the nodal agency at the state level.

(2) Project Executive Committee

GoUK will establish a Project Executive Committee (PEC) chaired by the state Secretary of Agriculture and Farmers Welfare, Uttarakhand. The Project Director (PD) will be a member secretary. Project Implementation Agency and the representatives from government line departments (Additional Secretary Finance, Director of Agriculture, Director of Planning / Economics and statistics, Director of Industry, Chief engineer of Irrigation Department, Chief Executing Officer of State level Rural Livelihood Management, CEO Uttarakhand Horticulture Board, Managing Director of APMC, Representatives from JICA will be the members. The Special Invitees to the PEC will include the Farmer's representatives.

The PEC will meet every quarter and the main function include;

- (i) Approving the Annual Work Plan and Budget (AWPB);
- (ii) Reviewing physical and financial progress;
- (iii) Reviewing progress towards achieving outcome indicators;
- (iv) Resolving implementation issues; and
- (v) Working towards achieving convergence between various government sponsored activities and UKIHDP activities.

Regarding the arrangement for the Project management and monitoring, PMU will act the following roles;

- a. To organize PGC and PEC meetings;
- b. To submit the consolidated AWPB for approval of JICA, PEC and PGC;
- c. To prepare a Procurement Plan and submit it to JICA for approval;
- d. To prepare and submit consolidated progress reports annually and quarterly to JICA based on the progress reports submitted by PMU; and
- e. To undertake Monitoring & Evaluation (M&E) and Knowledge Management activities related to the project.

Regarding the financial arrangement, financial unit under the PMU will act the following roles;

- a. To incorporate the budget requirements into the overall budget of the GoUK;
- b. To operate the Project Account for timely release funds to PMU;
- c. To receive statement of expenditure and supporting documents related to fund release to PMU and keep an account of fund release and utilization by each PMU;
- d. To prepare overall project financial statements;
- e. To prepare and submit the withdrawal applications to DEA for onward transmission to JICA; and
- f. To ensure preparation and submission of annual audit reports of PMU.

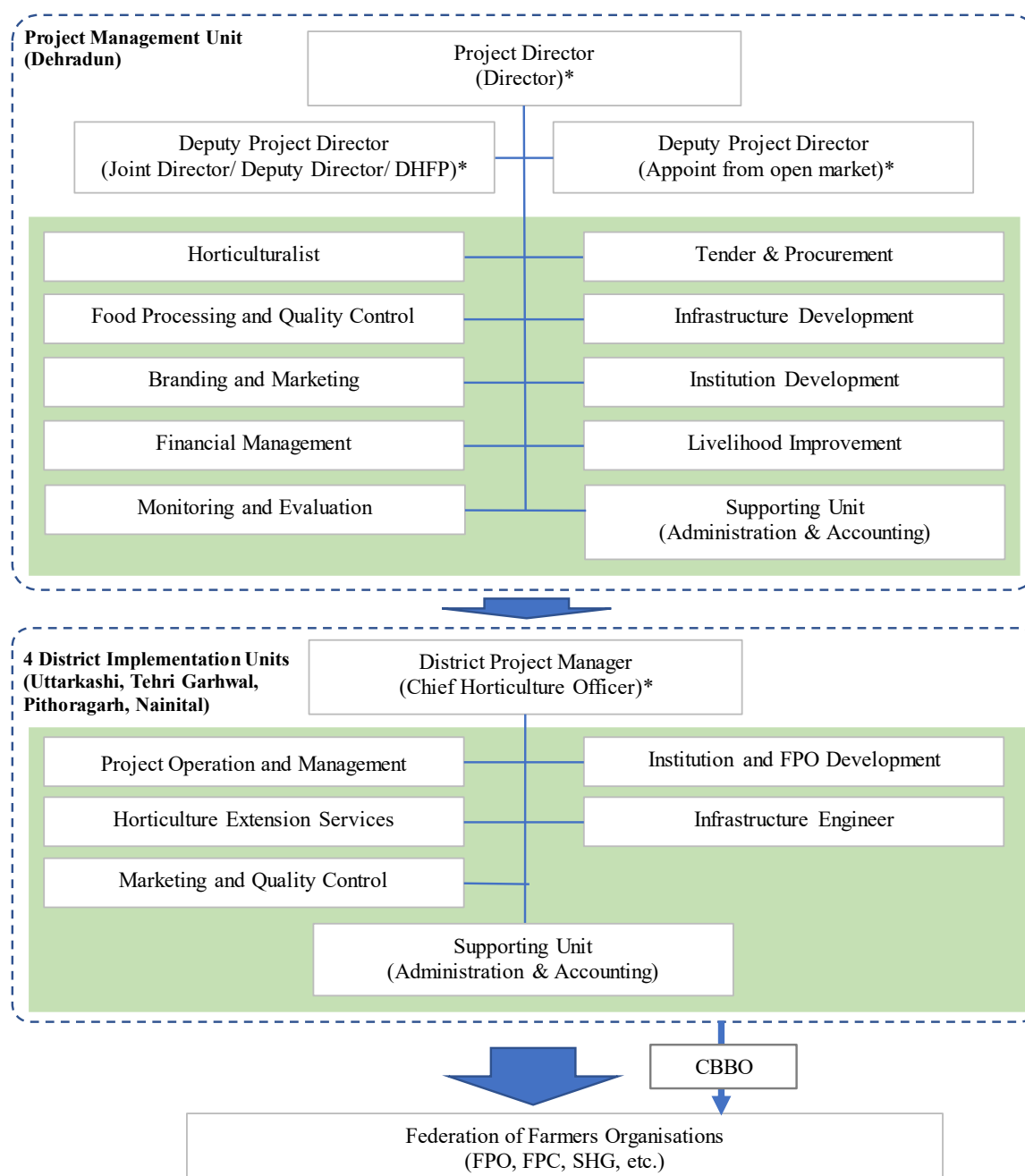
(3) District Coordination and Management Committees (DCMCs)

The DCMC would be established in each of the four districts covered by the Project and would be chaired by the District Magistrate and co-chaired by the district Chief Development Officer. Member secretary is designated officer of District Implementation Unit (DIU) and members are district economics and statistics Officer, Chief Agriculture Officer, General Manager of DIC (District Industry Center), Executive Engineer Minor Irrigation, Farmer's representatives. The committee would coordinate project implementation at the district level and ensure linkages between the project, line agencies and other government agencies. The DCMC will meet quarterly basis.

(4) Project Management Unit

The Department of Horticulture and Food Processing (DHFP) will establish a separate Society to implement the Project. This society will be a project implementing body, named as Uttarakhand Horticulture Development Society. The society mode is preferred as it has the flexibility to retain unspent funds at the end of the financial year as against the normal system of surrendering the unspent balance to the government treasury. State Government will nominate an experienced official from the central services as full time Secretary of the Society and this person will be the full time Project Director for implementation of project activities.

In the Uttarakhand Horticulture Development Society, the Project Management Unit (PMU) and District Implementation Units (DIUs) will be formed as shown below.



Notes: *) Dispatched from UKDHFP
Source: JICA Survey Team

Figure 7.2.2 Organization Structure of Each PMU Office

Project Management Unit (PMU)

The PMU in the society will be responsible for day-to-day implementation of the overall project activities, with District Implementation Units (DIUs) at target districts as needed. PMU will be headed by a full time PD. The main functions of the PMU will include the following:

- To coordinate and implement the project activities including procurement and consultation with JICA and under the guidance of PGC;
- To prepare AWPB and procurement plan for implementing the Project;
- To finalize and execute partnership agreements/contracts with non-governmental

organizations (NGOs), service providers and specialized institutions for implementing various project activities;

- d. To establish an effective M&E and management information system (MIS) to track the work progress from output, outcome and impact perspectives;
- e. To prepare and submit consolidated annual and quarterly progress reports to DHFP;
- f. To supervise and monitor the project-related activities and their progress towards achieving physical, financial and outcome related targets;
- g. To prepare project financial statements and statement of expenditures related to project expenditure for submission to DHFP;
- h. To submit annual audit reports to DHFP; and
- i. To liaise with the state administration and line agencies to ensure coordination in project implementation.

The PD will be assisted by a core team staff comprising of various experts to manage the Project. The PD will be responsible for the day-to-day operations, including the following functions:

- a. Ensure that the PMU carries out its functions as set out in the Project Agreement;
- b. Supervise and monitor the activities of the PMU and its progress towards achieving physical, financial and outcome related targets;
- c. Oversee field operations at DIUs and provide overall implementation guidance;
- d. Operate the PMU's Project account;
- e. Recruit staff required for implementing the Project;
- f. Undertake project procurement;
- g. Ensure that the PMU's Project accounts are audited annually and in accordance with JICA's audit requirements and submitted the same to DHFP; and
- h. Ensure that the PMU receives the required level of funding for carrying out the activities.

District Implementing Unit (DIU)

The PMU will establish a District Implementation Unit (DIU) at the target districts. The Project will engage suitable agencies capable of undertaking all activities related to horticulture and livelihood support at the district level. At each district, technical staffs under the guidance of their respective District Project Manager will implement the Project. In the Project, the functions of DIU will include the following:

- a. Establish a district (or other) level office with a multidisciplinary team;
- b. Establish a cluster level office with a Technical Coordinator and a small team;
- c. Develop a plan for the cluster and facilitate sourcing of funds and support the FPOs and group members to implement the plan;
- d. Develop and implement a horticulture supply chain improvement plan for the FPOs including irrigation and preventive measures to wild animal attacks;
- e. Ensure flow of funds to the FPOs and groups for implementing their plans;
- f. Supervise and monitor implementation of all activities related to project implementation; and
- g. Link up with the service providers including private companies and specialist NGOs to implement the work plan

(5) Project Management Consultant (PMC)

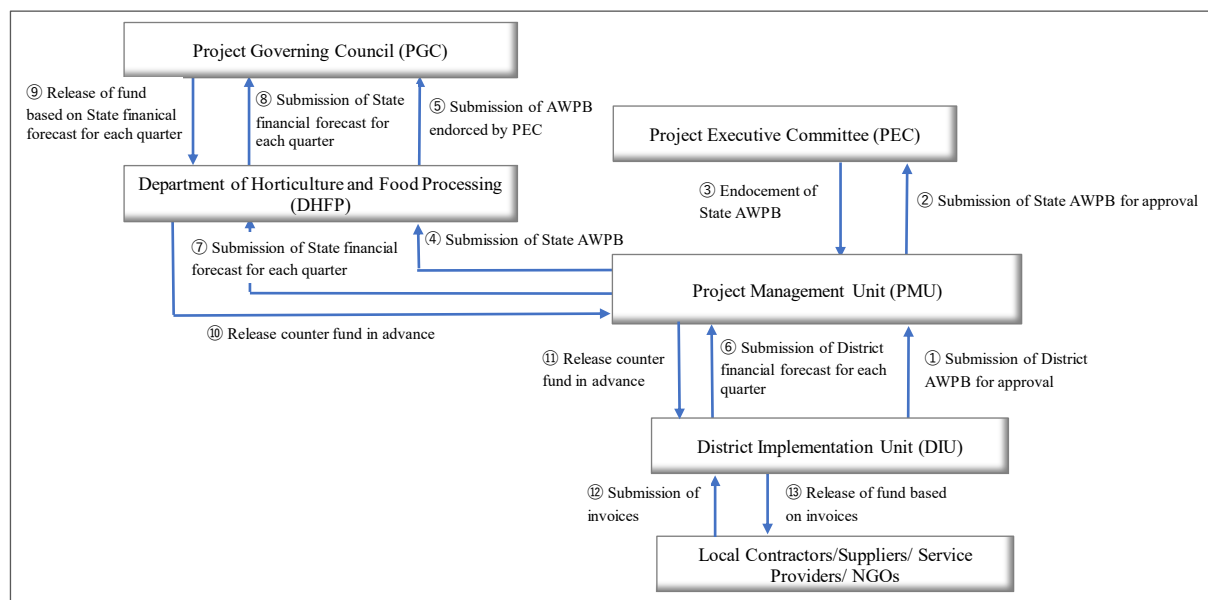
The Project Management Consultant (PMC) will be procured by the PMU utilizing the Japanese ODA loan to reinforce their implementation capacity, particularly to ensure technical and management support for the Project. The PMC will assist the PMU and DIUs in the improvement of process and procedures for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

(6) Mechanism of Inter Departmental Coordination and Knowledge Sharing

The PMU shall arrange a monthly meeting for information exchange/sharing between PMU and UKDHFP, which DIU shall participate in. In addition, PMU shall take the initiative for conducting project coordination meeting on a quarterly basis among the relevant organizations and stakeholders such as UKAPMB, HMB, KVK/ University, etc.

7.3 Overall Fund Flow

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



Source: JICA Survey Team

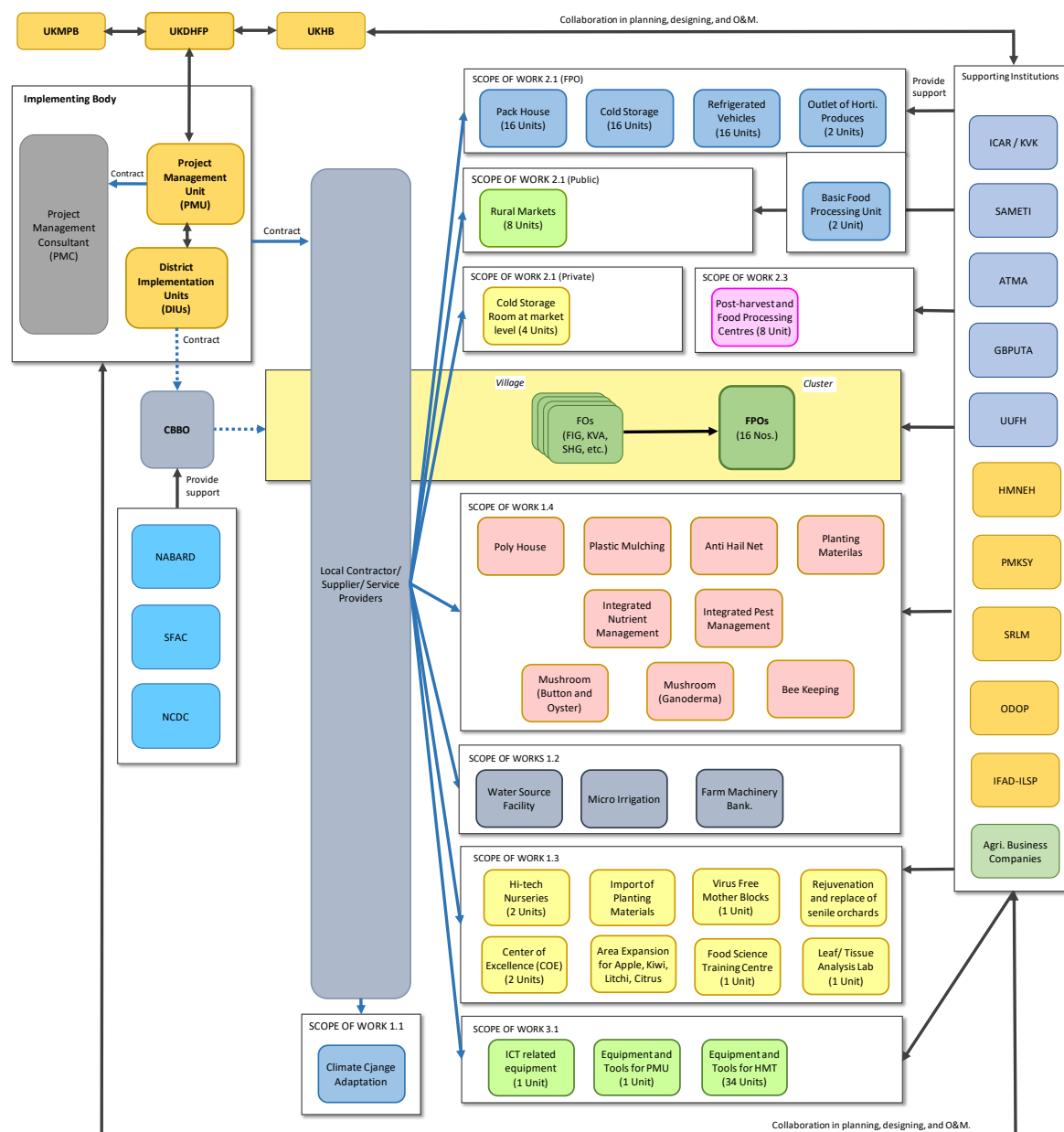
Figure 7.3.1 Overall Fund Flow

7.4 Implementation System for the Project

As discussed in the preceding chapter, the Project consists of three major components, namely: i) area expansion and production enhancement, ii) supply chain development, and iii) institutional development for project management. Various supporting institutions will be involved in the project implementation. In addition, many work items are expected to be implemented in convergence with other projects and programs.

(1) Implementing System for Infrastructure, Equipment and Materials

The figure below simply shows overall correlation diagram focusing mainly on work items of infrastructure, equipment, and materials. These work items will be constructed and/or provided by local contractors, suppliers, or service providers who will be selected using the bidding rules of the UK State.

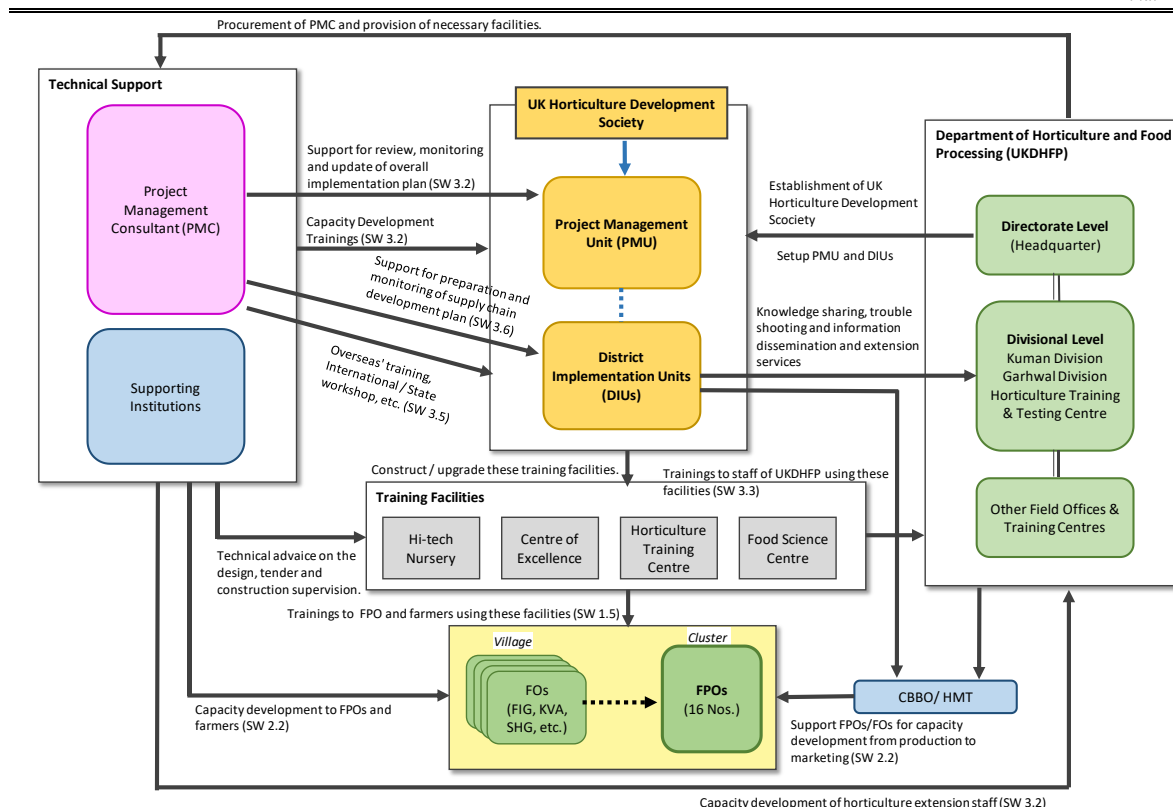


Source: JICA Survey Team

Figure 7.4.1 Implementing Organization for Work Items 1.1, 1.2, 1.3, 1.4, 2.1, 2.3 and 3.1 (Infrastructure, Equipment and Materials)

(2) Implementing System for Project Management and Capacity Development

The figure below indicates the overall correlation diagram mainly focusing on capacity development. The PMU and DIU will plan and implement the Project with technical support from the PMC and various supporting DIU institutions. It is noted that FPO development will be implemented in collaboration with the centrally sponsored scheme of Formation and Promotion of 10,000 FPOs under the Project.



