

# **APPLE VALUE CHAIN ANALYSIS AND MARKET ASSESSMENT FOR UTTARKASHI DISTRICT UTTARAKHAND**



***Submitted to :***

***Mission for Integrated Development of Horticulture  
MoA&FW, Govt. of India***



**CCS NATIONAL INSTITUTE OF AGRICULTURAL MARKETING  
( A Govt of India organization under Ministry of Agriculture and  
Farmers welfare)  
Kota Road, Bambala  
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# **APPLE VALUE CHAIN ANALYSIS AND MARKET ASSESSMENT FOR UTTARKASHI DISTRICT, UTTARAKHAND**

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## 1 Introduction

### 1.1 Uttarakhand State – At a Glance

Located in the foothills of Himalaya, Uttarakhand is predominantly a hilly State. Carved out of northern Uttar Pradesh, the State was formed on November 9, 2000 as 27<sup>th</sup> State of India. Situated in the northern part of the country, Uttarakhand shares its borders with China (Tibet) in the north, Nepal in the east, and inter-State boundaries with Himachal Pradesh in the west and north-west and Uttar Pradesh in the South. The total geographical area of the State is about 53,483 km<sup>2</sup> (i.e. 1.63% of India)

Figure 1. Uttarakhand Division and Districts



Source: Directorate of Economics & Statistics, Govt. of

out of which 86% is hilly terrain and only 14% is plain region. About 2/3<sup>rd</sup> of the total report area in the State is covered under dense forest.

The State comprises of 13 districts and 95 development blocks<sup>1</sup> that are administratively grouped into two major divisions viz. Garhwal (north-west region) and Kumaon (south-east region). The Garhwal Division consists of seven districts, i.e. Dehradun, Haridwar, Uttarkashi, Tehri, Pauri, Rudraprayag and Chamoli, while the remaining six districts, viz., Pithoragarh, Bageshwar, Almora, Nainital, Champawat and Udham Singh Nagar, are under Kumaon Division<sup>2</sup>. Rich in biodiversity and pilgrimage places, the State makes an attractive tourist destination. Mussoorie, Almora, Ranikhet, Nainital, Haridwar, Rishikesh, Badrinath and Kedarnath are among the most frequented visited places. Two of India's major rivers, Ganga and Yamuna also originate from Uttarakhand.

Table 1: Quick Fact about the State

Summary		
<b>1. Constituted on</b>	November 9, 2000	
<b>2. Capital</b>	Dehradun	
<b>3. Administrative Units</b>		
a. Divisions	No.	2
b. Districts	No.	13
c. Blocks	No.	95
d. Number of villages (Census 2011)	No.	16793
<b>4. Total Population</b>	Lakhs	100.86
a. Rural	Lakhs	70.37
b. Urban	Lakhs	30.5
<b>5. Geographical Area</b>	Sq. Km	53483
a. Hill	Sq. Km	46035
b. Plain	Sq. Km	7448
<b>6. Total Reported Area</b>	Sq. Km	59926
a. Forest Area	Sq. Km	38000
b. Net Area Sown	Sq. Km	7002

#### 1.1.1 Demographic Profile of the State

The total population of the State is approximately 1.01 crores (51% being males and 49% females) of which about 70.37 lakhs reside in rural areas (Population Census 2011). The average population density of the State is 189 per sq.km, whereas district-wise the density of population varies from 41 per sq.km in Uttarkashi to 801 per sq/km. in Haridwar district<sup>3</sup>. Sparse and scattered population, particularly in the higher hill regions including Uttarkashi, Chamoli and Pithoragarh, poses challenge for regional development and formation of market-based institutions, which requires certain minimum level of scale to operate. The gender ratio is at 963 females per 1000 males, which is higher than the national average ratio of 940. However, higher gender ratio may also be partly attributed to significant level of out-migration of males due non-availability of remunerative employment opportunity in the region. The literacy rate in the State has seen an upward trend from 71.62 percent in 2001 to 78.8 percent in 2011<sup>1</sup>.

#### 1.1.2 General Infrastructure Availability

Availability of adequate and efficient general infrastructure (including railways, roadways, ports, aviation, power, telecommunication, etc.) also plays a major role in the overall development of the State. It is particularly important for development of agricultural sector in the State. Better connectivity can reduce transaction cost in acquiring of inputs and marketing of the produce, besides encouraging introduction of new and more profitable activities. Due to undulating hilly terrain, the State is majorly dependent on its road network for transportation of agricultural produce. The total road length in Uttarakhand is 62,945 km, which include surfaced roads of 33,756 km at road density of about 984 km per thousand sq km area<sup>4</sup>.

<sup>1</sup> Uttarakhand at a Glance (2015-16), Statistical Publication by Directorate of Economics & Statistics, Government of Uttarakhand, ([http://www.des.uk.gov.in/files/Uttarakhand\\_At\\_A\\_Glance\\_-\\_English\\_2016.pdf](http://www.des.uk.gov.in/files/Uttarakhand_At_A_Glance_-_English_2016.pdf) accessed on 25.10.2017)

<sup>2</sup> District Administration, Uttarakhand Government Portal (<http://uk.gov.in/pages/display/983-districts> accessed on 13.09.2017)

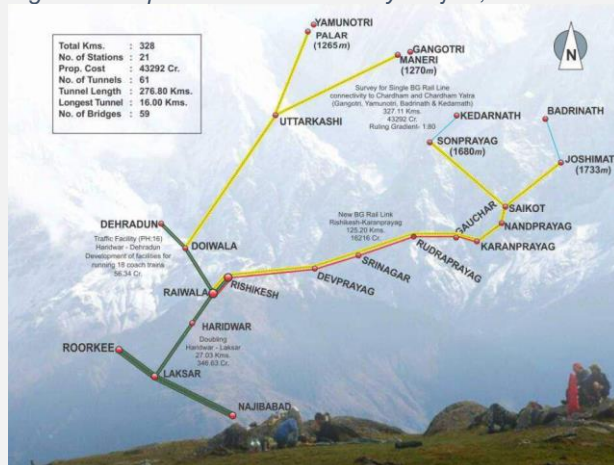
<sup>3</sup> National Population Census Survey 2011 conducted by the Census Organization of India (<http://www.census2011.co.in/census/state/districtlist/uttarakhand.html> accessed on 25.10.2017)

<sup>4</sup> Basic Road Statistics of India, 2013-14 and 2014-15, Ministry of Road Transport and Highways, Government of India (<http://morth.nic.in/showfile.asp?lid=2445> accessed on 15.09.2017)



The State also has rich potential for development of power infrastructure. The current installed power generation capacity of the State is 2361 MW<sup>7</sup>. Out of which, hydropower is the major source of electricity generation contributing around 76% of total power generation. Other major source of electricity generation in the state includes thermal (coal based) 17%, gas based 3%, nuclear 1% and balance about 3% cogeneration plus solar. The State is also rich in mineral deposits like limestone, marble, rock phosphate, dolomite, magnesite, copper, gypsum, etc

Total Kms.	: 328
No. of Stations	: 21
Prop. Cost	: 43292 Cr.
No. of Tunnels	: 61
Tunnel Length	: 276.80 Kms.
Longest Tunnel	: 16.00 Kms.
No. of Bridges	: 59

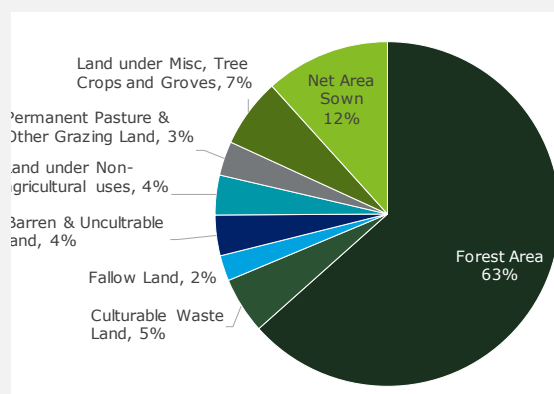


**Source:** Ministry of Railways, Government of India

Given the diverse terrain of the State and its favourable climatic conditions, agriculture plays a significant role in State economy. The sector continues to be the mainstay as about 70% of the population is dependent on the sector for their livelihood and food security<sup>8</sup>. Due to the increasing contribution of other sectors, the share of agriculture and allied sector in the State Gross Domestic Product (GSDP) (at constant price) has decreased over the years from 22.3% in 2004-05 to 9.4% in 2014-15. However, the size of the sector in absolute value terms continues to increase at compound annual growth rate (CAGR) of 2.8%.

Year	Share of Agriculture & Allied Sector (Rs. in Crores)	GSDP (Rs. in Crore)
2014-15	7302	77552
2013-14	6946	70926
2012-13	7125	65414
2011-12	6546	60880
2010-11	6293	55667
2009-10	6029	50598
2008-09	5499	42832
2007-08	5708	38022
2006-07	5591	32190
2005-06	5343	28340
2004-05	5520	24786

Figure 4. State Land Use Classification, 2014-15



Owing to predominant mountainous terrain and dense forest cover (63%), only about 12% of the total area in the State is reportedly under cultivation<sup>9</sup>. Irrigated area is about 47% of net area sown and has increased by only 1% during the past decade (2005-06 to 2014-2015). Even though the proportion of irrigated area under crops is low, the cropping intensity in the states is 156 percent<sup>10</sup>, which is indicative of potential for increased crop production with expansion of area under irrigation. Cultivable wasteland and fallow land account for about 7% of the total reported area. Effective utilization of these with proper planning and execution may provide additional gains for the sector growth. Besides, the diverse agro-climatic conditions of the state provides a unique edge in developing horticultural crop production in the State including both tropical and temperate fruits (litchi, mango, apple, peaches, apricot etc) , off-season vegetables (potato, cauliflower, tomato etc), floriculture, medicinal & aromatic plants.