Source: JICA Survey Team

Figure 7.4.2 Implementing Organization for Work Items 1.5, 2.2, 2.4, 3.2-3.6 (Capacity Development)

7.5 Procurement Method and Plan

(1) Procurement Method

The Project plans to procure (a) construction works, (b) supply of goods which include various items such as office equipment and furniture, transportation equipment, farm machinery and inputs, and laboratory equipment, and (c) services provided by PMC, NGOs or universities. The PMU will prepare the plan, design, specifications, special requirement or other description pertaining thereto in advance to the procurement. The description referred to shall be based on international standards, where such exist; otherwise, on national technical standards, regulations, or codes.

The PMU shall prepare description of procurement requirements in conformity with applicable environmental protection legislation. For the purpose of opening tenders or proposals and evaluation of bids, the PMU shall constitute a tender committee comprising a minimum of three members.

Procurement of construction works or goods or services can be made either through (a) international competitive bidding only for PMC, (b) local (national) competitive bidding, (c) quotation method, or (d) direct undertaking.

(2) State Procurement Rules

For the local competitive bidding, the Uttarakhand Procurement Rules 2008 will be used in principle. The rules specify all necessary procedures for the procurement of goods, works and services and for public-private partnership arrangements in infrastructure and service delivery projects and to regulate the matters connected.

Table 7.5.1 Major Points of Procurement Rules 2008

No.	Method of Procurement	Remarks
1	Procurement of Goods	
	Procurement without Quotation	Up to INR 15,000
	Purchase of Goods by Purchase Committee	Above INR 15,000 up to INR 100,000
	Purchase of Goods directly under Rate Contract	-

No.	Method of Procurement	Remarks
	Purchase of Goods by Obtaining Bids/Tenders	(a) Limited tender enquiry: Up to INR 1,500,000 (b) Advertised tender enquiry: INR 2,500,000 and above (c) Single tender enquiry: -
2	Procurement of Works	(a) Single Bid System (b) Two Bid System (c) Tenders with Pre-Qualification (d) Tenders with Post-Qualification (e) Tenders for works of a complex nature (f) Single-source procurement
3	Procurement of Services	(a) The number of shortlisted consultants should not be less than three. (b) The proposal should ordinarily be asked for from consultants in a 'two-bid' system with technical and financial bids sealed in separate envelopes. (c) The department may opt for a QCBS (Quality and Cost Based Selection) methodology. The department shall obtain the concurrence of the Finance Department for QCBS before starting the selection process.

Source: Uttarakhand Procurement Rules, 2008, Department of Finance, Government of Uttarakhand

(3) Procurement Plan

The procurement method for the three major components is summarized in Attachment 7.5.1.

7.6 Implementation Schedule of the Project

The implementation schedule of the Project is summarized in the table below.

Table 7.6.1 **Brief Implementation Schedule of the Project**

No.	Work Item	Fiscal Year (April to March)									
		2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	
0	Project Preparation Stage										
	Appraisal	▲									
	Pledge	▲									
	Signing of Loan Agreement	▲									
	Establishment of PMU/DIU		■								
	Selection of PMC		■								
1	Area Expansion and Production Enhancement										
	1.1) Climate Change Adaptation		■	■	■	■	■	■	■	■	
	1.2) Infrastructure Development			■	■	■	■	■	■	■	
	1.3) R&D Support (pre-harvest)		■	■	■	■	■	■	■	■	
	1.4) Provision of Farm Equipment and Materials			■	■	■	■	■	■	■	
	1.5) Capacity Development for Farmers			■	■	■	■	■	■	■	
2	Supply Chain Development										
	2.1) Infrastructure Development				■	■	■	■	■	■	
	2.2) FPO Development		■	■	■	■	■	■	■	■	
	2.3) R&D Support (post-harvest)		■	■	■	■	■	■	■	■	
	2.4) Promotion of Private Sector Collaboration			■	■	■	■	■	■	■	
3	Institutional Development for Project Management										
	3.1) Procurement of Equipment and Materials		■	■	■	■	■	■	■	■	
	3.2) Strengthening of PMU/DIU and HMT		■	■	■	■	■	■	■	■	
	3.3) Capacity Development for R&D			■	■	■	■	■	■	■	
	3.4) Branding and Marketing Development		■	■	■	■	■	■	■	■	
	3.5) Exposure Visits			■	■	■	■	■	■	■	
	3.6) Baseline Survey and Impact Assessment		■	■	■	■	■	■	■	■	
4	Consulting Services			■	■	■	■	■	■	■	

Source: JICA Survey Team

The detailed schedule is given in Attachment 7.6.1.

7.7 Operation and Maintenance (O&M) of Project Facilities

For proper O&M of project facilities in the long term, each organization responsible for O&M must ensure human resources, education/training, and financial resources. Accordingly, the O&M entity arranges person/s, gives education and training, and provides funds necessary for O&M.

In general, owners of the facilities belong to either government or private entity. Under the Project, the government facilities will be operated and maintained mainly by DHFA, of which idea is to manage these on public-private partnership (PPP) mode. As for private facilities, it is broadly divided into three:

private company, FPO, and individual. The O&M of the post-harvest and processing facilities by FPO can also be considered to be managed by PPP mode. In any case, the above three important factors shall be carefully examined from the proper O&M aspect of the project facilities.

The following points will be proposed to ensure the O&M of the project facilities under the Project.

(1) Handing Over with Trainings

Service providers must provide O&M training to the users along with O&M manual written in the local language before officially handing over the products. Costs for these activities shall be covered under the contract. In view of O&M, after-sales services including supply system of spare parts are important check points in the bidding.

(2) Warranty Services

Troubles and defects found in initial operation of the project facilities shall be covered by warranty services for equipment and tools and defect rectification services for infrastructures by stipulating the conditions in the contract agreement. The period depends on the products, but it is preferable to set the period to at least one year.

(3) Fund Raising

The O&M of the project facilities is the most crucial issue for O&M entities especially FPOs and individuals with limited financial resources. Possible solutions will be i) joint operation with private sector (PPP mode) and/or ii) fund raising for the O&M.

For the joint operation, a memorandum of understanding (MOU) will be concluded by the parties concerned in the PPP including O&M cost sharing in percent by the parties. As for fund raising, it will be proposed to deposit the cost to be shared by an FPO and individual into the corpus funds, tentatively named as cluster development funds (CDF).

The summary of O&M of the project facilities is shown in Attachment 7.7.1.

8.2 Summary of the Project Cost

The total project cost is estimated to be INR 5,256 million (JPY 8,042 million) consisting of INR 4,801 million for the L/C portion and INR 455 million for the F/C portion. The amount of the F/C portion is equivalent to JPY 697 million. The project cost is summarized as follows:

Table 8.2.1 Summary of Project Cost

Unit: Million

Description	F/C (JPY)	L/C (INR)	Total (JPY)	Total (INR)
1 Direct Cost for Procurement and Work	0	3,297	5,045	3,297
2 Price Escalation	0	326	498	326
3 Physical Contingency	0	181	277	181
4 Consulting Services	416	105	577	377
5 Interest during Construction	268	0	268	175
6 Front End Fee	13	0	13	8
7 Land Acquisition	0	0	0	0
8 Administration Cost	0	376	576	376
9 VAT, Import Tax and Other Taxes	0	516	789	516
Total	697	4,801	8,042	5,256

Source: JICA Survey Team

8.3 Annual Disbursement Schedule

The annual disbursement schedule is worked out based on the time of detailed design, construction works and FPO formulation. The summary is presented as below.

Table 8.3.1 Summary of Annual Disbursement Schedule

Unit: Million

Year	Total Cost (JPY)	JICA Portion (JPY)	Others (JPY)
2022	613	491	122
2023	1,206	980	226
2024	1,242	1,001	241
2025	1,283	1,025	258
2026	1,318	1,045	273
2027	1,343	1,057	286
2028	1,037	798	240
Total	8,042	6,397	1,646

Source: JICA Survey Team

8.3.1 Appropriate Bidding Method

The Local Competitive Bidding (LCB) shall be applied for the construction works to select the responsible and capable local construction firms at lower contract price. In addition, it shall be obligated to use relatively new and well managed construction machineries, which will be stipulated in the bid documents to avoid delay of the works due to frequent damage of construction machineries.

8.3.2 Formulation of Optimal Construction Plan

An optimal plan for construction works shall be prepared at the start of the work in the target area, which could contribute to reduction of delay of the works. Moreover, a simple procurement plan shall be prepared for smooth project management.

Chapter 9 Project Evaluation

9.1 Economic Evaluation Methodology and Assumptions

9.1.1 Method of Economic Evaluation

Economic evaluation is carried out to assess the economic viability of the pilot site cascade systems. In order to evaluate the cascade systems, indicators such as economic internal rate of return (EIRR), cost-benefit ratio (B/C), and net present value (B-C) are calculated by estimating the cash outflow (costs) and inflow (benefits) on annual basis over the project life with a certain discount rate by discount cash flow method (DCF method). The EIRR is a discount rate at which the present value of the in and out cash flows become equal. This rate shows the return to be expected from the Project as expressed in the following equation:

$$\sum_{t=0}^n B_t / (1 + r)^t - \sum_{t=0}^n C_t / (1 + r)^t = 0$$

Where C_t is Cost, B is Benefit, t is Year, n is Project Life (year), and r is the Discount Rate (EIRR).

The sensitivity analysis is also carried out to evaluate the viability of the cascade systems against possible adverse change in the future.

The financial internal rate of return (FIRR) is not calculated because FIRR is an indicator to assess the financial sustainability of the implementation agency with direct return from project activities such as airport and water supply project.

9.1.2 Basic Assumption of Economic Evaluation

The indicators for economic evaluation of the cascade systems are estimated with the following conditions and assumptions.

- i) The method and conditions for economic evaluation are based on the “Manual for Calculation of IRR (Internal Rate of Return), JICA, 2017”, “Study on Economic Evaluation Methods for Development Studies, JICA, 2002”, and “Manual for Calculation of Internal Rate of Return (IRR) for Japanese ODA Loan Projects, Japan Bank for International Cooperation (JBIC), 2002”.
- ii) The project life is assumed to be 30 years.
- iii) All prices and costs are expressed in economic prices of the local currency (INR). The other currencies are converted to INR by using the following exchange rates as of December 2021: USD 1.00 = JPY 114, USD 1.00 = INR 74.5, INR 1.00 = JPY 1.53
- iv) A discount rate of 6% is applied for calculation of B/C and B-C based on the rate used for other irrigation projects in Himachal Pradesh State and other states in India (Report of Himachal Pradesh Horticulture Development Project, The World Bank, 2016, Integrated Project for Source Sustainability and Climate Resilient Rainfed Agriculture in Himachal Pradesh, The World Bank, 2020, Preparatory Survey on Himachal Pradesh Crop Diversification Promotion Project Phase-II, JICA, 2020).
- v) All financial prices are converted to economic prices by using the prices and factors as follows: Transfer payment (taxes and subsidies), land acquisition, compensation, price escalation, and interest during construction are excluded from the calculation of economic project cost/benefit.
- vi) The economic prices of maize and wheat as export parity are estimated based on the data in 2018 to 2020 of the Trade Statistics from the Export Import Data Bank, Department of Commerce.
- vii) The prices of traded agricultural materials such as fertilizers/pesticides are calculated by excluding subsidies from the market price without Goods and Services Tax (GST).
- viii) Other goods are regarded as non-traded goods. The financial price was converted to economic

price using the standard conversion factor (SCF) of 0.97. The SCF is calculated from available data of the export/import statistical data from 2014 up to 2018 of India, since 2019 data is not yet available as of October 2021.

Table 9.1.1 Calculation of Standard Conversion Factors

(USD in Thousand)	2014	2015	2016	2017	2018	Average
a) Imports Value	459,369,463.60	390,744,731.40	356,704,792.11	444,052,353.84	617,945,603.08	453,763,389
b) Exports Value	317,544,642	264,381,004	260,326,912	294,364,490	322,291,568.43	291,781,723
c) Customs and Other Import Duties	24,816,000	27,746,400	29,475,600	17,833,200	14,836,800	22,941,600
d) Taxes on Exports	5,148	16,104	15,444	13,200	14,784	12,936
e) = a + b	776,914,106	655,125,735	617,031,704	738,416,844	940,237,172	745,545,112
f) = (a + c) + (b - d)	801,724,958	682,856,031	646,491,860	756,236,844	955,059,188	768,473,776
SCF = e / f	0.969	0.959	0.954	0.976	0.984	0.970

Source: JICA Survey Team based on the statistical data from the World Integrated Trade Solution (WITS), <https://wits.worldbank.org/>

- ix) The shadow wage rate (SWR) is 1.00 based on the reports of World Bank irrigation projects in India.
- x) For estimation of the project economic cost, only incremental cost is counted. The sunk cost is not included in the economic cost.

9.2 Project Economic Cost

Based on the financial cost described in Chapter 8, the economic project cost is estimated using the abovementioned conversion method to the economic price. The project economic cost includes all the project components for infrastructure development, farmers support, institutional development, value chain, and market development. The economic cost is shown in the following table.

Table 9.2.1 Economic Cost of the Project

Breakdown of Cost	Foreign Currency Portion (JPY in Million)			Local Currency Portion (INR in Million)			Amount (JPY in Million)		
	Total Cost	JICA Portion	Borrower Portion	Total Cost	JICA Portion	Borrower Portion	Total Cost	JICA Portion	Borrower Portion
Component 1	0	0	0	2,555	2,555	0	3,910	3,910	0
Component 2	0	0	0	471	471	0	721	721	0
Component 3	0	0	0	271	271	0	414	414	0
Physical Contingency	0	0	0	326	326	0	498	498	0
Consulting Services (C/S)	0	0	0	181	181	0	277	277	0
Price Escalation for C/S	416	416	0	105	105	0	577	577	0
Physical Contingency for C/S	268	0	268	0	0	0	268	0	268
Interest during Construction	13	0	13	0	0	0	13	0	13
Front End Fee	0	0	0	0	0	0	0	0	0
Land Acquisition	0	0	0	376	0	376	576	0	576
Administration Cost	0	0	0	502	0	502	768	0	768
VAT	0	0	0	14	0	14	21	0	21
Import Tax	0	0	0	0	0	0	0	0	0
Total	697	416	281	4,801	3,909	892	8,042	6,397	1,646

Source: JICA Survey Team

9.3 Operation and Maintenance (O&M) and Replacement Cost

(1) O&M Cost

Annual operation and maintenance (O&M) cost is estimated as shown in the following table. As of October 2021, the annual O&M cost is assumed as the total cost of solar fence and custom hiring unit. The O&M cost will be required every year according to the schedule of infrastructure development. Details of the annual incremental O&M cost are shown in Attachment 9.3.1.

Table 9.3.1 Economic Annual O&M Cost

No.	Items	Unit	Qty.	Unit Price (INR)	Amount (INR)
1	Farm Machinery Bank	L.S.	1	2,096,000	2,096,000
2	Water Source Facility	L.S.	1	11,118,000	11,118,000
Total					13,214,000
Economic Price (SCF=0.97)					12,817,580

Source: JICA Survey Team

(2) Replacement Cost

The following replacement cost is expected to be required periodically based on the economic life of infrastructure and equipment along with the infrastructure development schedule. Details of the annual incremental replacement cost are shown in Attachment 9.3.1.

Table 9.3.2 Economic Cost of Replacement
(INR in Million)

Year	Price in Every 10 Years	Total
2033	13	13
2034	13	13
2035	13	13
2036	13	13
2037	13	13
2038	10	10
2039	0	0
2040	0	0
2041	0	0
2042	0	0
2043	13	13
2044	13	13
2045	13	13
2046	13	13
2047	13	13
2048	10	10
2049	0	0
2050	0	0
2051	0	0
Total	150	150

Source: JICA Survey Team

9.4 Project Economic Benefit

9.4.1 Benefit from UKIHDP

The benefit from the Project is the increment of crop production income to be derived mainly from the increment of crop yield and crop diversification with fruits, vegetables and spices. In the Project, four crops which were identified by the Uttarakhand Department of Horticulture and Food Processing (UKDHFP) and the Japan International Cooperation Agency (JICA) Survey Team shall be recommended respectively to target districts. The crops will be expected to be potential crops for horticulture promotion in Uttarakhand State.

Table 9.4.1 Potential Crops for Each District

Nainital	Peach	Litchi	Tomato	Garlic
Pithoragarh	Sweet Orange	Apple	Turmeric	Garlic (Single Clove)
Tehri Garhwal	Plum	Potato	Ginger	Pea
Uttarkashi District	Walnut	Kiwifruit	Apple	Potato

Source: JICA Survey Team

The increment of the yields of these crops from without-project to with-project has been estimated and shown in the table below.

Table 9.4.2 Estimated Increment of Yields with the Project

Crop	Yield (mt/ha)			Reference
	Without	With	India Average	
Apple	2.0	8.2	6.3	To the average yield of J&K (11.4 mt/ha) and HP (5.1 mt/ha). Current UK apple yield is from conventional big and old apple tree.
Sweet orange	4.5	17.7	17.7	To the same level with all-India average yield, so that Indian average is rather high.
Kiwifruit	2.4	5.9	3.0	Quantity-wise, could not confirm reliable Indian data so referred also to Japanese (11.7 mt/ha) and New Zealand (11.6 mt/ha) data
Peach	9.6	14.4	5.9	To 120% of current UK yield that is better than all-India average yield
Plum	3.3	5.5	3.7	Ditto
Walnut	0.5	3.9	2.6	To the same level of all-India average yield
Pea	7.1	12.0	10.03	To 120% of Indian average with project
Potato	15.2	22.3	22.3	To the same level of all-India average yield

Crop	Yield (mt/ha)			Reference
	Without	With	India Average	
Tomato	8.5	25.0	31.0	To apply yield of HP (25.1 mt/ha). Japanese tomato yields are 42.6 mt/ha (July – November crop) / 99.4 mt/ha (December – June crop)
Garlic	4.0	6.4	5.4	To 120% of Indian average with project by irrigation
Ginger	10.3	12.4	6.7	To 150% of Indian average with project by irrigation
Turmeric	8.9	10.7	4.86	To 150% of Indian average with project by irrigation

Source: Prepared based on data supplied by UKDHFP on UK current yield and Horticulture Statistics at a Glance 2018, MAFF, Japanese Government.