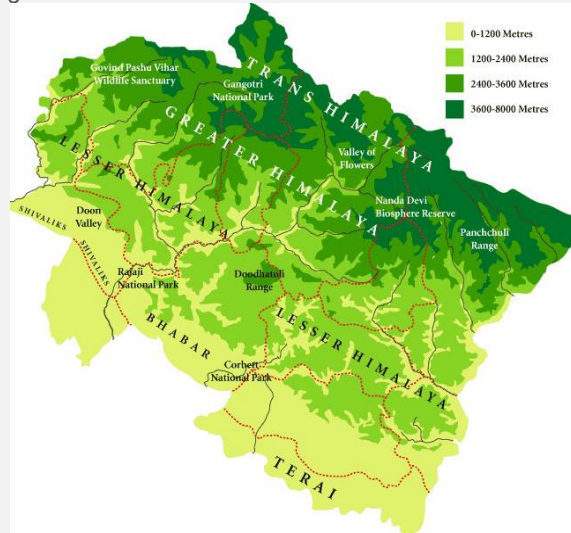
Majority of agricultural landholdings (upto 75 percent), particularly in the hilly region of the State, are small and marginal (ranging less than 1 hectare to 2 hectare)<sup>11</sup>. These are mostly fragmented lands, distantly located from village settlement roads and markets. Additional to the socio-economic constraints, inherent challenges related to remoteness and inaccessibility due to difficult terrain, poor logistic infrastructure and fragility in terms of soil and water resource conditions, have further led to under-utilization of existing resource bases. Farmers in hilly region of the State mostly practices rainfed subsistence farming resulting in poor productivity and limited marketable surplus. Thus low-income returns. Many areas of the State are witnessing increasing migration to urban area within and outside the State for employment and livelihood opportunities. Whereas, the intensification of agriculture is continuing with the expansion of cropped area, limited access to agricultural technologies and inputs (including quality planting material supply, chemical inputs for nutrient application and disease pest control etc), market information and other resource is contributing to the decreasing productivity of farms. High wastages due to lacking post-harvest storage and marketing infrastructure, limited access to processing facilities and credit access are among other factors limiting direct integration of farmers with the markets in the State.

### 1.3 Agro-Climatic Suitability

There is a large variation in the climatic condition across the State. The rainfall varies from 1000 to 2500 mm per annum and the soils range from sandy to sandy loam a along different districts. The altitude also ranges from 400 to above 2400 meters with low, mid and high hill areas and several valleys.

Physio-graphically, the state may be divided into four agro climatic zones covering six altitudinal sub-zones<sup>12</sup>. Due to climatic variation, the cropping practices differs from zone to zone.

Figure 5. Altitudinal zones of Uttarakhand



<sup>9</sup> State-wise land use statistic at a glance, 2005-06 to 2014-15, Directorate of Economics & Statistics, Ministry of Agriculture & Farmer Welfare, Govt. of India ([http://eands.dacnet.nic.in/LUS\\_1999\\_2004.htm](http://eands.dacnet.nic.in/LUS_1999_2004.htm) accessed on 25.10.2017)

<sup>10</sup> Cropping Intensity is calculated as ratio of total cropped area to net area sown

<sup>11</sup> Uttarakhand at a Glance (2015-16), Statistical Publication by Directorate of Economics & Statistics, Government of Uttarakhand, ([http://www.des.uk.gov.in/files/Uttarakhand\\_At\\_A\\_Glance\\_-\\_English\\_2016.pdf](http://www.des.uk.gov.in/files/Uttarakhand_At_A_Glance_-_English_2016.pdf) accessed on 25.10.2017)

<sup>12</sup> Uttarakhand Action Plan for Climate Change, 2014 Ministry of Environment and Forests, Govt. of India (<http://www.moef.gov.in/sites/default/files/Uttarakhand%20SAPCC.pdf>)



- I) *Zone A (upto 1000 m)*: This zone constitutes of Tarai, Bhabhar and Sub-Himalayan region (including Shivaliks and Doon valley region). While the Tarai is marshy and damp tract with fertile soils with good water retention capacity, the Bhabhar region comprises of level surface zone at the foot hills of the Himalayas with extremely porous soils types. Parts of Nainital, Dehradun & Pauri district fall under Bhabhar. Udham Singh Nagar & Haridwar forms the Tarai region. The region is rich in alluvial soil type, which is suitable for agriculture. Foodgrains and sugarcane are among the major crops. Among such as mango, litchi, guava, and papaya are the main fruit crops grown by the farmers. The foothills of Bhabhar & Tarai, are rich in *sal* forest.
- II) *Zone B (1000 – 1500 m)*: This zone constitutes of mid hills with an abrupt rise in elevation between 1,000 m and 1500 m. Parts of Champawat, Nainital, Almora, Dehradun, Tehri Garhwal, Bageshwar fall under the zone. Paddy, wheat, finger millet and pulses are among the major crops. The region also produces vegetable as potato, tomato, peas, cole crops and is suitable for fruits as peaches and plums.
- III) *Zone C (1500 – 2400 m)*: This zone constitutes of high hills with elevation between 1,500 m and 2400 m constituting district of Pithoragarh, Almora, Chamoli, parts of Bageshwar. The region majorly produces vegetables including french beans, cole crops, potato and fruits as peas, peaches, plums, pear, apple and other stone fruits. Amaranth and finger millet are among the other *key crop*
- IV) *Zone D (Above 2400m)*: The altitude of this zone varies between 3000 and 7,000 m. Except for the lower valleys, the slopes of which are covered by diversified vegetation and alpine pastures (bugyals), the Zone is perpetually covered with snow. This area comprises of parts of Pithoragarh, Chamoli and Uttarkashi. Apple is among one of the major fruit crops in the lower valley of this zone. Other horticultural crops include peas, cole crops and potato.

It may be noted that the above distribution is not exhaustive and rigid. Due to diverse climate and topography, several of the stated crops may be grown in more than one zone. It is thus difficult to demarcate crop-wise zones in continuous basis on a map<sup>13</sup>. Whereas the growth of conventional agriculture in the State is limited due to topographical constraints and marginal and scattered land holding patterns, the horticulture sector provides much needed opportunity for crop diversification in the region<sup>14</sup>. Moreover, the hill areas have a comparative advantage in off-season production of horticultural products that have a great demand in the plains. A related advantage for Uttarakhand is its relative proximity to Delhi and other urban cities in north India. Horticulture sector development in the State may thus supported accelerated development in the hilly areas while boosting farmer income beyond the current subsistence levels.

## 1.4 Apple Production Scenario in the State

### 1.4.1 Overview of Horticulture Sector

Uttarakhand is well known for horticulture crop production. Horticulture crops account about 43% of the total net sown area in the State. Apple, pear, peach, plum, apricot and walnut are the main fruit crop grown in hilly areas while mango, litchi, citrus fruits, guava, and pomegranate are mostly grown in plains (Tarai) and valley regions. The State is also leading producers of seasonal and off-season vegetables as potato, cabbage, tomato, cauliflower, okra, brinjal, pea etc., flowers cultivated under protected cultivation and spices as ginger, turmeric and chillies. In 2014-15, the total production of horticultural crops in the State was estimated 1.9 million tonnes from area of 0.303 million hectares.

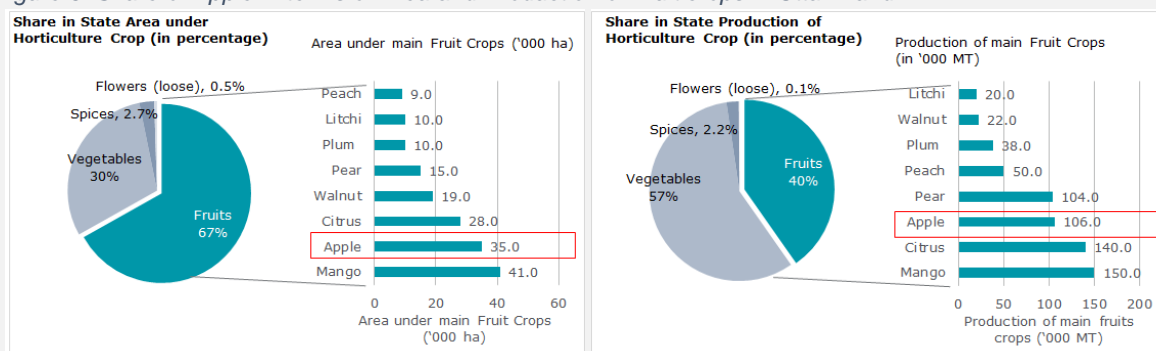
<sup>13</sup> Horticulture Guide For Uttarakhand By Harbans Singh, M.L. Dewan, V.R. Suri

<sup>14</sup> Agriculture Profile of Uttarakhand, Agricultural Economics Research Centre, University of Delhi ([http://www.du.ac.in/du/uploads/Academics/centres\\_institutes/Agricultural\\_Eco/16.2013-Agriculture%20profile%20of%20Uttarakhand-%20Usha%20Tuteja.pdf](http://www.du.ac.in/du/uploads/Academics/centres_institutes/Agricultural_Eco/16.2013-Agriculture%20profile%20of%20Uttarakhand-%20Usha%20Tuteja.pdf))

Fruit crops in particular account for about 67% of the total area under horticulture and contribute 40% to the State production (in volume terms).