Number of target households is 200 per one FPO, which can be 800 per 16 FPOs. Out of 4,280 ha land holdings for 800-household farmers in target districts, current net area sown is assumed at 2,280 ha in total, which is calculated from data described in Chapter 2¹. The rest 2,000 ha is 1,552 ha of cultivable waste and 448 ha of fallow area. In the Project, the cultivable area is expected to use for area expansion due to irrigation development. Therefore, total area of net area sown after the Project (with-project condition) will be 3,832 ha in target districts. Based on the result of supply chain survey in the JICA Survey, current cropping pattern at each district is estimated in the table below. The details of each crop area are shown in Attachment 9.3.1.

Table 9.4.3 Estimated Cropping Pattern at Target Districts

Nainital

Season	Crop	Area (%)
Without Project Condition		
Kharif	Tomato	50%
	Paddy	50%
Rabi	Tomato	45%
	Pea	20%
	Cabbage	15%
	Wheat	20%
TOTAL		200%
With Project Condition		
all year	Peach	5%
	Litchi	5%
Kharif	Tomato	40%
	Garlic	20%
	Paddy	30%
Rabi	Tomato	45%
	Pea	35%
	Wheat	10%
Total		200%

Pithoragarh

Season	Crop	Area (%)
Without Project Condition		
all year	Apple	20%
Kharif	Paddy	80%
Rabi	Tomato	35%
	Potato	35%
	Wheat	10%
TOTAL		200%
With Project Condition		
all year	Sweet Orange	15%
	Apple	20%
Kharif	Garlic	15%
	Paddy	50%
Rabi	Turmeric	20%
	Tomato	25%
	Potato	15%
	Wheat	5%
TOTAL		200%

Tehri Garhwal

Season	Crop	Area (%)
Without Project Condition		
all year	Apple	20%
	Walnut	15%
Kharif	Tomato	20%
	Potato	20%
	Pea	25%
Rabi	Potato	15%
	Pea	20%
	Cabbage	30%
TOTAL		200%
With Project Condition		
all year	Plum	5%
	Apple	25%
	Walnut	15%
Kharif	Tomato	25%
	Potato	10%
	Pea	20%
Rabi	Ginger	25%
	Potato	10%
	Pea	20%
TOTAL		200%

Uttarkashi

Season	Crop	Area (%)
Without Project Condition		
all year	Apple	30%
Kharif	Potato	40%
	Pea	15%
	Paddy	15%
Rabi	Potato	35%
	Pea	15%
	Wheat	20%
TOTAL		200%
With Project Condition		
all year	Walnut	2%
	Kiwifruit	3%
	Apple	30%
Kharif	Potato	40%
	Pea	13%
	Paddy	12%
Rabi	Potato	20%
	Pea	25%
	Wheat	20%
TOTAL		200%

Source: JICA Survey Team

¹ Data mentioned in Table 2.3.3 and 2.3.6 compiled from <https://des.uk.gov.in/contents/listing/3/168-statistical-diary>, https://des.uk.gov.in/files/Statistical_Abstract_Book_-_All.pdf

The intensity of with-project condition can be assumed based on current situation, which cannot be changed drastically from view of farmers' risk but can achieve income improvement. As for cereals, which are basic crops for farmers, the yields of with-project condition could not be reduced from without-project condition.

9.4.2 Crop Budget

Economic crop budgets of cereals and vegetables with and without project conditions have been prepared for estimation of the benefits considering the current situation of agriculture in the project area and the following conditions:

- (i) Crop budget is prepared for the Rabi season and the Kharif season as shown in table below;
- (ii) Back data of crop budget is basically referred from the following data:
 - Statistical data of wholesale price, Directorate of Marketing and Inspection, Ministry of Agriculture and Farmers Welfare, disseminated in the website of Agmarknet
 - Preparatory Survey of Himachal Pradesh Crop Diversification Project Phase-2 (JICA, 2020)
 - Research article and website on crop production costs applied in the Himalayan area
- (iii) Back data of crop budget of traded crop (wheat and paddy) are prepared from the data of trade statistics from the Export Import Data Bank, Department of Commerce.
- (iv) Costs of chemical fertilizer and pesticide/ chemicals are estimated based on the subsidy and goods and services tax (GST); and
- (v) Crop budgets are converted to economic prices based on abovementioned financial prices with use of conversion factors.

Details of crop budgets are presented in Attachment 9.3.1.

9.4.3 Project Benefit

Assumptions and conditions for estimation of the project benefit are as follows:

- (i) The economic benefit of the Project is derived from promotion of horticulture crops: increase of cropping intensity and unit yield of fruits, vegetables and spices. This benefit is estimated by converting the difference between the agricultural output of "without" and "with" project conditions to monetary value.
- (ii) Crop diversification is expected to come from the combined effects of infrastructure development, capacity development of farmers as well as the Project Management Unit (PMU)/ District Implementation Unit (DIU) and the Horticulture Mobile Team (HMT), and supply chain development in the Project.
- (iii) The benefits generated from the livelihood improvement activities such as mushroom cultivation and bee keeping are not included since these activities are planned on a pilot basis.

Economic project benefit is estimated at INR 551 million in the target four districts per year as summarized in the table below. Detailed calculation of economic benefits is shown in Attachment 9.3.1.

Table 9.4.4 Summary of Economic Benefit

Condition	Annual Total Benefit (INR in Million)
Without	148
With	699
Incremental Benefit	<u>551</u>

Source: JICA Survey Team

Annual benefit from crop production is estimated to increase gradually at 10%, 30%, 60% and 100% in each year in accordance with the progress of infrastructure development as well as harvesting time of crops including fruits. The construction work will be started from the second year of the Project, from which year project benefit will be generated with multiplying the increment rate of production benefit. The calculation of the total increase in annual benefit is shown below.

Table 9.4.5 Increase of Annual Benefit

Annual Disbursement for Infra. Development		Increase of Annual Benefit								
Year	Ratio/Year	2	3	4	5	6	7	8	9	10
2	17.4%	1.7%	5.2%	10.4%	17.4%	17.4%	17.4%	17.4%	17.4%	17.4%
3	17.4%	0.0%	1.7%	5.2%	10.4%	17.4%	17.4%	17.4%	17.4%	17.4%
4	17.4%	0.0%	0.0%	1.7%	5.2%	10.4%	17.4%	17.4%	17.4%	17.4%
5	17.4%	0.0%	0.0%	0.0%	1.7%	5.2%	10.4%	17.4%	17.4%	17.4%
6	17.4%	0.0%	0.0%	0.0%	0.0%	1.7%	5.2%	10.4%	17.4%	17.4%
7	13.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	3.9%	7.8%	13.0%
8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100.0%	1.7%	7.0%	17.4%	34.8%	52.1%	69.1%	83.9%	94.8%	100.0%

Source: JICA Survey Team

9.5 Results of Economic Evaluation

Based on the assumptions and conditions described so far, the indicators for economic evaluation are calculated as shown in the following table. The cash flow table for the calculation is shown in Attachment 9.3.1.

Table 9.5.1 Calculation Results of the Indicators for Economic Evaluation

EIRR (%)	Net Present Value (NPV) at Discount Rate = 6% (Unit: INR in Million)			B/C
	Benefit	Cost	Balance (NPV)	
6.0%	5,155	3,405	1,750	1.51

Source: JICA Survey Team

A sensitivity analysis is also carried out tentatively to evaluate the soundness against unexpected adverse changes such as cost overrun and decrease of benefit in the future. The result of analysis is shown in the following table.

Table 9.5.2 Result of Sensitivity Analysis

Sensitivity		Cost		
		Base	10% Increase	20% Increase
Benefit	Base	10.6%	9.4%	8.4%
	10% Decrease	9.3%	8.2%	7.3%
	20% Decrease	8.0%	7.0%	6.0%

Source: JICA Survey Team

9.6 Farm Economic Analysis

To evaluate the financial viability of individual farmers in the Project, annual farm income of average farm household is estimated based on the estimated crop budget. Net farm income for each district is shown in the following table and details are shown in Attachment 9.6.1.

Table 9.6.1 Farm Economic Analysis

(Unit: INR)

Net Receipt/ HH	Nainital	Pithoragarh	Tehri Garhwal	Uttarkashi
Average Land Holding (ha)	1.43ha	1.05 ha	1.50 ha	0.81 ha
Without	51,433	26,002	39,066	50,147
With	244,638	195,230	239,276	103,871
Balance	193,205	169,228	200,210	53,724

Source: JICA Survey Team

Average land holding per household is mentioned at Table 6.6.1 in Chapter 6. The result of analysis has shown that the net farm income after implementation of the Project will increase at least by INR 53,000 per year compared with the current condition. This result showed that the Project has a positive impact increasing the net farm income for individual farmers.

9.7 Intangible Benefits

The following positive effects as intangible benefits shall be envisaged through project activities.

(1) Increase of Farm Household Income in the Project

Based on farm economic analysis, the Project can be expected to increase farmers' income compared to the current situation. The income of farmers to be supported in the Project will be improved with application of the cropping intensity and patterns for the recommended fruits, vegetables and spices. In addition, material provision and technical support to the Project can make farmers achieve the yields increment under area expansion and production component.

(2) Strengthening of Management Capacity of FPOs

The supply chain development component will encourage Farmers Producing Organizations (FPOs) to stand as business entity independently with support of Cluster Based Business Organizations (CBBOs). General situation of FPOs operation in Uttarakhand is not preferable since it is difficult to continue the sustainable management and operation by FPO members due to insufficient capacity development. In the Project, CBBO will be instructed by PMU/Project Management Consultant (PMC) firstly and after starting of CBBOs support for FPOs also, PMU and PMC will monitor the progress and assist as necessity so that FPOs can conduct business activities. That will lead to accomplish the development of supply chain of horticultural crops in the Project.

(3) Capacity Development of Government Institutions

The project management component will strengthen the PMU/DIU and HMT capacities through various training programs. The Project will become the first experience for UKDHFP to implement a Japanese ODA loan scheme. With support of the PMC, the PMU/DIU can develop their capacity for project management as well as technical techniques in the component. This can also contribute to their management and monitoring skills for FPO activities for the purpose of supply chain development as well.

9.8 Operation and Effect Indicators

It is important to monitor and evaluate the project operation and effect indicators periodically, which will suggest the way to the proper operation and maintenance activities. The target year of the indicators is usually set for two years after project completion. However, it is recommended for the Project to set the target year of the indicators for 2033, five years after the project completion since it will take more than five years to get good yields of fruits. The set indicators in principle have been selected in reference to the "JICA Indicator Reference in Financial Assistance Project, Evaluation Department, JICA, 2020". It is noted that the current data are estimated based on the household survey conducted by the JICA Survey Team. Therefore, it is suggested to update the data based on the result of the baseline survey to be conducted at the initial stage of the Project.

9.8.1 Operation Indicators

The operation indicators are used to quantitatively measure the operation of the Project. The operation indicators are set for the Project in consideration of the project outputs as follows:

Table 9.8.1 Proposed Operation Indicators of the Project

	Operational Indicator	Unit	Current (2021)	Target (2033)
(1)	No. of beneficiary farmers (FPO members)	FHH	0	3,200
(2)	No. of FPOs starting business	no.	0	16
(3)	Introduction of micro irrigation	ha	0	2,090
(4)	Percent of beneficiary farmers who get technical advice from HMT	%	0	50
(5)	Organization/participation in food fairs and exhibitions	no.	0	4

Source: JICA Survey Team

9.8.2 Effect Indicators

The effect indicators are used to quantitatively measure the effects of the Project. The following effect indicators are set for the Project in consideration of mainly the project objectives.

Table 9.8.2 Proposed Effect Indicators of the Project

	Effective Indicators	Unit	Current (2021)	Target (2033)
(1)	Yield of recommended crops under FPOs in target	t/ha	Apple 2.0	8.2

Effective Indicators		Unit	Current (2021)		Target (2033)
	area		Sweet Orange	4.5	17.7
			Kiwifruit	2.4	5.9
			Litch	4.1	9.9
			Peach	9.6	14.4
			Plum	3.3	5.5
			Walnut	0.5	3.9
			Pea	7.1	12.0
			Potato	15.2	22.3
			Tomato	8.5	25.0
			Garlic	4.0	6.4
			Ginger	10.3	12.4
			Turmeric	8.9	10.7
(2)	Cultivation area of fruits under FPOs in target area	ha	Fruits	899	1,175
		ha	Vegetables	2,542	3,361
		ha	Spices	0	823
(3)	Rate of shipping price of FPOs to farmgate price of fruits, vegetables and spices in target area	%	-	100	120

Source: JICA Survey Team

9.8.3 Monitoring Method and System for Operation and effect Indicators

The operation and effect indicators shall be continuously monitored during and after the Project. It is proposed to have a monitoring method and system for each indicator, including specific data collection methods as shown in the following table.

Table 9.8.3 Monitoring Method and System for Operation and Effect Indicators

No.	Indicator	Monitoring Target	Responsible Organization	Timing of Data Collection	Data Source
A. Operation Indicators					
1	No. of beneficiary farmers (FPO members)	Sample FPO member	DIU	Once a year	Interview Survey
2	No. of FPOs starting business	All FPOs	PMU/DIU	Once a year	Annual Report
3	Introduction of micro irrigation	DIU	PMU/DIU	Once a year	Annual Report
4	Percent of beneficiary farmers who get technical advice from HMT	Sample FPO member	DIU	Once a year	Interview Survey
5	Organization/participation in food fairs and exhibitions	PMU	PMU	Once a year	Annual Report
B. Effect Indicators					
1	Yield of recommended crops under FPOs in target area	Sample FPO member	DIU	Once a year	Annual Report
2	Cultivation area of fruits under FPOs in target area (yearly)	Sample FPO member	DIU	Once a year	Annual Report
3	Rate of shipping price of FPOs to farmgate price of fruits, vegetables and spices in target area	All FPOs	PMU/DIU	Once a year	Interview Survey

Source: JICA Survey Team

This monitoring method and system will be finalized soon after starting the project activities by PMU. The system will be reviewed and updated with support of the PMC. Required costs are listed as baseline, mid-line, and end-line survey in the project management component.

9.9 Risk Management

9.9.1 Approach to Risk Management

Risk is defined as the possibility that an event will occur and adversely affect the achievement of an objective. According to the concept of risk management, risk is generally classified as the probability of occurrence and the impact (magnitude) of loss when it occurs. Based on the classification, treatments for risks shall be considered, such as avoidance, reduction (optimize, mitigation), sharing, and retention. The purpose of risk management is to identify potential problems before they occur. In the Project, “loss” is considered to be a “decrease of development effect”. Factors to reduce the development effect are called risks, such as decrease of the project benefit, increase of project cost,

unachieved development target of the project, project cancellation or suspension, and their multiple occurrences. Treatment for risks is generally classified as follows:

Table 9.9.1 Treatment for Risks

Impact	Probability	
	High	Low
High	Avoidance of the risk (to avoid activity itself with the risk)	Sharing of the risk (to transfer the risk to others, e.g., insurance)
Low	Reduction of the risk (to reduce probability and impact of risk before occurrence)	Retention of the risk (not to take action for the risk)

Source: JICA Survey Team

As mentioned above, the concept of risk management aims to treat critical and major risks based on the above categories, considering the costs associated with the treatment of risks. Risk identification and assessment shown below is done based on the concept of risk management.

9.9.2 Identification and Assessment of Risks

According to the JICA Risk Management Framework, the risks for the Project are identified and assessed in the following categories. The JICA Risk Management Framework classifies the risks into 1) stakeholder risk, 2) executing agency risk, and 3) project risk. The identified major risks in each risk category and the assessment results are shown in the following table.

Table 9.9.2 Identification and Assessment of Major Risks of the Project

Major Risks	Risk Assessment	Risk Treatment
1. Stakeholder Risk		
Risk of the project cancellation or suspension resulting from the low commitment of the state of Uttarakhand <u>Appraisal stage</u> / <u>Implementation stage</u>	Probability: M Impact: H	1) To hold regular high-level policy meeting, the Executive Committee to review and approve annual plan of operation and budgetary allocations at the timing of the next fiscal year's budget request. 2) To monitor the policy trends of the central government of India and the position of the Project in the annual plan of the state of Uttarakhand.
2. Executing Agency Risk		
2.1 Capacity risk 1) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from the lack of technical capacity of UKDHFP or delay in procurement of quality PMC to support PMU <u>Appraisal stage</u> / <u>Implementation stage</u>	Probability: M Impact: M	1) The PMC through its experts to support PMU for implementation of all the components. 2) To plan appropriate implementation structure for all of the components. In particular, employment and operation of CBBOs shall be taken care of by the PMC so that PMU/DIU could hire CBBOs with sufficient experience.
2) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from low project management capacity of UKDHFP <u>Appraisal stage</u> / <u>Implementation stage</u>	Probability: M Impact: M	1) To hold the Executive Committee meetings regularly to monitor, evaluate and approve financial management and procurement. 2) The PMC to support the PMU for the application of the guideline and manuals on financial management and procurement.
3) Risk of decrease of benefit, increase of cost, unachieved development target, and delay of the project resulting from low financial capacity of UKDHFP <u>Appraisal stage</u> / <u>Implementation stage</u>	Probability: L Impact: M	1) To hold the Executive Committee regularly to monitor, evaluate and approve financial management and procurement. 2) The PMC to support the PMU for financial management
4) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from delay of payment to contractor <u>Appraisal stage</u> / <u>Implementation stage</u>	Probability: L Impact: M	1) The PMC to support PMU for monitoring the construction and payment progress 2) To hold the Executive Committee meetings regularly to monitor payment work progress.

Major Risks	Risk Assessment	Risk Treatment
2.2 Governance risk 1) Risk of delay of the project resulting from the improper communication of related organizations and the implementation structure. Appraisal stage / <u>Implementation stage</u>	Probability: L Impact: M	1) To clarify the role, responsibility and relationship of each organization before starting the Project. 2) To hold Executive Committee meetings regularly to share and discuss on the progress of the project activities with related organizations. 3) To implement the project management component, including capacity development with support from the PMC.
2) Risk of delay of the project implementation schedule due to delays in the procedure of E/N and L/A by the government <u>Appraisal stage</u> / Implementation stage	Probability: L Impact: M	1) JICA to support Uttarakhand State to arrange meetings and documents in order to achieve necessary procedure and approval punctually before project implementation.
2.3 Fraud and corruption risk Risk of increase of cost and unachieved development target, delay of the project resulting from fraud in the procurement of the Project. Appraisal stage / <u>Implementation stage</u>	Probability: L Impact: M	1) To adopt the procurement guideline of Uttarakhand State with addition of necessary modification. 2) To monitor proper procurement work through the Executive Committee.
3. Project Risk		
3.1 Design risk 1) Risk of delay in the implementation of the Project from the design with too advanced techniques. Appraisal stage / <u>Implementation stage</u>	Probability: M Impact: M	1) To appoint PMC to support PMU in the conduct of project components especially for value chain and market development components.
2) Risk of unachieved development component in the project implementation from improper project scope and project monitoring system. <u>Appraisal stage</u> / <u>Implementation stage</u>	Probability: L Impact: M	1) To plan proper project components before the Project 2) The PMU/DIU to hold progress meetings to monitor and share the progress of activities. 3) To hold Executive Committee meetings to monitor the progress of project components.
3) Risk of delay of the project implementation schedule from too many number of packages <u>Appraisal stage</u> / Implementation stage	Probability: L Impact: M	1) To review the DPR to be prepared based on the PPR before the Project. 2) To confirm local situation about constructor's capacity and quality control before the Project.
4) Risk of cancellation or suspension of project implementation due to increase of project cost Appraisal stage / <u>Implementation stage</u>	Probability: L Impact: M	1) To consider the project cost based on economic situation of the country and target area before the Project.
5) Risk of decrease of benefit of the project implementation from sudden decrease of market demand for horticultural crops due to external factors. Appraisal stage / <u>Implementation stage</u>	Probability: L Impact: L	1) To conduct project economic analysis and confirm the resiliency against demand (benefit) decrease before the Project.