Table 2: Area and Production Horticultural Crops in Uttarakhand (in '000 ha, '000 MT)

Figure 6. Share of Apple in terms of Area and Production of Fruit crops in Uttarkhand



Source: Horticulture Statistics at a Glance, 2015, NHB

Crop	2010-11		2011-12		2012-13		2013-14		2014-15 (prov.)	
	Area	Prod..	Area	Prod..	Area	Prod..	Area	Prod..	Area	Prod..
Fruits	179.3	718.9	200.7	802.1	200.9	806	172	678	202	758.31
Vegetable	85.8	737.3	89.03	1059.57	88.03	1017	88	1017	91	1083
Flower (Loose)	1.3	2.3	1.5	1.81	1.56	1.82	1.35	2.02	1.62	2.56
Spices	6.7	38.8	8.1	41.1	8.1	41.1	8.1	41.1	8.1	41.1
Grand Total	273.1	1497.3	299.33	1904.58	298.59	1865	269	1738	303	1885
Net Sown Area	723	-	714	-	706	-	701	-	700	-
% of Net Sown	38%	-	42%	-	42%	-	38%	-	43%	-
All India	21825	240531	23243	257277	23694	268848	24198	277352	23417	283468
% of All India	1.3%	0.6%	1.3%	0.7%	1.3%	0.7%	1.1%	0.6%	1.3%	0.7%

Source: National Horticulture Board

#### 1.4.2 Area and Production of Apple in Uttarkhand

Among fruit crops, Apple is one of the major horticultural crop produced in the State. It accounts for 17% of the total area under fruit crop production in the State and 13% of the total fruit production.

The State ranks third in production of apple after Jammu & Kashmir & Himachal Pradesh accounting 11% of area and 5% of all India production of apple. In 2014-15, the total area and production of apples in State was estimated 34,000 ha and about 92,300 MT respectively compared 625,000 MT in Himachal Pradesh from area of 108,000 ha and production of 1,170,300 MT in J&K from area of 163,400 ha<sup>15</sup>. The average yield of apple in the State is estimate 2-3 tonnes compared to 5-6

<sup>15</sup> Final Area and Production Estimates for Horticulture Crops for 2014-15, National Horticulture Board ([http://nhb.gov.in/area-pro/2014-15\(FinalEstimate\).xlsx](http://nhb.gov.in/area-pro/2014-15(FinalEstimate).xlsx) accessed on 04.10.2017)

tonnes/ha in Himachal Pradesh and 7-8 tons/ha in Jammu & Kashmir<sup>16</sup>. The low production and productivity of apple in the State may be attributed various factors as old and senile orchards, relatively newly planted area under apple which is non-fruit bearing stage, quality of planting material, poor crop management practices, post harvest wastages, imbalance use of resources etc. Based on this study, it is assessed that there is significant potential for enhancing the overall State average productivity through various interventions along the apple value chain.

*Table 3: State-wise Area and Production of Apple in India (in '000 ha, '000 MT)*

State/ UT Name		Jammu & Kashmir	Himachal Pradesh	Uttarakhand	Arunachal Pradesh	Nagaland	All India
2009-10	Area ('000ha)	138	100	32	13	-	283
	Production ('000 MT)	1373	280	114	10	-	1777
	Productivity (MT/ha)	10	3	4	1		6
2010-11	Area ('000ha)	142	102	33	13	-	289
	Production ('000 MT)	1852	892	136	10	-	2890
	Productivity (MT/ha)	13	9	4	1		10
2011-12	Area ('000ha)	171	104	34	14	-	322
	Production ('000 MT)	1775	275	123	31	-	2203
	Productivity (MT/ha)	10	3	4	2	-	7
2012-13	Area ('000ha)	157	106	34	14	-	311
	Production ('000 MT)	1348	412	123	31	-	1915
	Productivity (MT/ha)	9	4	4	2		6
2013-14	Area ('000ha)	161	108	30	14	0	313
	Production ('000 MT)	1648	739	77	32	2	2498
	Productivity (MT/ha)	10	7	3	2	10	8
2014-15	Area ('000ha)	163	108	34	15	0	320
	Production ('000 MT)	1170	625	92	32	2	1922
	Productivity (MT/ha)	7	6	3	2	10	6

*Source: Ministry of Statistics and Programme Implementation*

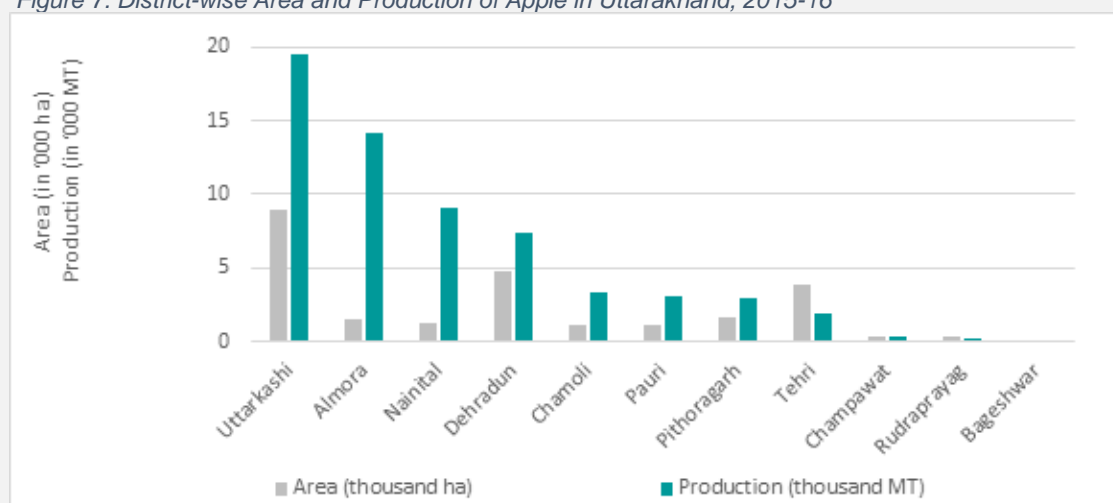
#### 1.4.3 District-wise Area and Production of Apple in Uttarkhand

Apple is cultivated in almost all hilly districts of the State. Uttarkashi and Almora are the two major district with highest production. Together, the two districts accounts for more than 50 percent of the State apple production. Adjoining to these, the districts of Nanital, Dehradun, Chamoli, Pauri, Pithoragarh and Tehri are among the other prominent apple growing regions. Uttarkashi district reports the highest area and production of apples in the State contributing about one-third of the State production and area under apple cultivation. In 2015-16, apple production in the Uttarkashi district was recorded as 19.5 thousand MT from and area of about 9 thousand hectare. Almora district, though has comparable production but the district has relatively lesser area under apple cultivation. Pear, peach, plum and citrus are among the main fruit crops of the district.

<sup>16</sup> Ministry of Statistics and Programme Implementation (<https://data.gov.in/catalog/all-india-and-state-wise-area-and-production-fruits>)

Considering the huge scope for increasing apple production in the District & potential for value addition, this study has been designed to assess the gaps and constraints along the existing apple value chain in the region and to suggest an action plan for greater integration of farmers and improving value realization from apple cultivation.

Figure 7. District-wise Area and Production of Apple in Uttarakhand, 2015-16



Source: State Department of Horticulture, Government of Uttarakhand

## 2 Approach & Methodology

### 2.1 Selection of Study Area

Notably there are three major production clusters of Apple in the district. These are located in the higher hill regions of three main valleys in the district i.e. Ganges valley in north-east of the district (zone 1, higher hills), Yamuna valley in the southern west zone (zone 2, mid hills), and Tons valley in west zone (zone 3, high hills bordering Himachal Pradesh). Detailed consultation was carried out with the State Department of Horticulture and three out of six major apple producing blocks of the district i.e. Bhatwari, Naugon and Mori were selected as the study area for data collection so that a representative data may emerge from all the three production clusters

## 2.2 Sampling Methods

The stakeholder sample selected for the interview and discussion included apple grower, traders (commission agents cum wholesales), transport service providers, processors and cold store operators and local retailers. Discussion and consultations were also carried out with State and district level officials to understand the overall scenario and seek suggestions.

The sample of apple growers for field survey were identified and mobilized at different selected locations with assistance of District Horticulture Office, Uttarkashi. Group discussion were conducted with the farmers in each of the selected clusters using

structured questionnaire to collect information on value chain activities undertaken by the farmers, package of production practices, cost of cultivation, value addition at farm level, marketing of produce and associated costs, access to services for procurement of inputs, technical guidance, transport, market information and infrastructure access, constraints in production and marketing etc. A sample of 40 farmers were also interviewed individually to collect general information and data on socio-economic background, scale of production, marketing channels etc. On the market side of the value chain, commission agent, wholesalers, retailers dealing with marketing of apple were also interviewed to understand the goods movement upto end consumer including marketing cost, margins and efficiency. Primary data was collected using structured questionnaires. Secondary data and information was collected by referring to published reports, information and data base of various relevant sources and their website.

Table 4: Fruit Crop production in Uttarkashi District, 2016-17

Fruit crops	Area (in ha)	Production (in MT)
Apple	9038	25850
Pear	1635	6134
Walnut	1448	680
Plum	738	2585
Peach	332	891
Citrus Fruits	325	718
Apricot	155	752
Other	1614	1890
Total	15285	39500

Source: District Horticulture Office

## 3 Primary Survey: Result & Discussion

### 3.1 Socio-Economic context of Apple Value Chain in the District

The hilly terrain of the Uttarkashi district allows favourable cultivation of various horticultural crops. Apple is one of the most important economic crop for the district and is grown in abundance in the district. Out of the total annual fruit production of 39500 MT from area of 15300 hectares, apple accounts for 65% of the fruit production and 60% of area under fruit crop cultivation in the District. Pear, peach, plum, apricot walnut and citrus are among the other prominent fruit crops.

Based on the field survey it is assessed that a sizable number of farmers are associated with apple cultivation in the Uttarkashi District. The production clusters of apple spread along Ganges valley in north-east of the district (higher hills), Yamuna valley in the southern west zone (mid hills), and Tons valley in west zone (high hills bordering Himachal Pradesh). Together these clusters contributes about 25 thousand metric tons of apple production (more than one-third of the production) worth more than Rs 60-80 crores<sup>17</sup>.

For 2016-17, the total area under apple cultivation in the district is reported about 9000 ha. Although, in last three year, there has been a marginal increase in area under apple cultivation, however, overall production of apple in the district has increased by over one-third from 19530 MT in 2015-16 to 25850 MT in 2016-17<sup>18</sup>. Increased production may be attributed to increasing number of farmers replacing

<sup>17</sup> The price is calculated considering (conservative) weighted average price of Rs.600 – Rs.800 per box of apple weighing 20-25 kg

<sup>18</sup> District Horticulture Office, Uttarkashi

their older non-productive orchards with high density spur type early maturing varieties of apple. However, during this year (2017-18) apple production in the district is estimated to be record all time lowest due to severe damage and losses caused by hailstorm and temperature fluctuations during flowering and fruiting stage. Based on the interactions held with the farmers and district level officials, the production this year is estimated to drop by 70 percent. Despite the sizable area and value of production, the average farm productivity and returns on investments to apple growers remains low. This may be attributed to multiple factors such as –

- Small and marginal landholdings. Thus, low volumes of individual marketable surplus.
- Rainfed cultivation. Lack of irrigation and water storage facilities near orchard clusters
- Lack of access and timely availability of quality planting material and other inputs (including chemical inputs, machinery and equipments, irrigation systems, packaging material etc);
- Limited of know-how among farmers on emerging best practices for production. Lack of exposure visits and in-depth trainings of progressive farmers
- Lack of technical advisory services due to manpower constraint. Limited private sector participation in rendering extension services;
- Changing weather conditions due to climate change (hailstorm, temperature fluctuations, changing rainfall pattern, increasing pest and disease incidence etc)
- Crop damage by wild boars, bears, monkey;
- Lack of proximal post-harvest infrastructure for sorting, grading and packing, storage/warehousing/cold chain infrastructure (including reefer vehicles), processing facility, regulated local markets and infrastrucure etc. Farmers depend on distant markets for sale of produce. All post-harvest activities related to sorting, grading, packing are performed manually at respective farms. Thus, not only the role of famer is limited upto production stage, but also all major expenses including transportation to distant market places is borne by them.
- Absence of farmer producer groups/companies/cooperative structures. Thus, integration into value chain and benefits of negotiation mostly limited to large producer or progressive farmers subject to individual ability and capacity
- Poor road infrastructure in interior locations and absence of road connectivity to distant orchards located in high hill adds to the cost of transportation of produce using mules, rope way etc, besides limiting the use of input resources for improved productivity.
- Absence of branding and promotion of apples grown in the State. Uttarkhand high-quality apples are less preferred to apples from Himachal Pradesh and Jammu Kashmir and those being imported from US, China, Chile and other areas.

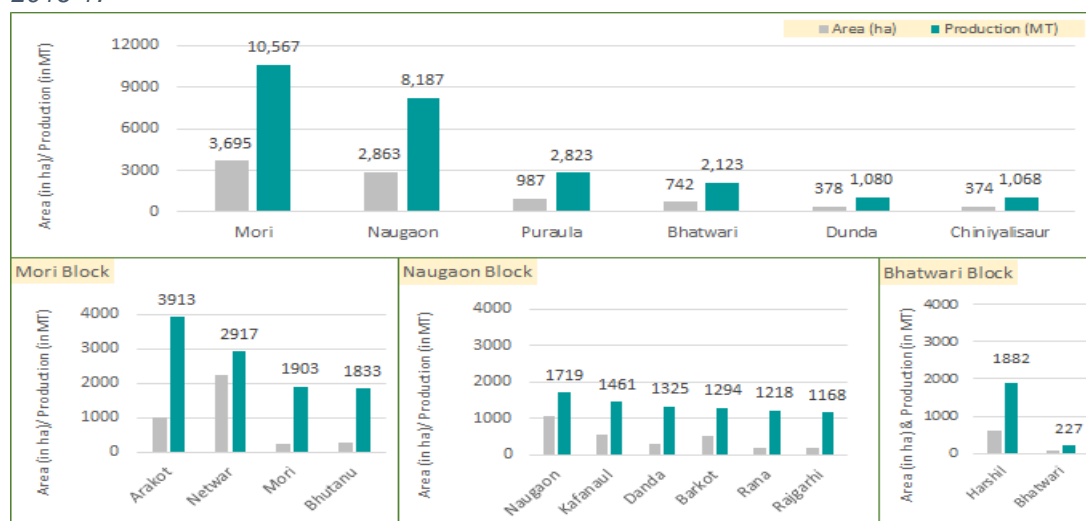
Integrated development of apple value chain in the State is important for socio-economic growth of the associated farming community as well as future sustainability of apple cultivation in these regions. There is also immense scope for development and promotion of secondary and tertiary level processing of apple that would create higher value for the produce and improve realization at the farm level, promote investments in agribusiness in the region, foster backward and forward linkages. Considering the high consumer demand for the apple across India as well as congenial climatic conditions for crop production in the State, apple as cash crop carries immense potential for the Uttarkashi district to be developed as hub of apple production in the State. For planning and implementation of sustained interventions along the value chain, it is important to understand the key characteristics of the targeted farmer group, their participation along the value chain, inter-linkages between various stakeholders, marketing channels and constraints.

### 3.1.1 Apple Production Clusters in Uttarkashi



Apple is cultivated across all the blocks of the district. Mori and Naugaon block respectively account for 40% and 30% of the total district production of apple. Aarakhot, Netwar and Naugaun are the main apple producing regions in these two blocks. Besides, apple is also the main crop in higher hill regions of Bhatwari block including areas as Dharali, Harsil, Jhalla, Purali, Jaspur, Sukhi and Mukhawa. Harshil in Bhatwari block is also a significant apple production belt. The region contributes to the late season (October month) arrival of apple in the market.

Figure 9. Block wise Apple Production in Uttarkashi District (and surveyed development block), 2016-17



Source: District Horticulture Office, Uttarkashi

### 3.1.2 Profile Analysis of Apple Growers in the Study Area

#### 3.1.2.1 Land Holding Size

The average landholding size of apple grower in the study area is estimated about 1.4 ha. Of the surveyed farmers, 53% were reportedly marginal farmers (less than 1 ha); 18% small (1-2 ha), 29% semi-medium (2-4 ha). None of the surveyed farmers had more than 4 ha of land<sup>19</sup>. Although the sample size of sub-production clusters is not statistically significant. However, based on the farmer group discussions and analysis of surveyed farmer data, it is assessed that the apple growers in the Ganga valley region i.e. Bhatwari block (higher hills) are relatively small and marginal growers compared to small to semi-medium scale production in Yamuna & Tons valley zone i.e. Naugaon and Mori block regions adjoining Himachal Pradesh. Further, it was notable due to mountainous terrain, the landholding of the farmer were fragmented and distantly located from road in high hill areas.

Table 5: Land Holding Distribution of Surveyed Farmers

S.No	Category	Operated Area	% of Farmers from Sample	As per overall State Statistics*
1	Marginal	Less than 1 ha.	53%	74%
2	Small	1 - 2 ha.	18%	17%
3	Semi-medium & medium	2 - 4 ha.	29%	9%
		4 -10 ha	-	
4	Large	More than 10 ha.	-	0.1%

\*Source: Uttarakhand at a Glance, 2015-16 (Census India 2010-11)

Given the dominance of small and marginal farmers, their smaller outputs, fragmented landholdings and often-distant location from major markets, deprives the farmer's to access markets, modern storage facilities and sometimes technology. Small scale of operations further reduce the bargaining

<sup>19</sup> The local land measurement unit is 'nalli'. The land data provided by the farmers in nalli has been converted into hectare at rate of one hectare equivalent to 50 nallis. 1 nalli has 5 trees on an average

power of farmers, makes them vulnerable, increases costs and adversely affecting the overall economic return.

### 3.1.2.2 Education Status

In general, the overall literacy rate in the State has seen an upward trend from 71.62 in 2001 to 78.8 percent in 2011. As per Census 2011, Uttarkashi district has literacy rate of 76 percent. Among the surveyed farmers all had undergone formal education up to certain level. Highest qualification among 9% of respondents was upto primary education (upto Class V) whereas rest of the respondents reportedly have better educational qualifications. About 38% of the farmers had attained upto secondary level education, 20% upto senior secondary and 25% graduate, 10% upto post graduate.

*Table 6: Education Status*

Highest Qualification	Primary School	Junior High School	Senior High School	Graduate	Post Graduate
Percent of Farmers	8%	38%	20%	25%	10%

Corresponding with the increased level of educational qualification, it is also notable that about 40% of surveyed respondents were middle aged ranging between 35 to 45 years whereas 30% belonged to age group above 45. Of the remaining 30% respondents aged between 28 to upto 35 years of age indicative of continuing interest among the relatively younger generation group to engage in the apple cultivation. Based on field observations and age data analysis, youth involvement in the value chain was notable mostly in Tons valley production cluster i.e. regions of Mori block located closer to commercial apple production clusters in Himachal Pradesh (Rorhu).