Major Risks	Risk Assessment	Risk Treatment
3.2 Program/donor risk Risk of decrease of benefit and delay of the project resulting from delay of the other schemes, other donors' projects or departments conducted in Uttarakhand. Appraisal stage / <u>Implementation stage</u>	Probability: L Impact: L	1) The PMU supported by the PMC to hold information exchange and project coordination meetings with relevant organizations periodically.
3.3 Delivery quality risk 1) Risk of impossibility to monitor and measure development effect due to lack of the way of data collection. Appraisal stage / <u>Implementation stage</u>	Probability: L Impact: L	1) The PMC to support PMU to collect data properly. 2) To establish MIS & GIS facilities and provide technical support, with guidance from the PMC
2) Risk of unsecured sustainability for O&M of project resulting from supplier's failure to provide training Appraisal stage / <u>Implementation stage</u>	Probability: M Impact: M	1) To conduct O&M training mainly by supplier with support from the PMC.
3) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from natural disaster Appraisal stage / <u>Implementation stage</u>	Probability: M Impact: L	1) To plan the construction work schedule to be conducted in Rabi season. 2) To plan and conduct project components in consideration of climate conditions with support from the PMC.
4) Risk of unfair benefit expression of the project resulting for the limited beneficiaries Appraisal stage / <u>Implementation stage</u>	Probability: L Impact: L	1) To conduct livelihood improvement activities with support from the PMC and relevant departments.

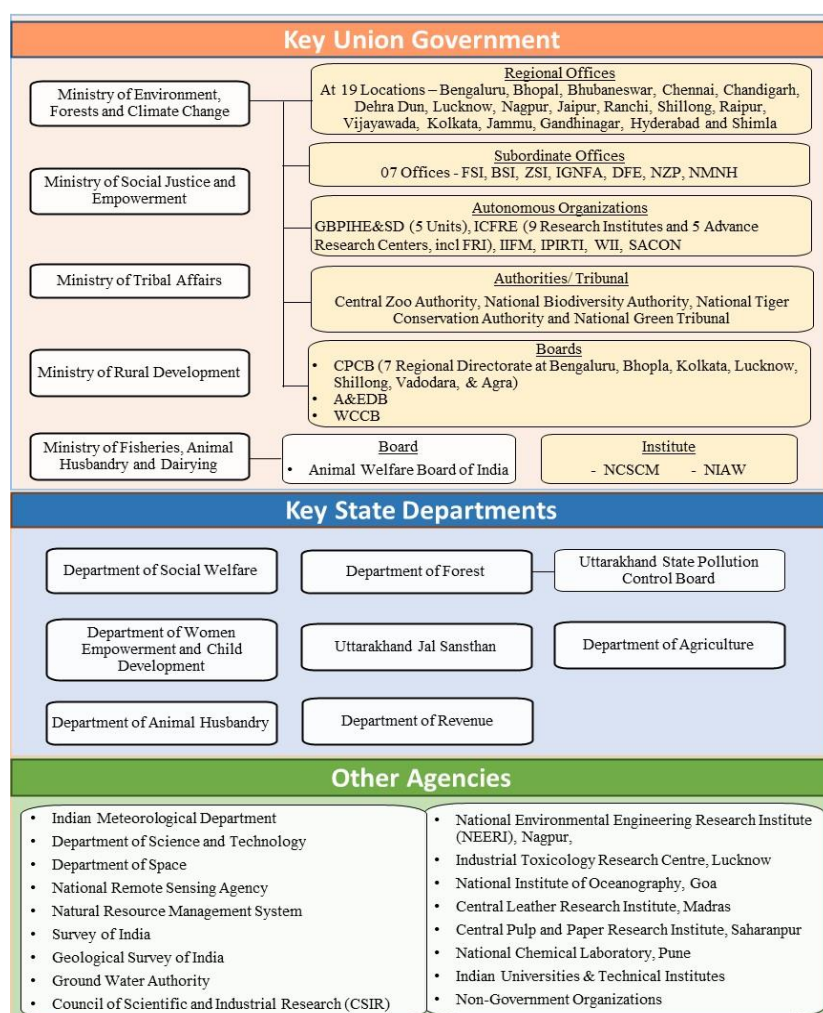
Remark: H: High, M: Middle, L: Low
Source: JICA Survey Team

The result of the risk identification and assessment is also shown in Attachment 9.9.1 in the format specified by JICA (Risk Management Framework).

Chapter 10 Environmental and Social Considerations

10.1 Environmental Administrative System in India

There are a number of ministries, departments, institutions, autonomous bodies and agencies that are involved in environmental management, monitoring and surveillance within the country. The Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India (GoI) is the apex body and central ministry in the country, in charge of regulating and ensuring environmental protection including planning, promotion, coordination, and supervision of environmental policy/program for implementation. The Central Pollution Control Board (CPCB) under MoEF&CC at the union level and the State Pollution Control Board (SPCB) at the state level together form the regulatory and administrative core of this sector, which are mainly responsible to periodically monitor pollution levels. Figure 10.1.1 provides an overview of the major institutions involved in ESC in the country. The Uttarakhand Pollution Control Board (UPCB) was established in the year 2001 as a statutory organization constituted under Section 4 of the Water (Prevention and Control of Pollution) Act, 1974 by the Forest and Environment Division, Uttarakhand Secretariat's notification dated 26-Dec-2001 to implement environmental laws and rules within the jurisdiction of the state of Uttarakhand.



Legend

-FSI - Forest Survey of India,
-BSI - Botanical Survey of India,
-ZSI - Zoological Survey of India,
-IGNFA - Indira Gandhi National Forest Academy,
-DFE - Directorate of Forest Education,
-NZP - National Zoological Park,
-NMNH - National Museum of Natural History
-GBPIHE&SD - Govind Ballabh Pant Institute of Himalayan Environment & Sustainable Development
-ICFRE - Indian Council of Forestry Research and Education

- IIFM - Indian Institute of Forest Management
- IPIRTI - Indian Plywood Industries Research and Training Institute
- WII - Wildlife Institute of India
- SACON - Salim Ali Center for Ornithology and Natural History
- CPCB - Central Pollution Control Board
- NAEDB - National Afforestation and Eco-Development Board
- WCCB - Wildlife Crime Control Bureau
- NCSCM - National Centre for Sustainable Coastal Management
- NIAM - National Institute of Animal Welfare

Source: Created by the JICA Survey Team (2021) based on the existing information

Figure 10.1.1 Major Institutions Involved in Environmental and Social Considerations

10.2 Environmental Laws, Regulations and Policies in India and the State of Uttarakhand

The need for protection and conservation of environment and sustainable use of natural resources is reflected in the constitutional framework of India and also in the international commitments of India. Over the years, these guiding principles have resulted in the development of strong legal policies and operative framework for the protection of environment and conservation of ecological resources in the country.

Article 48A-Directive Principles of State Policies of the Constitution of India 1949 stipulates that “The State shall endeavor to protect and improve the environment and safeguard the forests and wildlife of the country”. Further, the Constitution of India under Article 51A-Fundamental Duties, defines the fundamental duties of every citizen of India “to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures”.

With the focus on achieving the sustainable development goal in developing countries, as mandated in the Guidelines for Environmental and Social Considerations (April 2010) of Japan International Cooperation Agency (JICA), this chapter deals with a review and analysis of the national and state level policies, laws and regulations of relevant environmental and social considerations (ESC), primarily to ensure that the Project and its activities are in compliance with the JICA Guidelines as well as The World Bank’s Safeguard Policies.

10.2.1 Major National and State Level Laws and Regulations Relevant to Environmental and Social Considerations

In India, apart from the various national level laws/policies, the state governments formulate their own laws, rules, regulations, guidelines, policies and standards covering different aspects of ESC, consistent with key relevant national laws and regulations. The important and relevant national and state level legal frameworks which are applicable for ESC in relation to the proposed Project and its activities are outlined in Table 10.2.1.

Table 10.2.1 National/State Level Legal Framework for Environmental and Social Considerations

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
A. Environment Protection and EIA		
National Forest Policy, 1988	Envisages 33% of the area of India should be under forest/tree cover through involvement of local communities in joint forest management programs	MoEF&CC, State Forest Department, VPs
Wildlife Protection Act, 1972	The Act prohibits killing/trapping of wild animals, control of collection, protection, and sale of specified plants, defines restrictions on access and use of protected areas	MoEF&CC, State Forest Department, State Wildlife Board
Environmental Regulations	The state of Uttarakhand has adopted the following union level regulations and laws pertaining to environment protection and control of pollution: - The Water (Prevention & Control of Pollution) Act, 1974 and rules framed thereunder. - The Air (Prevention & Control of Pollution) Act 1981 and rules framed thereunder. - The Water (Prevention & Control of Pollution) Cess Act, 1977, as amended by Amendment Act, 1991, 2003, and rules framed thereunder - Environment (Protection) Act, 1986 and the rules/notifications framed thereunder: ▪ Environmental Protection Rules, 1986. ▪ Environmental Impact Assessment Notification, 1994, 1997, 2002, 2004, 2006, 2020 as amended. ▪ Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016. ▪ Manufacture, Storage and Import of Hazardous Chemical Rules, 1989; ▪ Plastics Manufacture, Sale and Usage Rules, 1999 and 2003; ▪ Bio-Medical Waste (Management and Handling) Rules, 1998 and Amendment Rules 2000, 2003, 2016; ▪ The Noise Pollution (Regulation and Control) Rules, 2000; ▪ Municipal Solid Wastes (Management and Handling) Rules, 2000; ▪ Ozone Depleting Substances (Regulation) Rules, 2000; ▪ Batteries (Management and Handling) Rules, 2001; ▪ The Manufacture, Use, Import, Export, and Storage of Hazardous Micro	Central Pollution Control Board, USPCB

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
	Organisms, Genetically Engineered Organisms or Cells Rules, 1989. - Chemical Accident (Emergency Planning, Preparedness, and Response) Rules, 1996. There are additional rules that are notified considering the need for the betterment of the health of the society in general as well as their bearing on the environment. Apart from Uttarakhand State Pollution Control Board, there are other agencies as well that are responsible for the implementation of these rules: - Public Liability Insurance Act, 1991. - The Uttarakhand Plastic and Other Non-Biodegradable Garbage (Regulation of Use and Disposal) Act, 2013. - Motor Vehicle Act, 1988.	
Human-Wild Life Conflict Relief Distribution Fund, 2012	The notification issued by the Uttarakhand State government is meant for compensating those who suffer injury, loss of life or damage to the property that includes livestock as well as damage to the agricultural crop. The notification specified amount of compensation for each category and subtype based on the injury or death caused by wild animals that include tiger, leopard, snow leopard, fox, wild elephant, bear, hyena, wild boar, crocodile, and snake as well as damage to agriculture crops caused by elephant, wild boar, blue bull, sambhar, chital, and monkeys.	State Forest Department
Uttarakhand Water Management and Regulatory Act, 2013 and 2016	The Water Management Regulatory Authority, ('Authority' was later amended to 'Commission') was established to facilitate and ensure judicious and equitable management of water resources in the state as well as its proper allocation and optimal utilization. The major objectives of the Act are: - The commission will have the powers of a civil court and the mandate to carry out developments in the state in an eco-friendly and sustainable manner. - Formulating a new water policy to manage rivers, especially rivers that are causing damage to villages located on their banks. - To fix rates for water use for industrial, drinking, power, agriculture, and other purposes and on land benefited by flood protection and drainage works. - Monitor conservation of environment and facilitate the development of a framework for the preservation of quality of surface and ground water resources.	Uttarakhand Jal Sansthan
River Ganga (Rejuvenation, Protection and management) Authorities Order, 2016 and 2019	The central government intends to take measures for prevention, control and abatement of environmental pollution in the river Ganga and to ensure continuous adequate flow of water so as to rejuvenate the river Ganga to its natural and pristine condition. It was initially established by the Central Government of India, in 2016 under Section 3(3) of the Environment Protection Act, 1986, which also declared Ganges as the 'National River' of India.	Ministry of Jal Shakti
Hazardous Waste (Management, Handling, and Trans-Boundary Movement) Rules, 2008	These rules impose restrictions and prescribe procedures for management, handling, disposal and trans-boundary movement of hazardous wastes; These rules apply to the management of hazardous and other wastes as specified in the schedules appended to the rules, and shall not apply to (a) wastewater and exhaust gases; (b) wastes arising out of the operation from ships beyond five km radius; (c) radioactive wastes; (d) bio-medical wastes; and (e) municipal solid wastes.	USPCB
Manufacture, Storage and Import of Hazardous Chemical Rules, 1989	These rules apply to an industry that manufactures, stores, and imports chemicals that are toxic, flammable and explosive. The rules recommend isolated storage of hazardous chemicals; identification of major accident hazards; prevent such major accidents; prevent their consequences to persons and environment; provide site personnel with information, training, and equipment necessary to ensure their safety.	USPCB
Plastics Manufacture, Sale and Usage Rules, 1999 and 2003; (Uttarakhand-Plastic-Ban-Order, 2017)	The central government had notified the "Recycled Plastics Manufacture and Usage Rules, 1999 (as amended in 2003)" under the Environment (Protection) Act, 1986, to regulate the manufacture, sale and use and recycling of plastic bags. These rules, inter alia, provided that plastic carry bags should have a minimum thickness of 20 microns; carry bags or containers made of recycled plastic shall not be used for packaging of food stuffs and recycling of plastic waste in accordance with BIS specifications. Powers have been delegated to the State Pollution Control Boards / Pollution Control Committees for taking action for violation of rules promulgated under the Environment (Protection) Act, 1986	CPCB, USPCB
The Uttarakhand Plastic and Other Non-Biodegradable Garbage (Regulation of Use and Disposal) Act, 2013	Through a notification in Uttarakhand, single use plastic/thermocool/styrofoam items, their sale, trading, manufacturing, import, storage, transport, use and supply or distribution are completely banned.	USPCB

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
Ozone Depleting Substances (Regulation) Rules, 2000	These rules provide regulations on production and consumption of ozone-depleting substances. The rules provide that no person shall produce or cause to produce any ozone-depleting substance after the date specified in column (5) of Schedule V unless he is registered with the authority specified in column (4) of that schedule. Further, no person shall import or cause to import from or export or cause to export to any country any ozone-depleting substance after the commencement of these rules.	USPCB
Batteries (Management and Handling) Rules, 2001	These rules provide the responsibility of a manufacturer, importer, assembler and re-conditioner to: (i) ensure that the used batteries are collected back as per the schedule against new batteries sold excluding those sold to original equipment manufacturer and bulk consumer(s); (ii) ensure that used batteries collected back are of similar type and specifications as that of the new batteries sold; (iii) file a half-yearly return of their sales and buy-back to the State Board in Form- I latest by 30 June and 30 December of every year; (iv) set up collection centers either individually or jointly -at various places for collection of used batteries from consumers or dealers; (v) ensure that used batteries collected are sent only to the registered recyclers, (vi) ensure that necessary arrangements are made with dealers for safe transportation from collection centers to the premises of registered recyclers; (vii) ensure that no damage to the environment occurs during transportation; (viii) create public awareness through advertisements, publications, posters or by other means with regard to the following (a) hazards of lead; (b) responsibility of consumers to return their used batteries only to the dealers or deliver at designated collection centers; and (c) addresses of dealers and designated collection centers; (ix) use the international recycling sign on the batteries; (x) buy recycled lead only from registered recyclers; and (xi) bring to the notice of the State Board or MoEF&CC any violation by the dealers.	USPCB
Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Micro Organisms, Genetically Engineered Organisms or Cells Rules, 1989	These rules shall be applicable in the following specific cases: (a) sale, offers for sale, storage for the purpose of sale, offers and any kind of handling over with or without a consideration; (b) exportation and importation of genetically engineered cells or organisms; (c) production, manufacturing, processing, storage, import, drawing off, packaging and repacking of the genetically engineered products; (d) production and manufacture of drugs and pharmaceuticals and food stuffs distilleries and tanneries, which make use of micro-organisms, genetically engineered micro-organisms one way or the other.	MoEF&CC State Forest Department
Chemical Accident (Emergency Planning, Preparedness and Response) Rules, 1996	These rules shall be applicable in the following specific cases; (a) sale, offers for sale, storage for the purpose of sale, offers and any kind of handling over with or without a consideration; (b) exportation and importation of genetically engineered cells or organisms; (c) production, manufacturing, processing, storage, import, drawing off, packaging and repacking of the genetically engineered products; and (d) production and manufacture of drugs and pharmaceuticals and food stuffs distilleries and tanneries, which make use of micro-organisms, genetically engineered micro-organisms, one way or the other.	USPCB
Insecticide Act 1968 (Act No. 46 of 1968); The pesticide Management Bill, 2020	The Insecticides Act, 1968 (the Act) was enacted to regulate the import, manufacture, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings or animals. In the said Act, there is a lack of sufficient deterrence against violations and there is no stricter penalty to safeguard the farmer's interest. There is also no mechanism to regulate pricing and disposal in an environmentally sound manner. Thus, it is proposed to replace the Insecticides Act of 1968 by a new legislation, namely the Pesticide Management Bill, 2020. The proposed bill, apart from other provisions, also include - (i) provision for encouraging indigenous manufacturing; (ii) provision for promoting pesticides that are biological and based on traditional knowledge; (iii) while registering a pesticide, the Registration Committee apart from evaluating its safety and efficacy, would also be guided by factors like necessity, end use, risk involved and availability of safer alternatives; (iv) fixation of maximum residue limits for pesticides have been made mandatory.	Ministry of Agriculture and Farmers Welfare
Public Liability Insurance Act, 1991	The Act was notified for the purpose of providing immediate relief to the persons affected by accident caused while handling any hazardous substance and for matters connected therewith or incidental thereto. In case of a death or injury resulting from an accident, this Act makes the owner liable to provide relief as specified in the Schedule of Act.	USPCB, Insurance Company
Motor Vehicle Act, 1988 (Amended in 2020)	The legislation has been prepared to provide for – (a) modification and amplification of certain definitions of new type of vehicles; (b) simplification of procedure for grant of driving licenses; (c) putting restrictions on the alteration of vehicles; (d) certain exemptions for vehicles running on non-polluting fuels; (e) ceilings on individuals or company holdings removed to curb “benami” holdings; (f) states authorized to appoint one or more State Transport Appellate Tribunals; (g) punitive checks on the use of such components that do not conform to the prescribed standards by manufactures, and also	USPCB, Ministry of Surface Transport, Police Department, Judiciary,

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
	stocking / sale by the traders; (h) increase in the amount of compensation of the victims of hit and run cases; (i) removal of time limit for filling of application by road accident victims for compensation; (j) punishment in case of certain offences is made stringent; (k) a new pre-determined formula for payment of compensation to road accident victims on the basis of age / income, which is more liberal and rational	Insurance Companies
B. Pollution Control and Waste Management		
Insecticide Act 1968 (Act No. 46 of 1968); The Pesticide Management Bill, 2020	The Insecticides Act, 1968 (the Act) was enacted to regulate the import, manufacture, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings or animals. In the said Act, there is a lack of sufficient deterrence against violations and there is no stricter penalty to safeguard the farmer's interest. There is also no mechanism to regulate pricing and disposal in an environmentally sound manner. Thus, it is proposed to replace the Insecticides Act of 1968 by a new legislation, namely the Pesticide Management Bill, 2020. The proposed bill, apart from other provisions, also include - (i) provision for encouraging indigenous manufacturing; (ii) provision for promoting pesticides that are biological and based on traditional knowledge; (iii) while registering a pesticide, the Registration Committee apart from evaluating its safety and efficacy, would also be guided by factors like necessity, end use, risk involved and availability of safer alternatives; (iv) fixation of maximum residue limits for pesticides have been made mandatory.	Ministry of Agriculture and Farmers Welfare
Water (Prevention and Control of Pollution) Act 1974	The National Water Act is adopted in Uttarakhand State and no separate rules have been formulated specifically for Uttarakhand. This Act prohibits the discharge of pollutants into water bodies beyond a given standard and lays down penalties for noncompliance. The Water Act includes the maintenance or restoring the wholesomeness of the water. ¹	USPCB
Air (Prevention and Control of Pollution) Act 1981	The National Air Act is adopted in Uttarakhand State and no separate rules have been formulated specifically for Uttarakhand. This Act restricts the operation of any industrial plant in an air pollution control area without a valid consent.	USPCB
The Water (Prevention and Control of Pollution) Cess Act, 1977	This Act is notified to provide for the levy and collection of a cess on water consumed by persons carrying on certain industries and by local authorities, in order to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Act.	USPCB
Bio-Medical Waste Management	These rules apply to all persons/ agencies/ institutions that generate, collect, receive Guidelines for Handling, Treatment and Disposal of Waste Generated during Treatment/Diagnosis/ Quarantine of COVID-19 Patients, 2020	MoEFCC, CPCB, USPCB
Waste (Management and Handling) Rules, 1998 and Amendment Rules 2002 (2003)	Store, transport, treat, dispose, or handle bio-medical waste in any form. Institution generating bio-medical waste which includes a hospital, nursing home, clinic, dispensary, veterinary institution, animal house, pathological laboratory, blood bank by whatever name called to take all steps to ensure that such waste is handled without any adverse effect to human health and the environment. Bio-medical waste shall be treated and disposed of in accordance with Schedule I, and in compliance with the standards prescribed in Schedule V. Persons/ agencies/ institutions shall set up requisite bio-medical waste treatment facilities like incinerator, autoclave, microwave system for the treatment of waste, or ensure requisite treatment of waste at a common waste treatment facility or any other waste treatment facility.	USPCB
Municipal Solid Wastes (Management and Handling) Rules, 2000	These rules shall apply to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes. In these rules, unless the context otherwise requires, Municipal Solid Wastes (Management and Handling) Rules, 2000 are being implemented by the municipal authorities as these authorities are responsible for management of municipal solid waste (MSW). The rules are in force from September 2000. Local bodies are required to ensure that solid waste generated in city/town is managed in accordance with the provisions of the rule relating to collection, segregation, storage, transportation, processing and disposal. Central Pollution Control Board (CPCB) during the reporting year interacted with State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs) in union territories and provided feedback on various aspects of the Rule. SPCBs/PCCs persuaded local bodies to seek authorizations and formulate action plan for management of solid waste.	USPCB
C. Land Acquisition/ Involuntarily Resettlement		
Right to Fair Compensation and Transparency in Land	An Act to ensure a humane, participative, informed and transparent process for land acquisition for industrialization, development of essential infrastructural facilities and urbanization with the least disturbance to the owners of the land and other affected families. The Act notifies to provide fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition and	Government of Uttarakhand - District Collector(s)

¹ Average water pollution in Uttarakhand is shown in Attachment 10.2.1.

Law/ Policy	Description/ Outline	Responsible Ministry/ Agency
Acquisition, Rehabilitation and Resettlement Act, 2013	make adequate provisions for such affected persons for their rehabilitation and resettlement, and for ensuring that the cumulative outcome of compulsory acquisition should be that affected persons become partners in development leading to an improvement in their post-acquisition social and economic status and for matters connected therewith or incidental thereto.	
Uttarakhand Panchayati Raj Act, 2016	An Act to consolidate, amend and replace the law relating to Panchayats with a view to ensure effective involvement of the Panchayati Raj institutions in the local administration and developmental activities.	Government of Uttarakhand
D. Social Policies and Legislation		
Rights to Information Act, 2005	An Act to provide for a transparent system of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, the constitution of a Central Information Commission and State Information Commissions and for matters connected therewith or incidental thereto.	Ministry of Personnel, Public Grievances and Pensions, State Information Commissioner
Scheduled Tribes and other Traditional Forest Dwellers (Forest Rights) Act, 2006	The Forest Rights Act (FRA), 2006 recognizes the rights of the forest dwelling tribal communities and other traditional forest dwellers to forest resources, on which these communities were dependent for a variety of needs, including livelihood, habitation, and other socio-cultural needs.	Ministry of Tribal Affairs, MoEF&CC
Human- Wildlife Conflict Relief Distribution Fund-2012	The notification issued by the Uttarakhand State government is meant for compensating those who suffer injury, loss of life or damage to property that includes livestock as well as damage to agricultural crops. The notification specified amount of compensation for each category and subtype based on the injury or death caused by wild animals that include tiger, leopard, snow leopard, fox, wild elephant, bear, hyena, wild boar, crocodile, snake as well as damage to agriculture crops caused by elephant, wild boar, blue bull, sambhar, chital, and monkeys.	State Forest Department
Uttarakhand Hills Consolidation of Holdings and Land Reforms Act, 2016	An Act to provide the consolidation of agricultural holdings in hill areas of Uttarakhand for the enhancement of agriculture productivity, to provide commercial shape to agricultural and to create a self-employment opportunity from this procedure. Re-arrangement of holdings in a unit amongst several tenure holders in such a way as to make their respective holdings more compact. The extension of this Act shall apply except districts Haridwar and Uddham Singh Nagar and the plain areas of districts Dehradun, Tehri, Pauri, Nainital, and Champawat.	Department of Revenue, Department of Agriculture

Source: Compiled by JICA Study Team (2021) based on information indicated below:
<https://forest.uk.gov.in/forest-policy-and-laws>, <https://ueppcb.uk.gov.in/pages/display/59-environment-rules>
<https://revenue.uk.gov.in/pages/display/105--go-acts->, <https://health.uk.gov.in/pages/display/117-acts-rules-i>

10.3 Environmental Clearance

Environmental clearance (EC) of new projects in India is subject to the EIA Notification, 2006 that became effective from 14th September 2006. This notification is applicable to all states. The Ministry of Environment, Forest and Climate Change (MoEF&CC) has published the draft EIA Notification 2020, with the intention of replacing the existing EIA Notification, 2006 under the Environment (Protection) Act, 1986.

10.3.1 Environmental Impact Assessment

In 1994, for the first time, the EIA Notification, under the Environmental (Protection) Act (1986), was formulated, which made the process of EIA a “statutory requirement” rather than an “administrative requirement” for a number of projects/activities that are likely to have significant environmental impacts and health implications. Thereafter, the EIA Notification has undergone several amendments, whereby, the provisions for conducting public hearing has been incorporated, and several important projects/activities have been brought into the ambit of EIA, thus requiring an “Environmental Clearance” from the MoEF&CC. The EIA Notification 2006, and subsequently the draft EIA Notification 2020, were issued with further improvements in the EIA procedure. Further, an effort has also been made to make the EIA procedure more transparent and to provide societal vigil of projects affecting the environment through public hearing/consultation by moving the environment protection agenda into

public domain. In the draft notification (2020), revised threshold criteria were introduced for different categories of projects.

In this section, the processes adopted in India and the requirement for EC is described, although as per the review of the proposed project activities, it is unlikely that the Project will require any environmental clearances.

10.3.2 EIA System and Requirements

As per EIA Notification, 2006, the projects/ developmental activities have been broadly divided into eight major categories and thirty-nine sub categories that require EC either from the central government (MoEF&CC) or at the state level from the State Environmental Impact Assessment Authority (SEIAA). In the draft EIA Notification 2020 however, the list is modified into 43 categories. As per draft EIA 2020 notification, the categories along with thresholds for the related project components and activities that require prior EC, are described in Attachment 10.3.1.

All projects and activities are broadly categorized into two types, namely: Category A and Category B, where Category B is further subdivided into B1 and B2, based on the size/scale of the concerned projects as well as spatial extent of potential impacts on human health and natural/ man-made resources. The detailed stages prior to EC are highlighted below.

- 1) Category 'A' projects or development activities are mandated to conduct EIA studies along with conducting public consultation as per the procedure stipulated in the notification and EC is required from the central government or MoEF&CC.
- 2) For Category 'B' projects, screening is under the purview of the State Expert Appraisal Committee (SEAC) and the State Level Environmental Impact Assessment Authority (SEIAA) / Union Territory Level Environmental Impact Assessment Authority (UTEIAA) committee for decentralized procedure of EC. Further Category 'B' projects are divided into Category 'B1' and 'B2'.

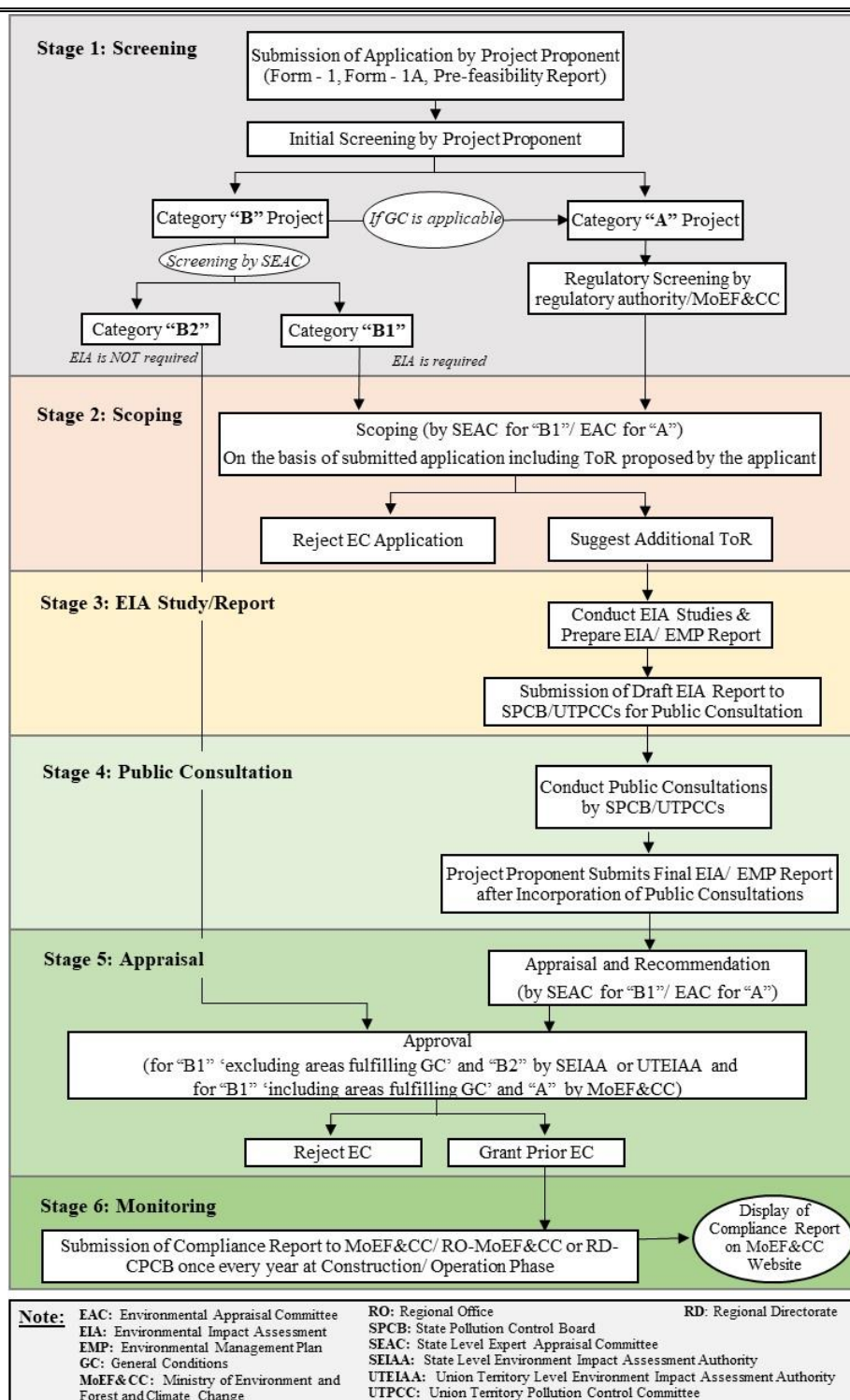
Under Category 'B1', there are two sub-types of projects:

- (a) 'B1' projects that exclude areas defined under 'General Conditions' shall require prior-EC from SEIAA or UTEIAA, as the case may be.
- (b) 'B1' projects that include areas defined under 'General Conditions' shall require prior-EC from the MoEF&CC without any changes in the category of the project.

Category 'B2' projects fall under the purview of the SEIAA or UTEIAA and do not require EIA. For 'B2' projects that are required to be placed before the Appraisal Committee shall require prior-Environmental Clearance (EC) from SEIAA or UTEIAA whereas, the rest of B2' category projects shall require prior-Environmental Permission (EP) from SEIAA or UTEIAA and shall not be placed before the Appraisal Committee.

10.3.3 Stages and Procedure to Obtain Environmental Clearance

As per EIA notification 2006 four stages of EC procedures were defined. On the other hand, as per draft EIA Notification 2020, broadly six stages of EC procedures were defined. For details of the stages for EC as per the draft EIA Notification 2020, please refer to Attachment 10.3.2. In order to maintain sanctity of both the notifications and for practicality and ease, the EIA has been divided into six stages in this report, i.e.; 1) Screening, 2) Scoping, 3) EIA Study, 4) Public Consultation, 5) Appraisal, and 6) Monitoring (Refer Figure 10.3.1).



Source: Compiled by the JICA Survey Team (2021) based on information from EIA Notification 2006 and draft 2020

Figure 10.3.1 Stages in the Environmental Clearance Procedure as per Draft EIA Notification 2020

The process of application for EC is given in Table 10.3.1. As part of transparency, all state-wise details of EC application, public hearing details for upcoming and approved Terms of Reference (ToR) are updated on the dedicated website of MoEF&CC.

Table 10.3.1 Process of Application for Prior EC as per the Draft EIA Notification 2020

Stage	Forms	Supplemented with	Applicability	Regulatory Authority
Scoping	Form-1	Pre-feasibility Report	All projects under Category 'A' and Category 'B1'.	Ministry: For the projects under Category 'A' and Category 'B1' (those which are defined in the General Conditions); and SEIAA or UTEIAA, as the case may be: For projects under Category 'B1' (those which are not defined in the General Conditions) and Category 'B2'.
Public Consultation	Simple letter addressed	(i) At least ten hard copies and a soft (electronic) copy of the Draft EIA Report prepared in English; and (ii) At least ten hard copies of summary of EIA Report in English and in the official language of the State or Union Territory or Regional language	All projects as given in subclause (1) of Clause 14 of this notification	Member Secretary of SPCB / UTPCC concerned.
Appraisal	Form-1	(i) Form-1A; and (ii) Conceptual Plan	All projects mentioned at column (5) under items 42 and 43 of the schedule	SEIAA or UTEIAA, as the case may be
	Form-1	(i) Form-1B2; (ii) EMP; (iii) Final Layout Plan; (iv) Feasibility Report or Mining Plan in case of mining projects; (v) District Survey Report in case of mining of minor minerals; and (vi) Cluster Certificate in case of cluster situation.	All projects falling under Category 'B2'.	SEIAA or UTEIAA, as the case may be.
	Form-2	(i) Final EIA Report; (ii) Copy of Feasibility Report or Approved Mining Plan in case of mining projects; (iii) Copy of final layout plan; (iv) Public consultation proceedings; (v) District Survey Report in case of mining of minor minerals; and (vi) Cluster Certificate in case of cluster situation; and (vii) Certificate of Compliance of Conditions earlier prior-EC or prior-EP, as the case may be, issued by the component authority in case of expansion or modernization proposals; and (viii) Other prerequisites as specified in sub-paragraph (5) of paragraph 17 of this notification.	All projects falling under Category 'A' or Category 'B1'.	Ministry: For the projects under Category 'A' and Category 'B1' (those which are defined in the General Conditions); SEIAA or UTEIAA, as the case may be: For the projects under Category 'B1' (those which are not defined in the General Conditions) and Category 'B2'

Source: Based on Draft EIA Notification (No. S.O.750(E) dated 17th February 2020) of MoEF&CC

10.3.4 Horticulture, Irrigation and Building Construction and Area Development Projects Requiring Prior Environmental Clearance

Based on the review of the DPR and further discussion with the Horticulture Department regarding the planned activities in the project, the details of similar project types like horticulture, irrigation and building construction/ area development projects, along with details of category and threshold limits as mentioned in the draft EIA Notification 2020 for requiring prior-environmental clearance, are listed in Table 10.3.2.

Figure 10.3.2 List of Projects Related to Horticulture, Irrigation and Building Construction Requiring Prior-Environment Clearance

Project		Category with Threshold Limit			Remarks
		A	B1	B2	
4	Irrigation	≥ 50,000 hectares of culturable command area	>10,000 hectares and	> 2000 hectares and < 10,000 hectares of culturable command area.	
19	Chemical fertilizers and standalone ammonia plants.	(i) All projects except single super phosphate including sulfuric acid. (ii) Standalone ammonia plants	Single super phosphate including sulfuric acid production.	-	
21	Pesticides including insecticides; herbicides; weedicides; pest control; and their specific intermediates (excluding formulations)	All projects located outside the notified industrial estates.	All projects located within the notified industrial estates.	-	
42	Building construction and area development projects	-	>1,50,000 m ² of built-up area and/or total land area of > 50 hectares	(i) >20,000 m ² and 50,000 m ² of built-up area (ii) > 50,000 m ² and < 1,50,000 m ² of built-up area projects having provisional 'certificate of green building' or relating to industrial sheds, educational institutions, hospitals and hostels for educational institutions	Note 1. Projects under (i) and (ii) of Column (5) shall not be referred to the Appraisal Committee. 2. Any change in the intended use, prior permission from the regulatory authority for amendment in the prior-EP shall be obtained. All such cases shall be referred to the Appraisal Committee.
				> 50,000 m ² and < 1,50,000 m ² of built-up area	Note: Projects under Column (5) shall be referred to the Appraisal Committee

Source: Based on the Draft EIA Notification (No. S.O.750(E) dated 17th February 2020) of MoEF&CC

Apart from sprinklers, there are no other irrigation developmental projects that are planned under the Project and as per draft EIA 2020, the threshold under irrigation projects is mentioned to cover >2,000 CCA, thus prior EC is not required. Also, there is no plan of establishment of chemical fertilizer plants.

The building infrastructure like training infrastructure, whose threshold limit in the draft EIA 2020 is set as >20,000 m² and 50,000 m² of built-up area, thus no EC is required.

10.3.5 Land Acquisition, Rehabilitation, and Settlement

Until 2013, GoI and the states were following the Land Acquisition Act, 1894. In the year 2007, GoI introduced the National Rehabilitation and Resettlement Policy. In November 2013, ‘The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act’ was passed by the Parliament. This objective behind the formulation of the Act was to bring in a transparent process of land acquisition through consultative and participatory approach for land acquisition with the least disturbance to the owners/families of the land with fair compensation and appropriate rehabilitation and resettlement of the families (refer Figure 10.3.2).