### 3.1.2.3 Annual Income

The farmers in Uttarkashi district are purely dependent on farming as their source of income. Among the study respondents, sizable number of farmers are exclusively dependent apple cultivation for income generation. The dependence is particularly high in higher hill villages as Darali, Harshil, Sukki, Jhala region in Bhatwari Block (Ganga valley) and Jhotari, Gokul, Makuri, Kiranu are in Mori Block (Tons valley), which are purely apple producing belts. Farmers in these regions draw more than 80-90% of their income from apple cultivation. Some of the farmers also cultivate vegetable crops as potato, peas, rajma etc for subsistence purpose. However, in Naugaon Block, the farmers have slightly reduced economic dependence on apple cultivation i.e. upto 70 percent. The farmers are found to be actively involved in cultivation of off-season vegetable (mainly tomatoes). These are supplied to Mother Dairy under formal purchase agreement facilitated with support of a local NGO which organizes collection of produce, receive and distribute payments to the farmer, organizes farmer training on best practices as well facilitate market information. The vegetable supply chain in this region is progressively developing well. It is relatively developed block. Some of the farmers are also involved in part time business like ration shops, provision stores etc. for extra income.

*Table 7: Income Status of Surveyed Farmers*

Annual Income	1-2 Lakhs	2-3 lakhs	3-5 lakhs	More than 5 lakhs
% of Farmers	28%	30%	25%	18%

Majority of sampled farmers in the study region fall under the income scale 2-5 lakhs. Few farmers, about 18%, with large land holding and aged orchards have income more than 5 lakhs per annum. The income was found to be highest in the Jhotadi village of Mori block due to large apple orchards. The growers in the region also fetch excellent price due to early arrival of produce in the market by mid of August i.e about month in advance of produce from H.P. & J&K

## 3.2 Varieties Grown & Seasonality of Production

### 3.2.1 Varieties Grown

Various apple varieties are grown in the district including Royal Delicious, Red Delicious, Richard, Delicious, Red Golden, Super Chief, Oregon Spur, Golden Spur, Tydemen Early, Golden Delicious (mostly planted as pollinizer<sup>20</sup>). Delicious Group varieties are found to be the most commonly grown. These group of variety are usually start bearing fruits after seventh year and reach commercial production from tenth year onwards. Moreover, these varieties are planted in low to medium density per unit area affecting the overall return on farmers investment. It was learnt from the farmer interactions that gradually a number of farmers are moving towards plantation of early maturing dwarf spur varieties, which have lower gestation period and bear fruit after two to three year of plantation as compared to Delicious Group. Spur varieties are also suitable for high density apple plantation.

### 3.2.2 Seasonality of Production

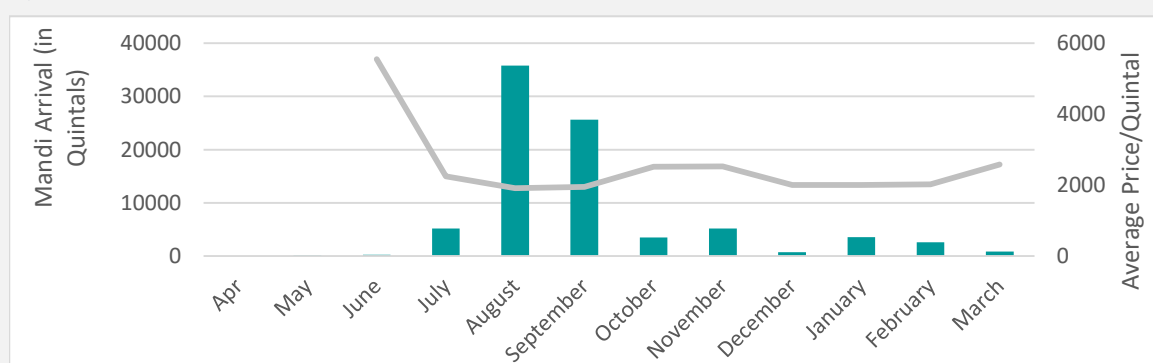
The month of August and September are the peak months of apple supply in the market as during these month apple is harvested in J&K and Himachal Pradesh(which accounts over 90% of the total production in the country). It is notable that Uttarakhand apple has relative price advantage over the two States, as its supply into the market begins from July (i.e. about a month in advance of production in Himachal and Jammu Kashmir) and continues till October due to late harvesting in Bhatwari block. Thus, the early and late harvest of apple in Uttarkashi district, fetches relatively better price to the farmers in these two month than during August and September. During Aug/Sept the price in the market tends to drop due to arrival of harvest from Himachal & Jammu Kashmir.

Figure 10. Seasonality of Apple Supply in the State

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
UTTARAKHAND						L	P	P	P	L		
HIMACHAL PRADESH							L	P	P	L		
JAMMU & KASHMIR								L	P	P	L	

P – Peak; L- Lean

Figure 11. Month-wise market arrival and wholesale price of Apple in Niranjanpur Mandi (Dehradun), 2015-16



Source: Mandi Samitee, Niranjanpur (Dehradun)

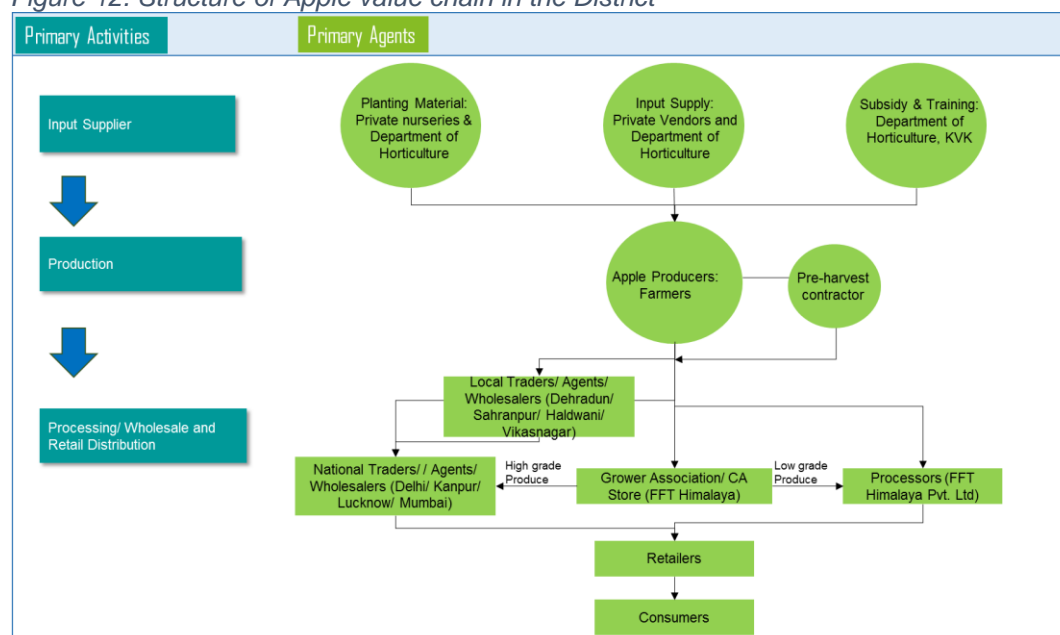
<sup>20</sup> Low density orchards have one pollinator tree after every 2-3 large trees while ultra-high density orchards have one pollinator tree after every sixth tree

### 3.3 Analysis of Apple Value Chain

#### 3.3.1 Structural Analysis

In general, the apple value chain in the district begins with farmer producers (who produces, harvest, sorts, grade, pack, load and transport the produce to the market). From there on the produce flows to commission agents cum wholesalers (who procure and trade apple in fresh form) and to the processor (who procure the fresh apple stock either directly from producer or through wholesalers). The processors then re-grade the apples. Low grade apple are either sold in the market or processed into juice. Grade A & Grade B apple are general stored by the CA store owner for off-season trading. Some of the farmers engage with pre-harvest contractor who usually hired the orchards on contract basis at time of harvesting season.

Figure 12. Structure of Apple value chain in the District



#### 3.3.2 Functional Analysis

The role played by various members of the value chain is as follows:

**Input Supplier:** Reportedly there are about 26 government accredited nurseries for temperate fruit crops out of which 18 are functional. As per NHB statistics there are about 7 nurseries in the Uttarkashi district that raise planting material for commonly grown apple varieties as Red delicious, Golden Delicious, Oregon Spur, Red Chief, Royal Delicious, Tydemen Early, Golden Spur, Super Chief etc. Under the area expansion scheme, the State Department of Horticulture also supplies and distributes apple planting material to the farmers annually. The department also extends required extension services to the farmer including technical guidance, supply and distribution of other input material to the grower subsidized rates including chemicals pesticides, machinery equipments as foot sprayers, knapsack sprayer, power sprayers, power tillers, weeder, brush cutter, power pruner, plastic crates, kiltas, packaging material etc. Through Department such inputs are mostly provided at 50 percent discount price. Very few private input suppliers are found to be based out of local markets in the production clusters for supply of other types of inputs (e.g. pesticides, machinery & equipment, sprinklers and other inputs)

**Grower:** The apple growers undertake cultivation of orchards throughout the year. The main operation carried out by the farmers includes land preparation, furrowing, sourcing and planting of planting material (for establishment of new orchards/ replacement of senile ones), nutrient application

in form of manure/fertilizers, weeding, pruning, application of insect pest control measures, harvesting and post harvest management including farm gate sorting, grading and packing. Exception to such a cases were the farmers supplying directly to CA Store, where the procuring CA agency collects the produce in crates and then re-grades the produce at collection centre and processing facility.

**Pre-harvest contractor:** Very few of the survey farmers located in higher hills in Bhatwari block informed that they engage with a pre-harvest contractors for sale of their produce. The farmers informed that these contractors are either fellow farmers or arrived from outside of the region/state at the time before crop harvesting/ flowering and/or fruit formation stage. The contract inspects the field, forecast the estimated orchard production and then negotiate price with the farmer based on distance of orchard from road and main wholesale markets, expected price during the season etc. Accordingly, a verbal or written contract is agreed into between the farmer and contractor. Onwards, the contractors becomes responsible for all risks and expenses related to undertaking the remaining farm operations including application of plant protection, harvesting, sorting, grading, packing, transportation and marketing of produce. Thus, the farmers get an assured rate for sale of produce and price risk is relatively reduced.

**Commission Agents & Wholesaler:** The commission agent facilitates the transaction process between wholesalers and farmer. In context to the apple value chain, it was notable from the interactions with the farmer as well as local apple traders (in Niranjanpur Mandi), that majority of agents are registered with Market yards as both commission agent and Wholesaler.

**Grower Association (Farmer Trust companies)/ Cold Storage/ Processing facility:** Presently there is only one Company operational the entire district, FFT Himalaya Pvt. Ltd., based out of Naugaon which is equipped with an integrated facility for CA storage of 1000 MT and normal storage of 100 MT and facility for processing and manufacturing apple juice. The company operates in unique engagement model with farmers where it has facilitated organizing and grouping of apple growing farmers into Farmer Trust. These Farmer Trust are responsible for collection of produce from farm gate in respective regions and undertake primary processing of harvest at the collection centres. Reportedly six such farmer trusts have been set-up and supported by the company including Bavar Silgaon, Syuri Naugaon, Taknor Jhala, Purola Netwar and Harshil Gangotri. Subsequently, a joint venture enterprise has also been formed which includes members from FFT India and respective FT as company stakeholder. The Joint venture firm is responsible for the collection, procurement, automated washing, sorting, grading, packing, pre-cooling and then reselling of the apples. The company also processes little quantities of procured produce into apple juice, which is directly sold to selected high end clients in national capital region. Whereas FFT India is responsible for providing technical support in terms of budgetary, administrative and legal support to the joint venture.

*Table 8: Functional Analysis of Value Chain*

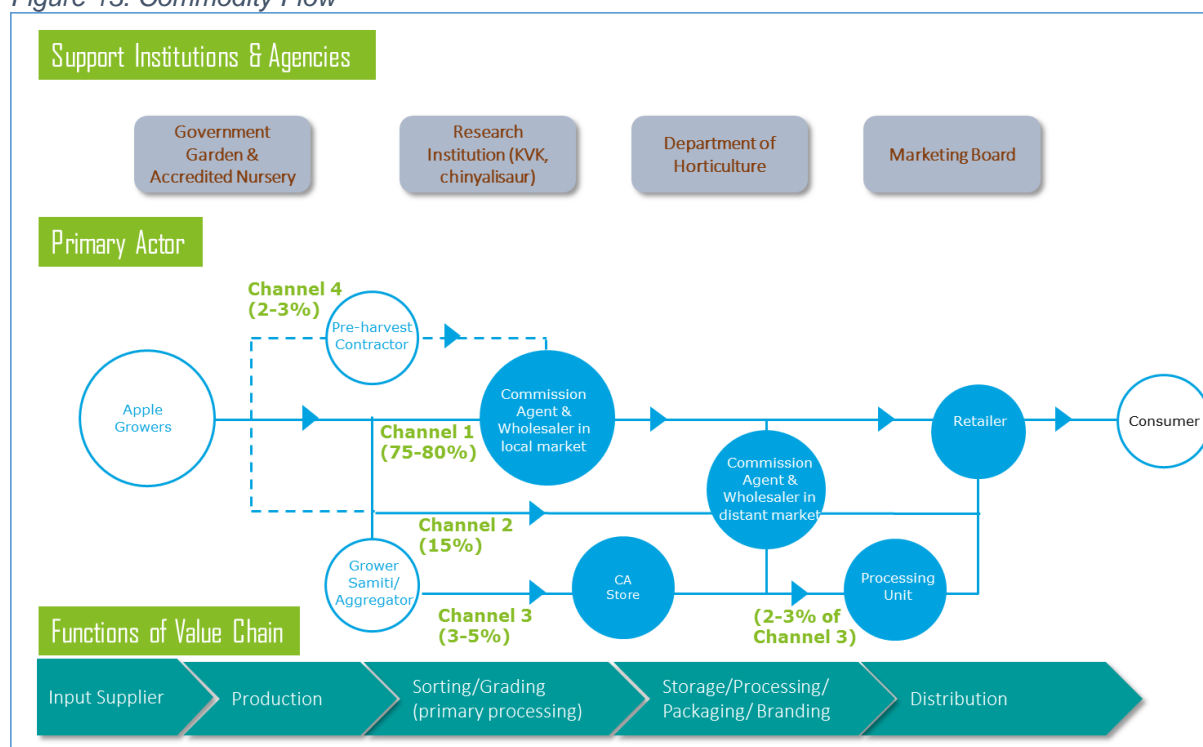
Activity	Agent	Output
Input Supply	Private vendors Department of Horticulture	Planting Material Fertilizers Pesticides Packing Material
Training and Subsidy	KVK Department of Horticulture	Training on Apple cultivation Subsidies on input supply (machinery, chemicals, planting material) Pilot scale demonstration of High Density Apple Cultivation
Production	Farmers	Fresh Apple
Post Harvest Management	Farmers Pre-harvest Contractors CA Store (FFT Himalayan Pvt. Ltd.)	Harvested apple Primary processed apple (sorted, graded and packed apple)
Transportation	Transport service Providers Aerial ropeway service provider	Logistic assistance

Secondary Processing	Processors (FFT Himalayan Pvt. Ltd.)	Apple Juice
Wholesale & Retail distribution	Wholesalers Commission Agents Retailers	Sorted and Graded Fresh Apple

### 3.3.3 Commodity Flow Analysis

Based on the stakeholder interaction four different marketing channels have been identified to be operating in the study area. The selection of marketing channel by the farmer is dependent on factors as scale of production and ability and accessibility to market information by the farmers.

Figure 13. Commodity Flow



#### Channel 1.

Farmer → Commission agent cum Wholesaler in local market (Dehradun/Vikasnagar/Saharanpur) → Local wholesale vegetable suppliers/ vendors (retailers)/ Wholesaler in distant market → Retailer → Consumers

#### Channel 2.

Farmer → Commission agent/Wholesalers in distant markets (as Delhi/Kanpur/Lucknow/Chandigarh) → Local traders/retailers → Consumers

#### Channel 3.

Farmers → Aggregators → CA Store/Processing Unit → Wholesaler in distant market → Consumers

#### Channel 4.

Farmers → Pre-Harvest Contractor → Commission agents/Wholesaler in local or distant market → Consumers

**Channel 1:** Channel 1 is observed to be the most prevalent channel. The farmer brings the produce directly to State APMC market, where the produce is sold in open auction through commission agent cum wholesaler. Based on the interaction with surveyed farmers, it is observed that mostly they sell



produce at Niranjanpur Market, which is the nearest market facility. Some of the farmers also sell the produce at other market as Roorkee, Saharanpur and Vikasnagar, subject to price prevailing in these market. Most of the agents in the mandi are registered as both Commission agent & wholesaler. As per the data provided by the marketing board in Niranjanpur Mandi (in Dehradhun), there were about 1123 agent were registered with the Mandi Samiti as both commission agent and wholesaler, 54 as commission agents only and 194 as Wholesalers only. Under Channel 1, the farmers are responsible for payment of costs associated with post-harvest activities as on-farm sorting, grading, packing, transportation from farm to market, loading and unloading charges etc. The cost of transportation to various key markets is usually arranged through prices negotiation between growers and transport union operating in respective clusters. Arrival of each lot into the market is registered in the records of the market yard. The commission agents cum wholesaler arrange the stock in their shops in grower-wise lots for sale. Local wholesale vegetable and retail suppliers inspect the lot for quality parameters and then purchase the lot in open auction. Though the method of sale is open auction, some of the farmers informed that mutual negotiations are also carried out. Besides local sale the produce is also sold onward to distant markets in other urban cities. The proceeds of payment under the channel are mostly made in cheque or cash within few days of sale and sometimes immediate. The advance credit provided by the trader to farmer, if any, is also settled at the time of payment.

**Channel 2:** Some of the progressive farmers in the regions, who have larger scale production, tend to explore prices in markets outside the State including wholesale markets in Delhi, Kanpur, Chandigarh, Lucknow and Mumbai. Mostly the Grade A produce is sold to these markets whereas the Grade B quality is sold in market within State. Grade C apple are mostly disposed off locally to roadside vendors within the district. The price information is generally obtain based on direct conversation with traders based out of these mandis. Sometimes, in case delay in logistic and transport, farmer face disadvantaged situation as the produce would be ultimately sold corresponding to the prices prevailing in the market at the time of sale.

**Channel 3:** The Channel 3 i.e. sale of produce to private CA company through aggregator farmer samite (trust), is observed to be mostly adopted in higher hill regions in Bhatwari block where apple is harvested in month of October. Although the price in market in month of October are relatively higher, quite a number of farmer in the region seem to be adopting this channel for sale of produce. This may be partly attributed to active operations of the private apple processing company FTF Himalaya (based out of Naugaoan) in the regions. The company has facilitated set up of primary processing centre (Farmer Trust) in Jhala (in Bhatwari Block). The collection centre is equipped with sorting and grading equipment and pre-cooling container with a refrigerated truck. The centre act as aggregation point for collection, sorting and grading of apple. About a week before start of apple harvesting in the region, the Company along with Farmer Trust undertake discussion and negotiations with farmers and sets fixed prices for various grades of apple. These prices are usually set competitive to prevailing market rates during the season. Interested farmer formally register with the trust giving their consent on sale of produce to these Centre. The farmer then share the details about the number of trees and estimated production at his orchard. Accordingly, the centre manager arranges and provides required number of crates to the farmer for collection of harvested produces. The produce collected in crates is transported from the farm gate and to the nearest collection centre (in Jhala), where it is sorted and graded. The farmers are then accordingly paid for the produce as per the grade and agreed prices announced earlier to harvesting.