Source: JICA Survey Team (2021) based on information from RFCTLARR Act 2013

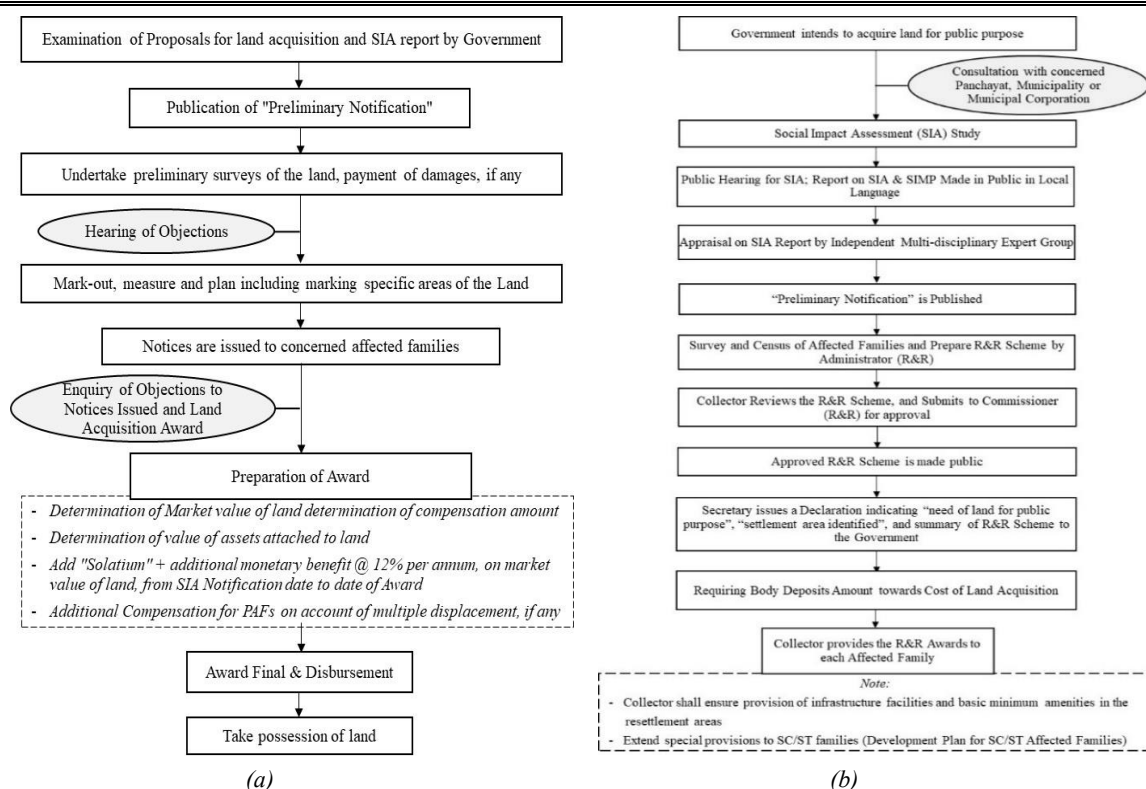
Figure 10.3.2 Objective of RFCTLARR Act 2013

The 2013 Act brought in several key changes to the process of land acquisition in the country.

- It increased the compensation provided to landowners, from 1.3 times the price of land to two times the price of land in urban areas, and two to four times the price of land in rural areas.
- Unlike the earlier act, which did not provide rehabilitation and resettlement (R&R), the 2013 Act provided R&R to landowners as well as to those families which did not own land, but were dependent on the land for their livelihood. The act permits states to provide higher compensation and R&R.
- It mandated that a Social Impact Assessment (SIA) be conducted for all projects, except for those land that are required urgently. An SIA assesses certain aspects of the acquisition such as whether the project serves a public purpose, whether the minimum area that is required is being acquired and the social impact of the acquisition.
- It mandated that the consent of 80% of landowners be obtained for private projects and the consent of 70% of landowners be obtained for public-private partnership projects. However, consent of landowners is not required for government projects.

On the 3rd of April 2015, the bill exempted five categories of projects, namely: (i) defense, (ii) rural infrastructure, (iii) affordable housing, (iv) industrial corridors (set up by the government/government undertakings, up to 1 km on either side of the road/railway), and (v) infrastructure projects, from this provision of the 2013 Act including the requirement of a social impact assessment and the limits that apply for acquisition of irrigated multi-cropped land, through issuing a notification.

The processes involved in land acquisition and involuntary resettlement are depicted in Figures 10.3.3.



Source: Compiled by the JICA Survey Team (2020) based on information from RFCTLARR Act 2013 and subsequent rules

Figure 10.3.3 (a) Process of Land Acquisition and (b) Process of Resettlement and Rehabilitation

Under the project, apart from sprinklers irrigation system, no other irrigation scheme type is proposed, and for setting up the required infrastructure for sprinklers on the private farmland land, written consent from the willing individuals shall be taken up. Thus, under the project, no anticipated resettlement and rehabilitation due to project activities would be required.

10.4 Environmental and Social Conditions

Baseline information pertaining to social and environmental conditions is very important to understand the perceived impact that the project activities might have on the local environment. The importance attached to baseline information does not depend on whether there will be any negative impact on the environment due to project and its activities and/or whether EIA is required or not. Thus, some key baseline data pertaining to the social and natural environment are represented in the subsequent sections.

10.4.1 Social Environment

This section describes the details of the socio-economic conditions and cultural perspectives of scheduled tribes (STs) in the state.

(1) Scheduled Tribes

The total scheduled tribe (ST) population of Uttarakhand is 291,903 representing around 2.89% of the state's total population. STs generally reside in rural areas and thus, the percentage increases slightly in terms of rural areas, i.e., 264,819 ST people representing 3.77% of the total rural population of Uttarakhand (based on 2011 Census Data).

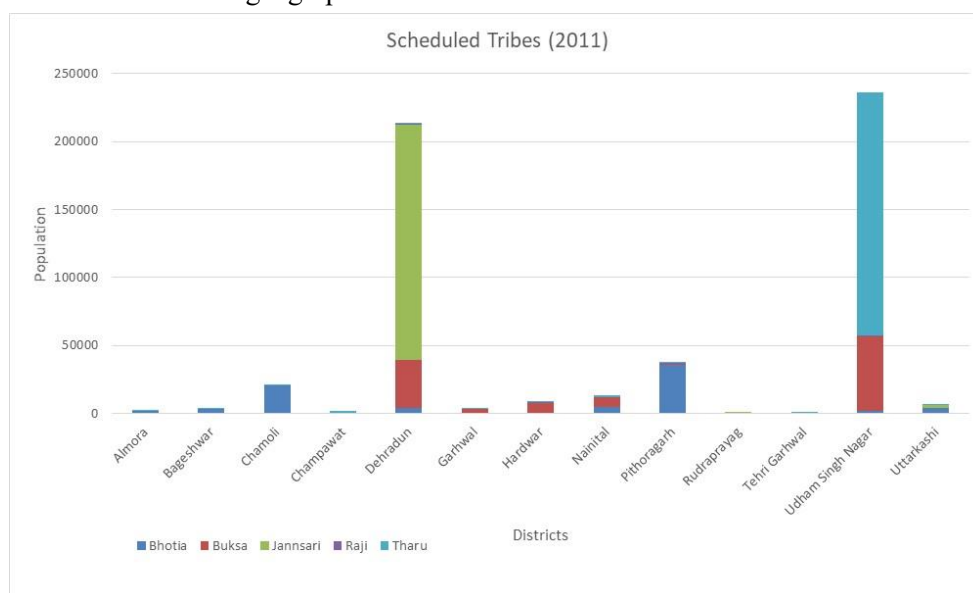
Five different ST groups are found in Uttarakhand: The Bhatia, Buksa, Jaunsari, Raji, and Tharu groups. As per 2011 census data, the Tharus are the largest of the five STs in Uttarakhand. They account for 31.29% of the ST population of the state, followed by Jaunsaris (30.37%), Buksas (18.51%), Bhotias (13.40%), Rajis (0.21%), and others account for 6.22%.

Table 10.4.1 Scheduled Tribe Populations in Uttarakhand, 2011

S.No.	Scheduled Tribe	Population	Proportion of State's Tribal Population (%)
1	Tharu	91,342	31.29
2	Jaunsari	88,664	30.37
3	Buksa	54,037	18.51
4	Bhotia	39,106	13.40
5	Raji	609	0.21
6	Other (<i>Anusuchit jan-jati, Girijan, Adivasi</i>)	18,145	6.22
Total		291,903	100

Source: Census of India (2011)

These tribal groups are generally found in specific geographical pockets. Based on the Census of India 2011 data, the majority of the ST population (92%) is concentrated in four districts, namely: Udham Singh (US) Nagar (43%), Dehradun (39%), Pithoragarh (7%), and Chamoli (4%). The figure below provides an illustration of the geographic distribution of STs in Uttarakhand.



Source: Compiled from data from Census of India 2011

Figure 10.4.1 Geographical Distribution of STs in Uttarakhand

The table below provides a summary description of each of the ST groups.

Table 10.4.2 Scheduled Tribes in Uttarakhand

	Group	Distribution	Description
Scheduled Tribes			
1	Buksa	Tarai-Bharbar Region	Defined as a Primitive Tribal Group (PTG), the Buksa have suffered from extensive land alienation as outside settlers settled in the Tarai. As a result, most Buksas work as landless farmers. Mulberry trees are commonly grown for sericulture as well as fruit trees
2	Tharu	Tarai-Bharbar Region (particularly US Nagar and Champawat Districts)	Tharus are a settled tribe found mainly in the Tarai and low hill areas. There are well-documented ongoing conflicts over land rights particularly in US Nagar as this tribe lost land many decades ago to Uttarakhandis and other settlers. Agriculture is the mainstay of their livelihoods.
3	Bhotia	Higher altitudes of Pithoragarh, Bageshwar, Chamoli and Uttarkashi districts	The name Bhotia is actually in reference to a geographic area, Bhot, used by the British in the colonial era. The people themselves dislike the term and should actually be addressed as the Marchas, Tolchas, Johari Saukas, Dannians, Chaudansis, and Byansis. These people migrate seasonally to graze goats and sheep from which they produce wool, their primary livelihood.
4	Raji	Pithoragarh	The Rajis are a PTG, very small in number, occupying the high-

	Group	Distribution	Description
	(Van Rawat)	District	altitude regions in Pithorgarh and in Nepal. They have their own dialect, live in seclusion, and have a very close relationship with forests and other natural resources. Rajis derive an important part of their diet from fishing using long cloths.
5	Jaunsari	Chakrata and Kalsi Blocks, Dehradun District	The only ST group that occupies the mid-hills region. They maintain distinctive dress but they are a settled tribe, participate actively in Panchayati institutions (although they also have their own governance system, the Khat) and many are well-educated. They maintain large herds of cattle and goats and depend on forest resources for timber for house construction, firewood and fodder.

Source: JICA Preparatory Survey Team (Information compiled from various sources²)

10.4.2 Natural Environment

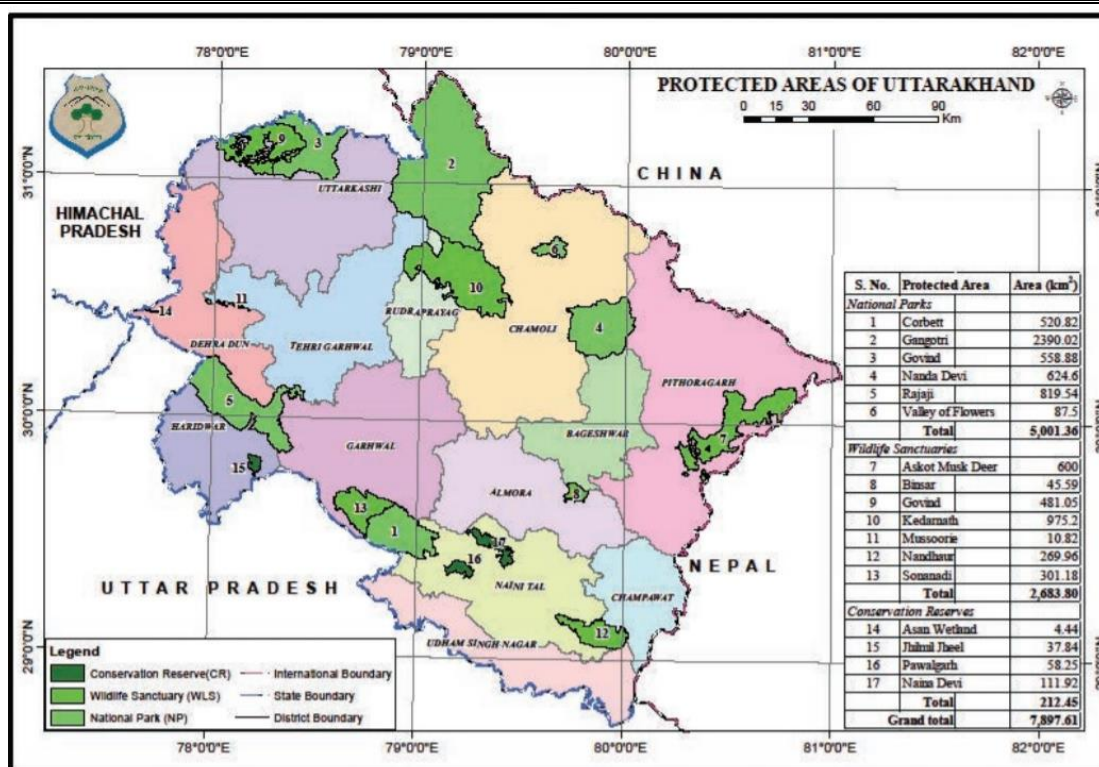
(1) Protected Areas

In the state of Uttarakhand, there are a total of 17 protected areas, out of which six are national parks covering an area of 4,915.02 km², seven wildlife sanctuaries covering an area of 2,690.12 km², and four conservation reserve covering an area of 212.45 km².

Table 10.4.3 Protected Areas of Uttarakhand

	Name of Protected Area	Protected Area	Year of Notification	Area (in km ²)
1	Corbett	National Park	1936	520.82
2	Gangotri	National Park	1989	2390.02
3	Govind	National Park	1990	472.08
4	Nanda Devi	National Park	1982	624.6
5	Rajaji	National Park	1983	820
6	Valley of Flowers	National Park	1982	87.5
7	Askot	Wildlife Sanctuary	1986	600
8	Binsar	Wildlife Sanctuary	1988	47.07
9	Govind Pashu Vihar	Wildlife Sanctuary	1955	485.89
10	Kedarnath	Wildlife Sanctuary	1972	975.2
11	Mussoorie	Wildlife Sanctuary	1993	10.82
12	Nandhaur	Wildlife Sanctuary	2012	269.96
13	Sonanadi	Wildlife Sanctuary	1987	301.18
14	Asan Wetland	Conservation Reserve	2005	4.44
15	Jhilmil Jheel	Conservation Reserve	2005	37.84
16	Naina Devi Himalayan Bird	Conservation Reserve	2015	111.92
17	Pawalgarh	Conservation Reserve	2012	58.25

Source: Forest Department, Government of Uttarakhand



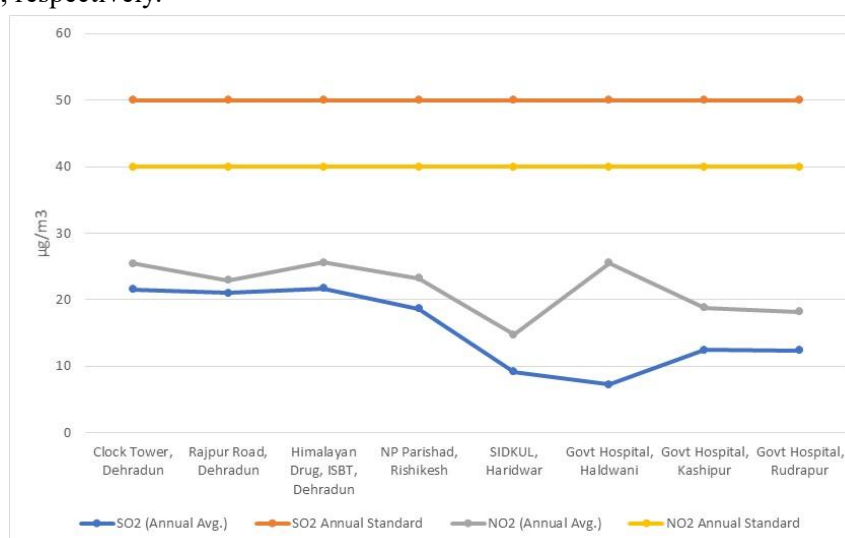
Source: Forest Department, Government of Uttarakhand

Figure 10.4.2 Geographical Distribution of STs in Uttarakhand

(2) Ambient Air Quality

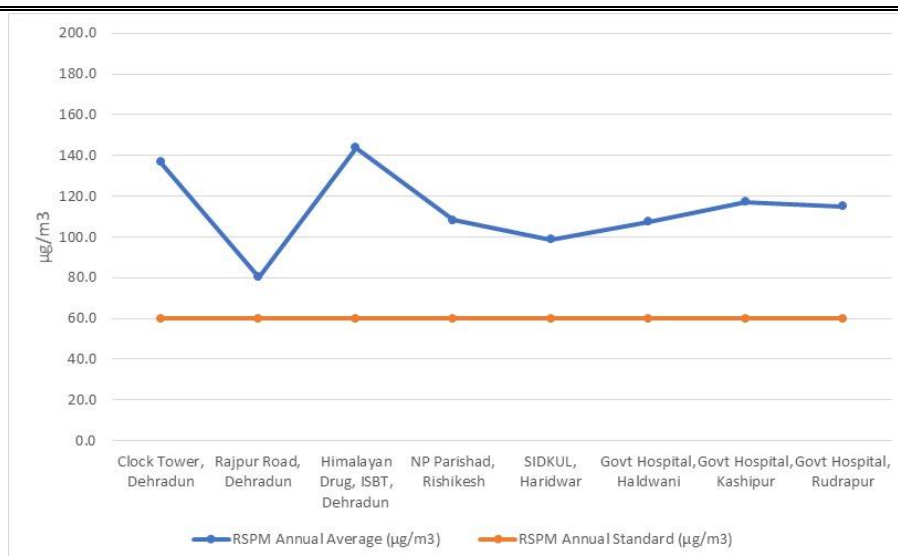
In Uttarakhand State, ambient air quality is being monitored in six towns/cities, namely: Dehradun, Rishikesh, Haridwar, Haldwani, Kashipur, and Rudrapur. As per the notification dated 18 November 2009 on the National Ambient Air Quality Standards by the Central Pollution Control Board, the air quality standards have been fixed for a 24-hour average including 100 $\mu\text{g}/\text{m}^3$ for Respirable Suspended Particulate Matter (RSPM), 80 $\mu\text{g}/\text{m}^3$ for SO_2 , and 80 $\mu\text{g}/\text{m}^3$ for NO_2 , while the annual average standard fixed is 60 $\mu\text{g}/\text{m}^3$ for RSPM, 50 $\mu\text{g}/\text{m}^3$ for SO_2 , and 40 $\mu\text{g}/\text{m}^3$ for NO_2 .

The data collected in all the stations for the year 2020 were scrutinized against the annual standards for eight locations, and the trends of annual average of RSPM and SO_2 and NO_2 are shown in Figure 7.4.3 and Figure 7.4.4, respectively.