The graded produce (placed in crates) is then transferred using refrigerated truck to the CA cum cold store facility of the firm, which is based in Naugaon (about 150 km from the production cluster). The lot received at the CA facility is run through washing line and is graded electronically using sensor based technology. The raw material is then placed into wooden or plastic crates using automated machines. On an average, 60% of the produce is Grade A, 30% is Grade B and 10% is Grade C. Generally, Grade A & B apples are put into CA chambers for long term storage for 6 months extending upto 8 months and then sold off-season in month of Feb/ March at relatively higher prices. The company is also into apple juice production. The production is very small though as it is currently carried out on order basis for supply to limited number high end/ luxury Hotel based out National Capital Region and online e-commerce stores. The juice is manufactured, packed, branded and marketed on own by the company

It is notable that along Channel 3 supply chain model, the packing material and transport vehicle is arranged through the primary processing centres (operated through Farmer Trust Company). Thus, the farmer does not have to arrange for packing of produce into corrugated boxes or for its transport upto point of sale. Also, as the apple growing regions in the district is located far from urban markets (such as Dehradun district and other distant places), therefore, suiting to the farmer's convenience they tend to prefer to sell their produce to the nearby aggregation facility (farmer trust company) which offers assured price at pre-agreed rates saving on farmer's cost, time and resources. Moreover, though the prices under this model are fixed before harvesting of the crop. However, it is not binding on the farmers to sell the produce to these aggregation facilities. The farmer have the flexibility to explore other marketing options before finalizing the sale of produce. Thus, the interest of the farmers

*Table 9: Grade-wise prices paid (in Rs per kg)*

Grade	Size (pieces)	Price Paid (Rs/Kg)	% Share of grade in procured produce
Grade A	Large (100), Medium (125), Small (150)	Rs 55/kg	60%
	Extra Small (175)	Rs 47 / Kg	
	Extra Extra Small	Rs 35 / kg	
	Open (240)	Rs 30/kg	
Grade B	-	Rs 24/ Kg	30%
Grade C	-	Rs 8/ kg	10%

is relatively safe guarded compared to other prevalent marketing channels in the region (where the traders have an upper hand in setting of prices). Besides, when selling the produce in distant markets, the farmers are bound to sell and dispose off the produce after a certain withholding period due to its perishability and lack of adequate of storage and marketing facilities at such places. In context to channel 3, it is also notable that the farmers in other apple production clusters (in Naugaon and Mori) do not prefer to sell to the CA company. This may be attributed to the reason that due to early harvest of crop in these region (ahead of harvesting in H.P & J&K), the farmer get relatively better price for the produce in the market. Despite the low adoption rate, the operating model seems to be gaining grounds in the higher hill regions. It was observed during the survey that this year some new private entrants (CA company) based outside of Uttarkashi district are also expected to procure directly from the farmers offering equally competitive rates to the farmer as locally based CA firm.

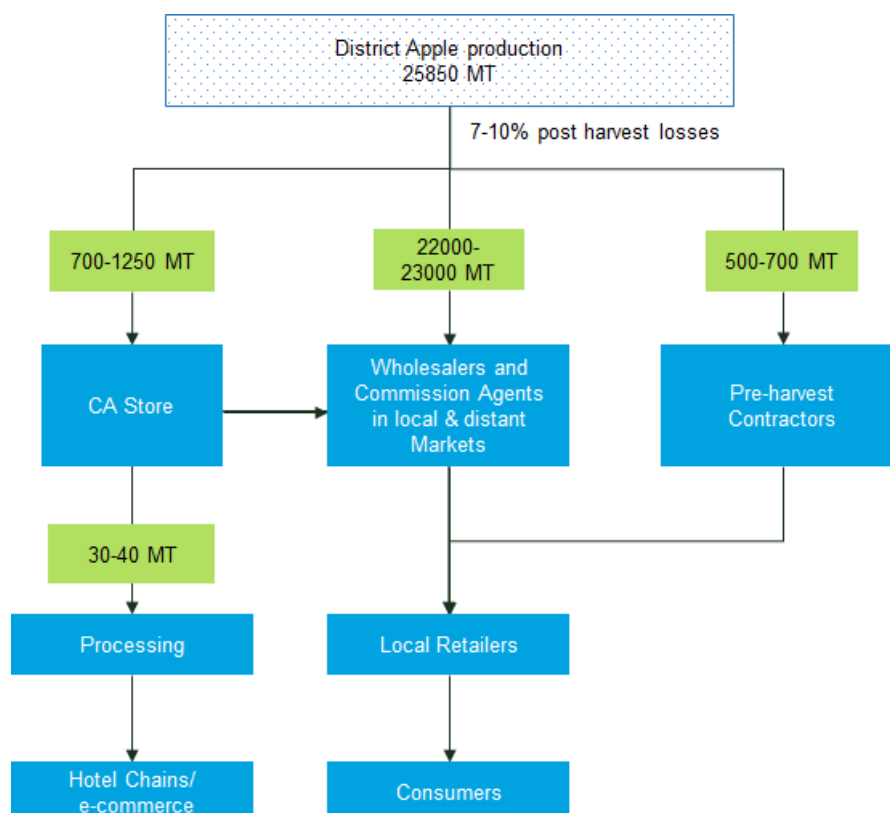
**Channel 4:** The apple grower in the study area are assessed to be progressive and relatively well aware of the market situation in local and distant markets. However, some of the small and marginal farmers in the study area reported to be following Channel 4 i.e. Pre-Harvest Contractor where the orchards are given on lease to the contractor at the time of flowering. The lease amount is mutually agreed based on pre-assessment of estimated production. Part of the agreed amount is paid in advance and remaining after sale of produce. Whereas the pre-harvest contracting saves on time, cost and labor input of the farmer for harvesting and post harvesting activities. However, there is a price risk for both farmers and contractor in this channel as the price tend to fluctuate based on market dynamics and there is no guarantee of increasing trend of prices. Moreover, as the final price

is decided at flowering stage, the orchard owner also tend to neglect the overall health of the trees affecting the quantity and quality of produce and the end returns to both pre-harvest contractor and farmers. It is observed that gradually farmers are moving away from this model of marketing of produce

### 3.3.4 Quantification of Physical Flow of Apple along different channels

Based on the commodity flow assessment, the district level physical flow of overall production may be quantified as represented below:

Figure 14. Quantification of Physical Flow of Produce



It is notable that despite significant production potential, there is minimal value addition in terms secondary processing of apple into other products. Thus, there is immense scope for vertical integration of producers with downstream industrial processing units.

### 3.3.5 Technical Analysis of Various Functions

#### Production

Most of the apple plantation are on slopes of the high and mid hills regions of the district, with low soil fertility and limited or lacking irrigation infrastructure. The average cultivation cycle of the apple orchard comprises of various farm management activities.

### 3.3.5.1 Land Preparation

For creation of new orchards, land preparation and proper layout is very essential. Before planting the orchard is cleared of unwanted vegetation and ploughed. Pits of 1m x1m x 1m size are prepared in month of October to November. In each pit farmyard manure along with other nutrient like phosphate, potassium, nitrogen are added to enrich the soil in organic matter before planting. In established orchards, the pit is cleared twice a year for purpose of application of organic nutrient and weeding and basin management.

### 3.3.5.2 Planting material

Planting is done usually in the month of January and February after land preparation. The crop is propagated using grafting method. Farmers source planting material either from the State Department of Horticulture under Area Expansion Scheme or from local nursery in respective region (Batwari, Dwari, Raithal, Barkot, Nuagaon, Jermola, Ganchwan etc). These nurseries are usually owned and maintained by fellow progressive farmers. Some of the farmers interviewed during the group discussion in Mori block (Nuagon & Aarakhot region) also informed that based on their own experience and experiments they have learnt to graft and ready the planting material at their own at farm. Some farmer also reportedly source planting material from apple producing belts in Himachal. It is notable that except few, not many of such respondents had received any form of formal training or exposure on scientific propagation techniques for apple crop.

During the group discussion, farmers expressed that the quantity of planting material being supplied with support of department was insufficient to meet their requirement. In addition, some of them expressed that they had little trust on the quality and productivity of planting material being supplied through the government. They were apprehensive as the non-spur varieties mostly yield only after seventh year of plantation. On contrary to the farmer's belief, it was observed during field visit to Government garden in Jarmola (in Uttarkashi district) that the department has been maintaining mother stock of some of the best-imported apple cultivars for propagation purpose. However, not many of the surveyed farmers reportedly had visited the facility or were aware about imported cultivars, resulting in lacking trust on performance of the material being supplied. Thus, irrespective of guaranteed quality performance the farmer's prefer to source the planting material from peer.

On an average planting material cost Rs 50-70 per plant, which adds significantly to the cost of cultivation considering that about 250 plant per hectare are required to be planted in case non-spur type varieties and about 1100 plants per hectare are planted in high-density plantation practice. Cost and availability of quality planting materials in sufficient quantities is one of the major limiting factor in improving apple production in the region. Supply of quality planting material is elementary for ensuring higher income to farmers through improved crop performance, besides for reducing their vulnerability to changing climatic conditions.

### 3.3.5.3 Spacing and Number of plants per unit hectare

The planting distance varies according to the variety. As per scientific recommendation, average number of plants per Hecate may vary from 200 to 4444.

Table 10: Recommended Spacing and No. of plants per hectare

Type	Low density	Moderate density	High density	High density	Ultra high density
Spacing (m x m)	6 x 6	5 x 5	4 x 4	3 x 3	1.5 x 1.5
Density (trees/ha)	277	400	625	1111	4444

In general, the surveyed respondents are assessed to be planting more than recommended number of tree per unit area. This factor also affects crop productivity.