Source: Compiled by the JICA Survey Team (2021) based on data from USPCB

Figure 10.4.3 Annual Average of SO_2 and NO_2 in Uttarakhand State in 2020



Source: Compiled by the JICA Survey Team (2021) based on data from USPCB

Figure 10.4.4 Annual Averages of RSPM in Uttarakhand State in 2020

The annual average values of SO₂ and NO₂ in all the stations were well below the permissible annual average standard values. The highest peak values of 21.72 µg/m³ for SO₂ and 25.57 µg/m³ for NO₂ were recorded from the station at Himalayan Drug, ISBT in Dehradun.

On the other hand, the average annual values for RSPM levels recorded were above the permissible limits in all eight monitoring stations and the highest values recorded from two locations in Dehradun, i.e., 143.9 µg/m³ and 136.9 µg/m³ from the station at Himalayan Drug, ISBT and Clock Tower, respectively.

(3) Ambient Noise Level

Noise pollution is often misunderstood as sound pollution. Sound is pure tune, harmonic, with fixed frequencies and amplitudes, occurring at regular intervals, producing meaningful communication and pleasure in hearing. “Unwanted sound” is noise, having a complex mix of pure tones of various frequencies and amplitudes. These sound waves fluctuate and repeat themselves in highly haphazard manner. Folks from cities, towns, and even villages are increasingly exposed to various sources of noise pollution, namely, loudspeakers, public address system, amplified music especially during social functions, movement of vehicles, blowing of horns, and in factories and industries.

The state board regularly conducts ambient noise monitoring for 11 areas/zones spread over the entire state.

Table 10.4.4 Noise Level Standards

Area Code	Category of Area	Limit in dbA	
		Day	Night
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Source: Compiled by the JICA Survey Team (2021) from The Noise Pollution (Regulation and Control) Rules, 2000

(4) Water Quality

Water quality data reflects the level of impacts on water quality and helps in ascertaining the nature and extent of pollution control measures that are required. The Central Pollution Control Board is sponsoring the water quality monitoring of major rivers of the state through its national program, namely, the Monitoring of National Aquatic Resources (MINARS). The objective of MINARS is to standardize the measurement of identified parameters in order to define the status and trends of water quality. Under the MINARS, systematic procedures of collection, preservation and transportation, storage, analysis of water samples and dissemination of data are followed for sample locations from natural water bodies

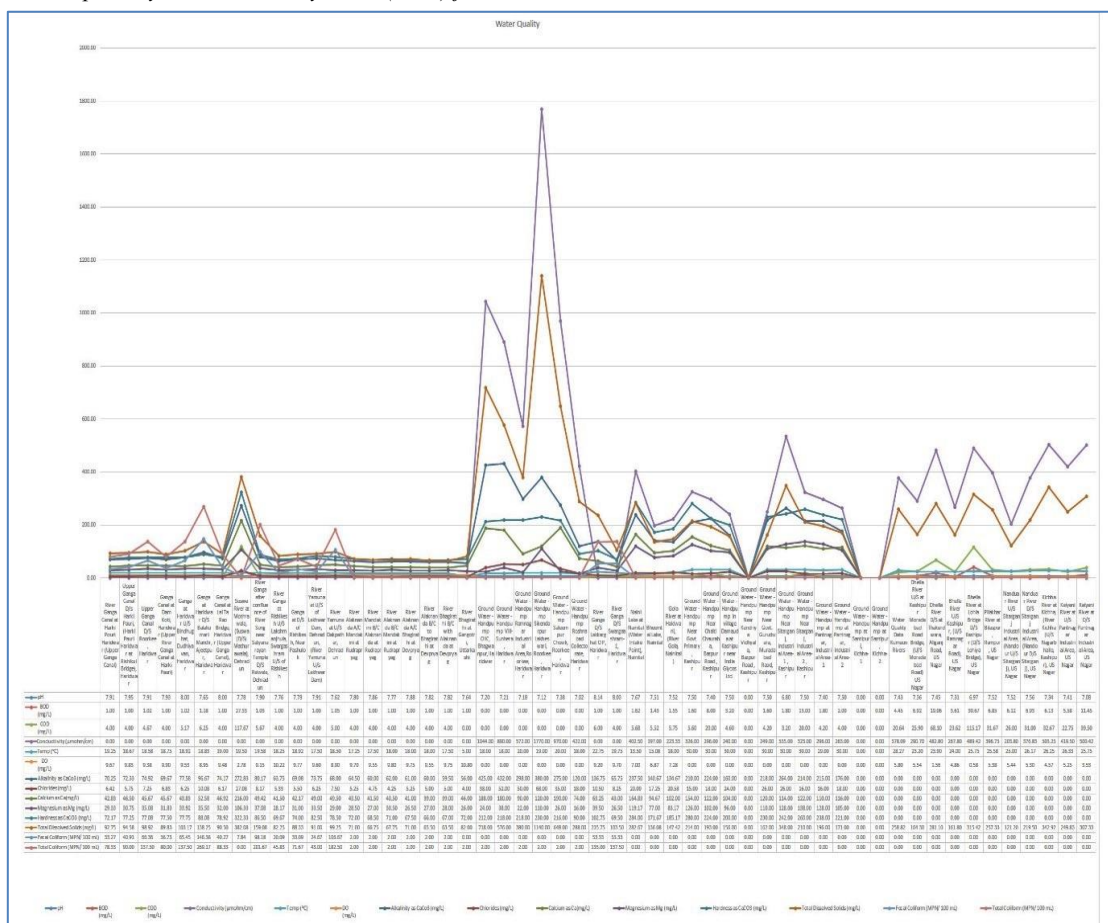
(surface and ground water). The State Pollution Control Board in collaboration with the Central Pollution Control Board (CPCB) is carrying out water quality monitoring at 58 locations in the state. Regular monitoring of water quality is being carried out and data are being forwarded to the CPCB. Table 10.4.5 depicts the criteria for primary water quality.

Table 10.4.5 Primary Water Quality Criteria

Designated Best Use	Class of Water	Criteria
Drinking Water Source Without Conventional Treatment but After Disinfection.	A	1. Total coliform organism MPN/100 ml shall be 50 or less. 2. pH between 6.5 and 8.5. 3. Dissolved oxygen, 6 mg/l or more 4. Biochemical oxygen demand, 5 days 20°C 2 mg/l or less.
Outdoor Bathing (Organized)	B	1. Total coliform organism MPN/100 ml shall be 500 or less. 2. pH between 6.5 and 8.5. 3. Dissolved oxygen, 5 mg/l or more. 4. Biochemical oxygen demand, 5 days 20°C 3 mg/l or less.
Drinking Water Source After Conventional Treatment and Disinfection	C	1. Total coliform organism MPN/100 ml shall be 5,000 or less 2. pH between 6 and 9. 3. Dissolved oxygen, 4 mg/l or more. 4. Biochemical oxygen demand, 5 days 20°C 3 mg/l or less.
Propagation of Wildlife and Fisheries	D	1. pH between 6.5 and 8.5. 2. Dissolved oxygen, 4 mg/l or more. 3. Free ammonia (as N), 1.2 mg/l or less.
Irrigation, Industrial Cooling Controlled Waste Disposal	E	1. pH between 6.5 and 8.5. 2. Electrical conductivity at 25°C micro mhos/cm max. 2,250 3. Sodium absorption ratio max. 26. 4. Boron max 2 mg/l.

Note: If three parameters fall in Category 'A' but fourth parameter falls in Category C. The overall quality of the river will fall under Class 'C'

Source: Compiled by the JICA Survey Team (2021) from CPCB and UEPPCB



Source: Compiled by the JICA Survey Team (2021) based on data from USPCB

Figure 10.4.5 Annual Averages of Water Quality Parameters in Uttarakhand State in 2019

10.4.3 Man-Animal Conflict

Man-animal conflict is defined by the World Wide Fund (WWF) as the interaction between humans and wildlife that results in any kind of negative impact affecting human's social, economic or cultural life, on the conservation of wildlife populations, or on the environment. In case of Uttarakhand, the man-animal conflict is one of the common problems that still bother planners and the conservationists to strike a right balance between development and conservation as well as for remedial measures. In Uttarakhand, out of the total human death caused by wild animals, around 50% cases are caused by leopards. Maximum number of human deaths are reported from Shiwalik (20.4%), North Kumaun (19.7%), and Western (16.6%) Forest Circle.

**Table 10.4.6 Human Deaths Caused by Wild Animals in Uttarakhand
(Jan. 2000 to Jul. 2021)**

	Forest Circle	Forest Division	Human Death Caused by Wild Animal (No.)						
1	Corbett Tiger Reserve	Kalagarh Tiger Reserve FD	2	4	2	0	1	0	9
2		Ramnagar Tiger Reserve FD	2	5	16	1	2	0	26
3	Rajaji Tiger Reserve	Rajaji Tiger Reserve	19	17	0	0	1	0	37
4		Govind WLS NP FD	0	0	0	2	0	0	2
5		Gangotri NP	0	0	0	0	0	0	0
6	Nanda Devi Biosphere Reserve	Nandadevi NP FD	5	0	0	4	2	0	11
7		Kedarnath WLS FD	29	0	0	3	6	0	38
8	South Kumaon	Nainital FD	17	0	0	1	6	1	25
9	North Kumaon	Almora FD	32	0	0	3	15	4	54
10		Bageshwar FD	14	0	0	0	8	1	23
11		CS Almora FD	13	0	0	0	0	1	14
12		Champawat FD	23	1	0	0	2	2	28
13		Pithoragarh FD	49	0	0	1	10	6	66
14	Western	Haldwani FD	0	9	4	0	5	0	18
15		Tarai Central FD	0	6	0	0	19	0	25
16		Tarai East FD	3	19	17	1	30	5	75
16		Tarai West FD	3	4	6	0	11	1	25
18		Ramnagar FD	2	3	3	0	5	0	13
19	Yamuna	Mussorrie FD	4	0	0	4	1	0	9
20		Chakrata FD	0	0	0	0	1	0	1
21		Upper Yamuna Barkot FD	3	0	0	1	0	0	4
22		Tons FD	2	0	0	0	0	0	2
23	Shiwalik	Dehradun FD	10	43	0	0	3	0	56
24		SC Kalsi FD	0	0	0	1	0	0	1
25		Lansdowne FD	52	27	0	5	0	0	84
26		Haridwar FD	7	42	0	0	0	2	51
27	Bhagirathi	Narendranagar FD	28	10	0	2	0	1	41
28		Tehri FD	31	0	0	5	1	0	37
29		Uttarkashi FD	11	0	0	3	6	0	20
30	Garhwal	Badrinath FD	11	0	0	9	0	0	20
31		Garhwal FD	75	0	0	12	5	5	97
32		Rudrapryag FD	23	0	0	1	2	2	28
Grand Total			470	190	48	59	142	31	940

Source: Compiled by the JICA Survey Team (2021) based on data from Chief Wildlife Warden, UKFD

On the other hand, the maximum number of human injuries in the state caused by bears and leopards stands at 38% and 33%, respectively. Maximum number of human injuries are reported from Garhwal (27.35%), North Kumaon (22.81%), and Bhagirathi (13.31%) Forest Circles (Refer Table 10.4.7).

Table 10.4.7 Human Injury Caused by Wild Animal (Year Jan. 2000 to Jul. 2021)

	Forest Circle	Forest Division	Human Injury Caused by Wild Animal (No.)						
1	Corbett Tiger Reserve	Kalagarh Tiger Reserve FD	9	5	5	5	0	2	26
2		Ramnagar Tiger Reserve FD	23	17	28	5	10	7	90
3	Rajaji Tiger Reserve	Rajaji Tiger Reserve	23	2	0	7	0	0	32
4		Govind WLS NP FD	6	0	0	61	0	0	67
5		Gangotri NP	0	0	0	0	0	0	0
6	Nanda Devi Biosphere Reserve	Nandadevi NP FD	22	0	0	112	4	2	140
7		Kedarnath WLS FD	55	0	0	142	4	11	212

	Forest Circle	Forest Division	Human Injury Caused by Wild Animal (No.)						
8	South Kumaon	Nainital FD	52	0	0	30	30	15	127
9	North Kumaon	Almora FD	148	0	0	23	23	68	262
10		Bageshwar FD	116	0	0	27	9	38	190
11		CS Almora FD	35	0	0	1	1	48	85
12		Champawat FD	32	1	0	24	0	22	79
13		Pithoragarh FD	134	0	0	76	77	72	359
14	Western	Haldwani FD	3	8	2	6	21	1	41
15		Tarai Central FD	0	3	3	0	33	0	39
16		Tarai East FD	28	9	8	54	18	32	149
16		Tarai West FD	29	9	25	0	27	6	96
18		Ramnagar FD	15	6	23	5	52	8	109
19	Yamuna	Mussorrie FD	2	0	0	12	0	6	20
20		Chakrata FD	3	0	0	6	0	0	9
21		Upper Yamuna Barkot FD	13	0	0	28	0	2	43
22		Tons FD	6	0	0	5	0	1	12
23	Shiwalik	Dehradun FD	33	14	0	2	14	7	70
24		SC Kalsi FD	0	0	0	0	0	9	9
25		Lansdowne FD	61	54	0	7	1	15	138
26		Haridwar FD	64	51	1	97	15	21	249
27	Bhagirathi	Narendranagar FD	48	12	1	74	1	9	145
28		Tehri FD	111	0	0	80	0	45	236
29		Uttarkashi FD	56	0	0	118	9	31	214
30	Garhwal	Badrinath FD	29	0	0	322	2	4	357
31		Garhwal FD	196	0	0	256	78	100	630
32		Rudrapryag FD	119	0	1	96	0	20	236
Grand Total			1471	191	97	1681	429	608	4471

Source: Compiled by the JICA Survey Team (2021) based on data from Chief Wildlife Warden, UKFD

The compensation provided by the Uttarakhand Forest Division (UKFD) as per the guideline on man – animal conflict - 2012 is given in Table 10.4.8. The trend shows that the cases of crop damage received in a financial year are showing an increasing trend from 242.57 ha in 2018-19 to 435.29 ha in 2020-21. Similarly, cases obtained in a Financial Year (FY) for human death and injury are also on a rise between 2018-19 to 2020-21 from 294 to 454 cases, respectively.

Table 10.4.8 Man Wildlife Conflict - Settled Cases and Amount Distributed

Year	Type of Damage	Cases Obtained in Financial Year	Remaining Cases of Last Year	Total	Disposed of Cases	Funds Distributed by Divisions (Rs in Lakh)	Total Funds (Rs in Lakh)
2018-19	Human Death (No.)	60	29	89	68	199.80	1155.69
	Human Injury (No.)	234	123	357	287	65.12	
	Loss of domesticated animal (No.)	3315	10673	13988	5372	790.55	
	Crop Damage (Ha)	242.57	1104.27	1346.85	914.85	94.34	
	House Damage (No.)	81	31	112	59	5.88	
2019-20	Human Death (No.)	68	21	89	69	208.80	1770.33
	Human Injury (No.)	304	70	374	267	62.00	
	Loss of domesticated animal (No.)	4364	8616	12980	9803	1403.09	
	Crop Damage (Ha)	306.07	432.00	738.07	549.47	83.93	
	House Damage (No.)	110	53	163	144	12.51	
2020-21	Human Death (No.)	81	20	101	80	243.80	1203.04
	Human Injury (No.)	373	107	481	361	82.84	
	Loss of domesticated animal (No.)	6469	3177	9646	5665	796.83	
	Crop Damage (Ha)	435.29	188.60	623.89	403.26	72.58	
	House Damage (No.)	82	19	101	81	6.99	
2021-22 Till July	Human Death (No.)	29	21	50	21	86.70	260.11
	Human Injury (No.)	83	120	203	75	17.87	
	Loss of domesticated animal (No.)	1773	3981	5754	812	148.77	
	Crop Damage (Ha)	90.36	220.63	311.00	19.89	4.47	
	House Damage (No.)	21	20	41	25	2.31	

Source: Compiled by the JICA Survey Team (2021) based on data from the Chief Wildlife Warden, UKFD

10.5 Institutional Arrangement and Capacities of Implementing Agency for Environmental and Social Considerations

10.5.1 Overview

The Uttarakhand Horticulture Development Society (UKHDS) will be the implementing agency (IA) for this project and will execute the proposed activities. All activities of the Project shall be implemented in accordance with the legislation system at the national and state level, which provides clear guidelines and procedures for environmental and social safeguards. However, UKHDS does not have dedicated units or personnel for implementation of environmental procedures such as screening, categorization, and environmental review as per prevailing laws and regulations.

In this regard, the Environmental Social Assessment Framework (ESAF) shall be the principal document to serve as an instrument to guide the IA on undertaking the necessary environmental and social due diligence on each project activity. It would provide the basis for detailed procedures for screening, categorization, and environmental review of the Project and its activities. For the implementation of ESAF, the IA will assign nodal officers for environmental and social safeguards.

10.5.2 Institutional Arrangement

Under the Project, most of the aspects related to environmental and social issues and protection are to be managed by the IA, i.e., Uttarakhand Horticulture Development Society (UKHDS) through the institutions responsible for horticulture development, i.e., Department of Horticulture and Food Processing (DHFP) along with the support from the supporting institutions under Department of Agriculture (DoA) and other agencies involved in different environmental and social safeguard aspects or issues. The Department of Horticulture and Food Processing (DHFP) is responsible for overall planned intervention in the Project, legal/policy development, ensuring adequate consultation and participation, inclusion of vulnerable groups such as STs, small-scale and marginal farmers, and women-headed households, in planning and implementation and the equitable distribution of benefits associated with site-level project interventions. The district administration is the designated agency responsible for land administration, land acquisition, disbursement of compensation and providing Resettlement and Rehabilitation (R&R) benefits to the project-affected families.

The ESAF will be implemented through the institutional structure of the Project and a director/officers at each administrative level shall be appointed as focal persons for ESAF compliance. Table 10.5.1 highlights the institutional structure for ESAF with key environmental and social management roles and responsibilities.

Table 10.5.1 Institutional Structure for ESAF Implementation and Monitoring

• Institution	• Role in the Project	• (Additional) Role and/or Responsibility in ESAF
Uttarakhand Horticulture Development Society (UKHDS)	- Decision-making body - Lay down the broad policy framework for functioning of the society - Review the society's performance - All administrative and financial powers - Monitor utilization of funds	- Overall supervision of the ESAF and its implementation and M&E - Facilitation and coordination with various line departments and other agencies - Provide directions/advice to the PMU and DIU to ensure smooth/ efficient project operation on environment and social consideration - Periodical checks and due diligence on safeguards reports and monitoring data.
Project Management Unit (PMU) at State Level	- Project implementation, supervision and monitoring of all activities. - Documentation and reporting	- Owner and implementation of ESAF - Report to concerned departments in the state government as well as to JICA in relation to environmental and social considerations - Information disclosure through project information brochures and project homepage. - Consultation and guidance to DPD/DIU/Federation of Farmers Organizations (FPO, FPC, F-SHG, MPAC) and field level officers on information disclosure and consultation - Technical guidelines on beneficiary selection, safeguard checks/ guidelines for particular

• Institution	• Role in the Project	• (Additional) Role and/or Responsibility in ESAP
		activities (if required) - Development of planning/ monitoring forms, review of monitoring data, reporting, assistance with evaluations - Finalize criteria for categorization (Category B or C) as per JICA Guidelines as well as exclusion criteria - Review of participatory environmental and social assessments - Performance of due diligence follow-up - Guide, instruct, prepare guidelines, establish and operate M&E, disseminate project information, hand-holding support in the field for all project activities.
DPDs (Monitoring and Evaluation and Infrastructure Development)	- Support the PMU and facilitate project implementation at state level, and would extend all technical inputs and guidance to the DIU level as and when required, and through regular review meetings, frequency of which to be determined during the preparatory phase of the Project	- Coordinate, monitor and supervise the ESC-relevant activities at state level, including the screening and selection of subprojects and determination of the required procedures for specific subprojects following the guidance/instruction of the PMU - Liaise with other line departments at the appropriate level for inter-sector convergence - Provide any specific support required for implementation and monitoring of the Project
District Implementation Unit (DIU)	- Function as the dedicated and extended wing of the PMU for project implementation at the district level and as a subordinate office of the autonomous society. - Facilitate project implementation at the district level, and would extend all technical inputs and guidance to the Federation of Farmers Organizations (FPO, FPC, FSHG, MPAC, etc.)	- Coordinate, monitor and supervise the ESC relevant activities at the district level - Conduct the screening and selection of subprojects and determine the required procedures for specific subprojects following the guidance/instruction of the PMU - Liaise with other line departments at the appropriate level for inter-sectoral convergence - Provide any specific support required for implementation and monitoring of the Project - Coordinate with subject matter experts
Project Operation and Management Office at DIU	- Support the DIU and facilitate project implementation at district level, and would extend all technical inputs and guidance to the field level organizations as and when required and through regular review meetings, frequency of which to be determined during the preparatory phase of the Project	- Coordinate, monitor and supervise the ESC relevant activities at the district level, including the screening and selection of subprojects and determination of the required procedures for specific subprojects following the guidance/instruction of DMU - Liaise with other line departments at the appropriate level for inter-sector convergence - Provide any specific support required for implementation and monitoring of the Project.
Field Level		
Federation of Farmers Organizations (FPO, FPC, FSHG, MPAC, etc.)	- Assist in selecting target beneficiaries - Clarify local needs and expectations on the Project	- Conceive and raise awareness in the locality on environmental and social considerations. - Provide support in micro planning activities at the subproject level - Participate in environmental and social assessments - Support public consultation and due diligence checks

Source: Prepared by the JICA Survey Team (2021)

As mentioned earlier, UKHDS or DHFP does not have any dedicated units or personnel for the purpose of ESC. Hence, one specialist in the PMC and nodal officers will support the PMU and DIU for the compliance of the environmental and social safeguards for its smooth and efficient implementation such as environmental and social assessment, and management and monitoring of the environmental and social aspects within the ambit of the Project, which are proposed as follows:

PMC member - Safeguards Expert: The expert needs to be deployed under the Project Management Consultant (PMC) to assist the PMU and DIU on ESC issues of the Project. The expert is expected to support the PMU and DIU to review the project activities with focus on the compliance on ESAF, provide guidance and technical advice to the PMU and DIU for required environmental and social safeguard measures, as well as reporting to JICA to ensure smooth and efficient implementation of environmental and social safeguard measures.

Nodal Officers - DPD, Monitoring and Evaluation and DPD, Institutional Development at PMU and Project Operation and Management Officer at DIU: The project officers shall be engaged on contractual basis with the PMU and DIU from the initial preparatory phase of the Project. This is to assist the PMU and DIU gain a head start with safeguard-related actions while waiting for the PMC Expert to be deployed. Once the project implementation begins, the nodal officers shall maintain the continuity of the introduced processes/measures during the intermittent period when the PMC Expert is not mobilized to the Project. The nodal officers will report to the Director under PMU who would be holding the additional charge to ensure the compliance of ESC. The officers will assist the PMU and DIU in the following aspects:

- i) To facilitate and coordinate with various implementation and line departments;
- ii) To update and finalize ESAF;
- iii) To develop appropriate training materials on environmental and social safeguards, following the requirements in ESAF;
- iv) To provide training courses and capacity enhancement at the different levels of stakeholders who will be designated with the responsibilities to ensure implementation of environment and social safeguards; and
- v) To supervise/ manage the project activities to ensure that the required procedures indicated in ESAF are followed properly. The experts may also be required to follow-up in the field, where particular issues are identified and report to PMU.

The institutional arrangement for safeguard monitoring system is more or less similar to the project component monitoring system. At the field level, monitoring and reviews will be conducted by the respective level implementing organization and report to DIU. Then, the DIU Officer shall compile the monitoring results that need to be reviewed regularly and report to the PMU, which shall analyze the result and share to the concerned departments in the state government as well as in a form of annual report to JICA. The organization chart cum safeguard flow is shown in Attachment 10.5.1.

10.5.3 Draft Environmental and Social Management System Checklist

As mentioned above, the PMU shall mobilize nodal officers at the preparatory phase of the Project and the experts shall support the PMU and DIU for the finalization of the ESAF document, which fully addresses all issues arising under the Project and its activities/subprojects. Mitigation measures will be built into the project component design and implementation. Under the Project, as mentioned above, the overall coordination and support for ESAF will be provided through the PMU headed by the Director, who would be entrusted with additional responsibility to ensure implementation and monitoring and compliance of the ESAF during the project implementation. Under the supervision of the PMU, nodal officers (Deputy Project Directors (DPDs)) will look after the environmental and social safeguard aspects in support with the Subject Matter DPDs for their activities in each designated work field. In order to examine the proposed institutional arrangement and enhance its system, the draft Environmental Social Management System (ESMS) checklist for the Project has been prepared and depicted in Attachment 10.6.1-1.

10.6 Draft Environmental and Social Impact Assessment Framework (ESAF)

10.6.1 Overview

Under the Project, it is anticipated to have multi-sectoral interventions and activities, that would be implemented at several sites with many subprojects and activities, although many of these are yet to be defined in detail w.r.t site location, size/scope of the activity. In these circumstances, it would be inappropriate at this stage of the project preparation to assess the environmental and social impacts and

propose detailed management and mitigation measures. Considering the present status, the JICA Survey Team, however, assessed the broad types of activities proposed and outlined the procedures to manage and mitigate potential risks associated with the activity during the project implementation. Accordingly, ESAF, which provides guidance on the appropriate management and mitigation measures against environmental and social risks, was prepared as the main safeguard instrument considering the existing environmental and social management systems in India and Uttarakhand State as well as the JICA requirements.

10.6.2 Structure

The ESAF of the Project is structured as follows, while the draft ESAF with detailed measures and procedures is presented in Attachment 10.6.1.

- i) **Project Summary Description** will describe the project objectives, project components and expected outcomes, and phasing of Project.
- ii) **Environmental and Social Safeguard Policies of JICA:** briefly describes JICA's environmental and social safeguard policies, and clarifies how the Project shall be categorized and what types of measures will be required.
- iii) **Existing Environmental and Social Management Systems:** Outline the legal and policy context for environmental and social safeguard in India as well as in the Uttarakhand State.
- iv) **Environmental and Social Considerations and Potential Impacts:** details-out the environmental and social considerations within the Project and assessment of positive and negative impacts.
- v) **Environmental and Social Management Measures and Monitoring:** explains the procedures to be followed to manage and monitor environmental and social aspects.
- vi) **Environmental Management Plan and Environmental Monitoring Plan:** describes the management measures adopted for various environmental concerns, risks associated with the Project/ subproject activities and monitoring plans to address environmental concerns (a draft monitoring form is Attachment 10.6.2).
- vii) **Institutional Arrangement and Capacity Development for ESAF:** identifies the recommended institutional arrangement and capacity development and training requirements for effective implementation of the ESAF.
- viii) **Consultations and Participation:** describes the mechanisms for consultations and participation.
- ix) **Grievance Redress Mechanism:** identifies the available and suggested mechanisms for grievance redressal, and
- x) **Cost Estimation and Budget Allocation:** identifies the required cost to implement ESAF, with the estimation of the necessary human resources and capacity development program, and its budget allocation.

10.6.3 Target Social Groups

The ESAF shall be applicable to all communities and people from all social groups within the project area. The draft framework is designed to ensure their participation in the course of the project implementation and include as beneficiaries as well as to avoid/mitigate any negative impacts due to the Project and its activities. The ESAF indicates the key groups identified in the framework to address environmental and social considerations. It should be noted that an individual or household may be categorized into more than one of the categories.

10.7 Recommendation of Inclusion of Environmental and Social Consideration in the Model DPR

Referring to the EIA Notification (2006), all projects and activities are broadly categorized into three categories, i.e., Category A, B1, and B2, based on the spatial extent of potential impacts on human health as well as natural and man-made resources. In case a project is classified as Category B2, environmental survey and environmental clearance issued by the State Environment Impact Assessment Authority are not necessary. The Project has several activities, e.g., installation of irrigation system and introduction of new crop, but the area of the subproject is not large, only about 100 ha. Therefore, the Project might be classified as Category B2. However, improvement of agricultural chemicals (pesticides and fertilizers) may cause deterioration of

groundwater. Introduction of facilities may cause air pollution and noise. Thus, environmental and social impacts should be considered after the selection of subprojects with further information.

JICA has classified the project as Category B. The JICA Environmental and Social Guidelines requires Initial Environmental Examination (IEE) for Category B projects. This project aims to be funded by JICA; it is deemed that IEE is basically necessary.

In the meantime, as final location and contents of the subprojects would not be determined before the JICA loan agreement, the IEE cannot be conducted during the feasibility study (F/S) stage. The F/S will review the environmental and social impact assessment framework formulated in Phase-1 and collect information on environmental and social considerations so that necessary mitigation measures will be taken just after specifying the subprojects. If a subproject is regarded as Category A or B, the project is required to conduct environmental and social considerations study.

The ToR of the JICA Survey requires to prepare the criteria for selection of subproject from the viewpoint of environmental and social considerations and establish the environmental and social impact assessment framework. Classification of the category for each subproject and necessary environmental and social consideration measures are determined/prepared through two steps, i.e., the F/S period and detailed design period, in accordance with the ToR. Hence, it is difficult to determine the necessity of environmental and social study during the F/S stage, and the decision will be made after the selection of the subprojects using the framework.

The DPR mentions that EIA and IEE are not necessary with preliminary screening even though present situations at sites and original designs are not clear. After the selection of the subprojects with original designs, screening at each subproject must be implemented; therefore, the F/S survey should collect environmental and social information and predict possible necessary procedures to make provision for smooth implementation of the project. The environmental checklist is given in Attachment 10.7.1.

Chapter 11 Recommendations

11.1 Activities to be Implemented Immediately by UKDHFP

UKDHFP will establish a PMU for the smooth implementation of the Project. PMU will be registered as an Independent Public Benefit Corporation (Society) under the Uttarakhand Society Registration Act 1860, which has its own constitution and by-laws covering finance, accounting, human resources and administrative norms. The Society functions as a dedicated organization for the implementation of the project. For the smooth implementation of the project, therefore it is necessary to establish the Society as soon as possible. It is proposed that the following activities be implemented immediately after the start of the project, in parallel with the procurement process of the PMC.

- Establishment of the implementation and monitoring system
- Appointment of staff of Project Management Units (PMUs)/ District Implementation Units (DIUs) and procurement of office equipment
- Comprehensive market survey at accessible large markets
- Scrutiny of production clusters in the target districts and selection of the development blocks
- Procurement of Cluster Based Business Organizations (CBBOs)
- Preparation of the basic design of hi-tech nurseries and Centers of Excellence

At the initial stage of the Project, a comprehensive market research will be conducted targeting large scale markets that are relatively easy to access. In this section, the JICA survey team proposes to clarify the purchasing conditions of promising crops from the market (buyer) side and reflect them in the cultivation plan and R&D plan, while referring to the results of a simple survey in the Delhi market conducted in this survey.

Currently, UKDHFP has data on production clusters created by HMNEH. However, the reliability of the data is questionable. Thus, UKDHFP is recommended to review the available data for its quality. Thereafter, the updates shall be conducted and additional information shall be collected systematically especially for the production cluster of the four target districts. The data items shall be included; 1) name of the cluster, 2) registration status and contact details; 3) physical location; 4) the number of member farmers; 5) area under cultivation; 6) crops grown; 7) production volume and yield; and etc. The data shall be kept in a manner that can easily be retrieved. This will ease the access from the buyers to the producers. It is also recommended that UKDHFP will select the development blocks based on the market survey results and the latest information on production clusters to avoid overlapping of development plans and interventions of other projects and programs.

11.2 Development of FPOs

It is understood that the main component of the Project, supply chain development, is linked to the new agricultural policy, which aims to develop and strengthen Farmers Producing Organizations (FPOs) that operate in production clusters based on development blocks for creating a system to benefit their member producers economically. FPOs must have at least a certain number of members in order to achieve economies of scale. In this project, keeping the focus with the existing farmer groups, other farmers are also encouraged to participate. The Project shall anticipate that even with the existing FPO that meets the requirements to take part in the training and strengthening, it will take time to confirm with them the FPO concept in the Project, build consensus among the FPO members, or to mobilize more number of farmers in the surrounding area. In case there is no existing FPO, an even longer time is needed to initiate the formation process and build capacity of the organization to the level of self-supporting stage. Therefore, it is recommended for the Project to engage CBBOs with proven track records in implementing the FPO development.

11.3 Smallholder Horticulture Empowerment and Promotion (SHEP) Approach

Small Horticulture Empowerment Project (SHEP) is the agricultural extension approaches organized by JICA. SHEP approach is based on market-driven concept from the economic theory "grow to sell" as

well as the psychological theory "a mechanism for unlocking farmer motivation". The SHEP approach is composed of main four steps: a) participatory baseline survey carried out by farmers and extension officers together, b) stakeholder forum for farmers to contact and discuss with actors from agricultural industry sector, c) demand -driven technical training for farmer's requirement identified in market survey.

The essence of SHEP approach is farmer's decision making based on their own collecting information and analysis on the potential market for conducting agricultural business. In the preparation of the FPO business plan, a market survey will be conducted by the farmer group to understand not only price fluctuations, but also the crops, varieties, quality, quantity, and timing demanded by the market (buyers), which will be reflected in the business plan. The JICA Survey Team proposes the introduction of the PDCA (Plan-Do-Check-Action) cycle to reflect what is learned through the implementation of the business plan, including crop management, in the next year's business plan. This will provide an opportunity for individual members to recognize the issues they face as an organization and work on solutions with a sense of ownership and responsibility.

11.4 Strengthening of Horticulture Extension Services

Under the project, new varieties and cultivation technologies will be introduced. In this process, agriculture extension services play a critical role in achieving the planned outcome. The crop selection shall be done based on the results of market surveys conducted by experts and farmer groups so that the crops with higher market potential can be selected for promotion by the Project. The project extension system shall also be designed to promote climate change adaptation measures in order to build the resilience of the farmers against impacts of climate change. The Horticulture Mobile Teams (HMTs) shall become the contact point at the field level to provide horticultural trainings to beneficiary farmers in collaboration with the UKDHFP's training centers, Indian Council of Agricultural Research (ICAR), universities, KVK and other agricultural institutions. It is also proposed to promote the dissemination of online cultivation consultation system and other systems using familiar ICT devices such as smart phones.

11.5 Measures for Climate Change Impact

As for the strategic horticultural crops in its target districts, the Project aims to establish a relative advantage in the horticultural crop market through R&D efforts related to cultivation technology, variety improvement and crop conversion as a measure against climate change. In order to achieve this, it is proposed to continuously conduct surveys, verification and research on climate change impacts during the project period.

11.6 Formation of Production Centers and Branding Strategy

As mentioned as Branding and Marketing Development mentioned in Chapter 6, according to branding strategy drafted by UKDHFP, effective measurements for branding through R&D production, quality control, marketing and sale promotion shall be discussed carefully by PMU/ DIUs with support of PMC.

The branding strategy is a two-stage process that includes the formation of production centers of a target crop, which should be undertaken from a long-term perspective, and the registration of production area brand names and logo marks, advertising through media such as television and newspapers, and participation in product exhibitions and displays, which can be tackled in the short term.

Regarding long-term measures, the first priority is to become able to do basic things continuously. High level management of quality control such as certificate application such as organic produce and Good Agriculture Practice (GAP) could be supported to formulate production centers. However, it is not included in the project scope as of now since the current priority is for farmers and extension officers to learn the proper and basic farming practices to achieve a steady crop supply to the target market with the demanded quantity and quality. The topic of those certificates will be shared to DIU and HMT officers in technical trainings, which might be useful for them in certain trials in the Project or future.

The JICA Survey Team suggests that the producers, the private sector, and the concerned government agencies work together under a united brand strategy for the long term, since branding is a never-ending attempt to respond to updates in market circumstances with changes in socio-economic circumstances. It is advisable that the Project place priority on establishing a solid foundation of the state administration

system to implement the branding strategy by integrating respective stakeholders into one team. As a reference, the examples of Japanese branding cases are shown in Attachment 11.8.1.

11.7 Involvement of the Private Sector

Partnership and collaboration between producers/FPOs, the private sector and the government agencies concerned should be strategically promoted in the Project to strengthen capabilities of FPOs as a business entity and to drive the further development of private-sector-led supply chain of horticultural produce. In the case of introducing advanced technologies from the private sector, it is proposed to provide a matching opportunity for FPOs and local agribusiness companies to connect outside partners through the Single Window Clearance System of the Department of Industries of Uttarakhand, and to support the introduction of highly promising technologies as a pilot trial under the Project. It is also important that the public sector should step down from being a business operator in the supply chain and change its roles in providing administrative supporting services to the private sector including FPOs, in accordance with GOI's agricultural market reform policies, often referred to as the 2020 Farm Bills.

11.8 Gender and Nutrition

Women play an important role in horticulture and also face various challenges such as pest control and fertilizer application and are willing to participate in training. On the other hand, they are struggling to find the time to participate in the training and have limited access to extension services or any other technical information sources due to their heavy workload in family and farm works. In order for women to participate in the training conducted by the Project, it is proposed that a training program be designed by taking into consideration the location of the training venue and duration of the training. With regard to women's participation in FPOs, it is recommended that the bylaws of the organization shall stipulate both the head of the household and spouse to be entitled to a membership, if currently not defined so. To encourage women's engagement in the decision-making process of the organization, it is also recommended that at least 30% of FPO office bearers be reserved for women members. To this end, a gender mainstreaming strategy and action plan is proposed in Attachment 11.10.1.

As far as nutrition is concerned, it is recommended to promote home gardens under the Project to improve nutrition, as most of the women prepare meals using crops grown in the nearby areas. In addition, as a measure against anemia, iron fortified Indian sweets (*laddoos*) developed by KVK Tehri Garhwal may be promoted. It is also recommended that wall painting of nutritional information on the walls of buildings that are easily visible to the villagers and school gardens be implemented to disseminate knowledge on nutrition.

11.9 Convergence

Convergence involves multiple numbers of stakeholders. The success of the convergence lies on the coordination: how efficiently and effectively coordination can be done. This is also one of the common challenges faced in implementing an action through convergence. Sometimes the activities may not be implemented in a timely manner as planned in the Project due to the time spent for coordination with the partner programs or the status of budget execution or the lack of facilities and personnel. Since the activities to be implemented in the convergence will also need to contribute to the achievement of the project goals, if the convergence is hampering the progress of the project activities, it may not be a wise option for the Project to follow. Thus, in order to avoid such risks, adequate budgetary arrangement of necessary resources including budget funds shall be made by the Project. It is also recommended that an official notification on convergence be issued in the name of the Chairman of the Project Governing Council to ensure smooth coordination with government departments and projects.

11.10 Any Changes for the Project Components and Others

As detailed in Chapter 6, the infrastructure and the location proposed for the Project has been decided in consultation with UKDHFP. However, during the project implementation, if needed, the construction locations can be changed in consultation with PMU. Thus, in case of any change for the benefits of the project can only be changed by the approval of Project Executive Committee. Any addition or deletion of components and others shall also be changed by the consent of Project Executive Committee.