#### 3.3.5.4 Nutrition

The soil requires timely input of nutritional contents and organic matter for the growth of the plant. The land preparation happens thrice a year in which different manures and chemicals are mixed with soil. The conventional inputs used are farm yard manure, DAP, NPK and Urea. The amount varies with the age of the plant. A newly planted sapling requires 0.5 – 1 kg of cow dung. Trees of age 5 – 6 years require 4 – 5 kg which fruiting trees of 10 – 12 years require 10 kg of cow dung. Other chemical requirement varies from 0.1 kg to 1 kg depending on the age of the tree.

Table 11: Fertilizer Application in Apple orchard				
Type	Age	Cowdung	DAP/NPK	Urea
New Plant	0 - 1 year	0.5 - 1 kg	0.1 kg	0.1 kg
Non-fruit bearing tree	5- 6 years	4 - 5 kg	0.5 kg	0.5 kg
Fruit bearing trees	10 - 12 years	10 kg	1 kg	1 kg

Majority of the surveyed farmers apply fertilizer doses without assessing the actual nutrient requirement of the soil, particularly for micro-nutrients as zinc, boron, manganese and calcium. During the field survey, the farmers particularly in Mori and Naugaon were found to be aware of benefits of soil testing but very few reported to have their soil tested. In this regard, one of the major reason cited by the farmers during the group discussion, was limited number and distant location of existing soil testing facility in the district. One soil testing facility was reportedly available at Chinyalisaur which is about 180 km from Arakot apple production belt (in Mori), 70 km from Naugaon and about 120 km from Harshil/Dharali. During the discussions, the farmers expressed need for improving access to such facilities near to farm gate. Mobile testing laboratories may be promoted in these region to address the issue.

#### 3.3.5.5 Irrigation

Water is a scarce resource in the hilly region. Also the run off losses are usually high due to mountainous terrain. Cultivation is mostly rainfed as near to farm irrigation and water storage tanks/infrastructure are either lacking or inadequate. Some of surveyed farmers informed that they have purchased drip irrigation units facilitated under government scheme. However, quantity of units being supplied are inadequate compared to number of farmers and their requirement.

#### 3.3.5.6 Plant Protection

Fruit-bearing apple tree requires about 8-10 sprays of different chemicals through out the year. Each stage has a scheduled spray with specific chemical requirements to curb crop damage. All the surveyed farmers spray plant protection chemicals to save the crop from insect, pests and diseases. Chemicals are usually procured from input supplier in local market or supplied through government department. Similar, as in case of planting material, the farmers had poor perception about the quality and performance of chemical pesticides being supplied through government department. Also, quantity being supplied was reported in-sufficient. Farmers also expressed requirement of continuous technical guidance from subject matter specialist on matter and issue related to pest and disease control and adoption of practice to mitigate climate change risk. The extension services to farmer need to strengthened. Besides crop losses due to insect pest and disease, increasing number of farmer reported crop damages due to wild boars, bears and monkeys. Some of the farmers reported orchard damage as high as upto 30% due to bear attack.

### 3.3.5.7 Pruning & Thinning

Pruning is a critical farm operation and is particularly essential for maintaining proper balance between vegetative growth and spur development and thus good productivity. Pruning activity is majorly undertaken during winters during mid December to January. Young fruit trees are pruned to make them to become structurally sound for the coming fruit bearing years. In case of fruit bear trees, it is performed after harvesting. Farmers informed that they engage skilled worker for pruning purpose. The worker charge relatively higher wage rate than farm workforce that is engaged for general farm operations.

### 3.3.5.8 Harvesting

Aforementioned, the apple varieties generally starts bearing fruits after 7<sup>th</sup> years of plantation and extends beyond 25-30 years depending on the agro-climatic conditions and variety. Harvesting season in the district varies from July to October.

Based on the above technical analysis of production practices, it is assessed that if recommended package of practices are followed, more than double of current production is achievable from the existing acreage of about 9000 ha for fruit bearing mature apple plantations in the region

Figure 15. Physical flow of Input and Output



### Post-Harvest Management

To realize potential value of the harvest, it is important to sustain the quality of the apples until they are delivered to the consumer. Proper postharvest management and handling of produce is thus important to prolong the duration for which the fruits remain fresh and marketable.



#### 3.3.5.9 Primary Processing (Sorting, Grading & Packing)

The harvested fruits are sorted, graded and packed at farm level. The produce is designated Grades A, B, C which may be further classified to AAA, AA, A. Different grades of apple are packed into different corrugated boxes using variable tray sizes. Each corrugated box contains six trays inside. The upper tray is placed upside down covering the top 6<sup>th</sup> layer of apples. In the surveyed area, all farmers practice manual sorting and grading of the produce. Specialized infrastructure such as that for cleaning, grading, packaging and weight standardization are lacking. Manual sorting and grading of apple requires special skill set. The farmers informed during the interview that specialized labor is engaged by them for picking of apples, sorting, grading and packaging into boxes. Whereas on contrary, the traders/wholesalers interacted in the market opined that apple growers in Uttarakhand do not follow the standard grading practices and often the bottom layer of packaged boxes is lined with smaller size or relatively low grade of apples. Comparatively, the quality of box packing of apples from Himachal and Jammu & Kashmir were found to be more standardized in terms of grade and weight. A box of apple from Himachal usually weighs 18 kg, from J&K weighs 15 kg. Whereas the average weight of Uttarakhand apple box varied between 20-25 kg. The commission agent & wholesale, informed that due to assured quality of the lot, the apples from Himachal and J&K usually fetches a relatively higher price in the market. Thus, there is a need for training of farmers on picking, sorting, grading and packaging practices to reduce post-harvest losses and standardizing quality of fruits for greater returns. Capacity building of women groups, in particular, may be encouraged to strengthen their socio-economic status and integration along the apple value chain.

One of the critical observation made is that in some of the surveyed area Uttarakhand apple was being packed and marketed under name of Himachal Pradesh brand. The farmers informed that due to shortage of packing material under brand Uttarakhand, they are forced to sell the produce in non-Uttarakhand branded packing material which is easily available with local suppliers due to high demand in adjoining regions of Himachal. Farmers informed that they usually procure the packing material from local stores, which in turn source the material from bulk suppliers who place orders with manufacturers. The manufacturers on the other hand require bulk purchase orders to undertake manufacturing of branded boxes at a scale. Some of the farmers informed that they also source branded packing material from the government department. However, at time the supply from department is delayed and thus farmers have to depend on non-branded material for packing of the harvested produce. Except in some regions as Harsil, labelling and branding of produce is not being practiced by many.

#### 3.3.5.10 Secondary Processing

Currently, there is only one private agency (FFT Himalaya) which was found to be engaged in processing of apples into juice. The processed quantities are though very minimal and subject to order from selective high-end clients. Besides fruit juice, there is significant potential for commercial production and up-scaling of various other value added apple products as jam, apple cider, dried apples etc. Apart from private sector encouragement, participation of women and farmer groups through self help groups/ producer companies/ cooperatives may be developed and promoted for collectively undertaking processing activities with support under grant assistance from various government schemes helping them to integrate higher up in the value chain and realize greater returns. Such initiatives may be linked and converged with brand building initiative of the State. Also, until formal FPOs and FPGs are established and become functional, Farmers Trust based model may be promoted in the region which seem to be already working successfully in the region. Beside, formation of common service centers may be promoted with a focus on collective purchase and efficient management supply of inputs, common place to bring/collect/aggregate the produce, and eventually the bargaining power of the farmers to strengthen the first stage of the supply chain.

## **Transportation and Logistic**

Aforementioned there are various marketing channels along apple value chain. The most preferred for farmers to sell the produce directly to local and distant market. Farmers harvest, grade, pack the produce into boxes. Proper post-harvest handling and transportation of material from farm gate to market is thus critical for linking of supply with demand side. Mostly the growers arrange for the transport themselves. Transport agencies also work actively with farmer as 'Grower Union'. These union pre-fixes the charges for transportation from various local apple producing area to major markets. On an average, transportation of produce from Uttarkhasi district to Dehradun cost between Rs.80 to Rs 100 per box (for box weighing 20-28 kg) whereas cost of transportation to distant locations as Delhi, Chandigarh, Lucknow, Kanpur ranges between Rs 110-140. The union also offer transport insurance service to the farmer at rate of Rs 3 per kg. This covers the farmer's risk due to seasonal road blockages.

Transportation of material is observed to be relatively easier for farmer who have apple orchards along road side. However, majority of the apple orchards particularly in Mori block are distantly located in higher hills which are not linked with motorable/metal road network. In such areas (as Netwar), the packaged boxes are loaded on mules (chargeable at Rs 45-60/box) and then transported from farm to an assembling point nearest to the road network. At the assembling point the produce is placed in open till it the entire produce gets aggregated at one place and is ready for transportation. It usually takes about 2-3 days after harvesting before the produce is fully loaded and dispatched to market locations for sale. Harvesting and transportation arrangements are usually scheduled back-to-back. Subject to road connectivity, the produce is then loaded on to pick-up trucks or utility campers and transported either directly to main local markets or upto forwarding points where is unloaded and reloaded into bigger trucks for onward supply to distant markets. In Arakhot region (adjoining himachal), as apple orchard are distantly located on the higher hill with no road connectivity. Therefore the produce from such location is transported to the assembling point use aerial ropeways (as in Makuri, Kiranu, Gokul), chargeable at cost of Rs.40/box. Considering the difficult terrain in the hill area, transportation connectivity is a critical factor for apple marketing in the region. Due to lack of suitable infrastructure, farmers are unable to properly store the produce. Temporary raised shed structures and other facilities for storage may be set-up at common identified assembling points in the sub-region for safe storage of the produce at the time of harvesting and minimizing the transportation related issues to an extent. Also, apart from development of link roads, new mechanized ropeways may be built in selected regions.

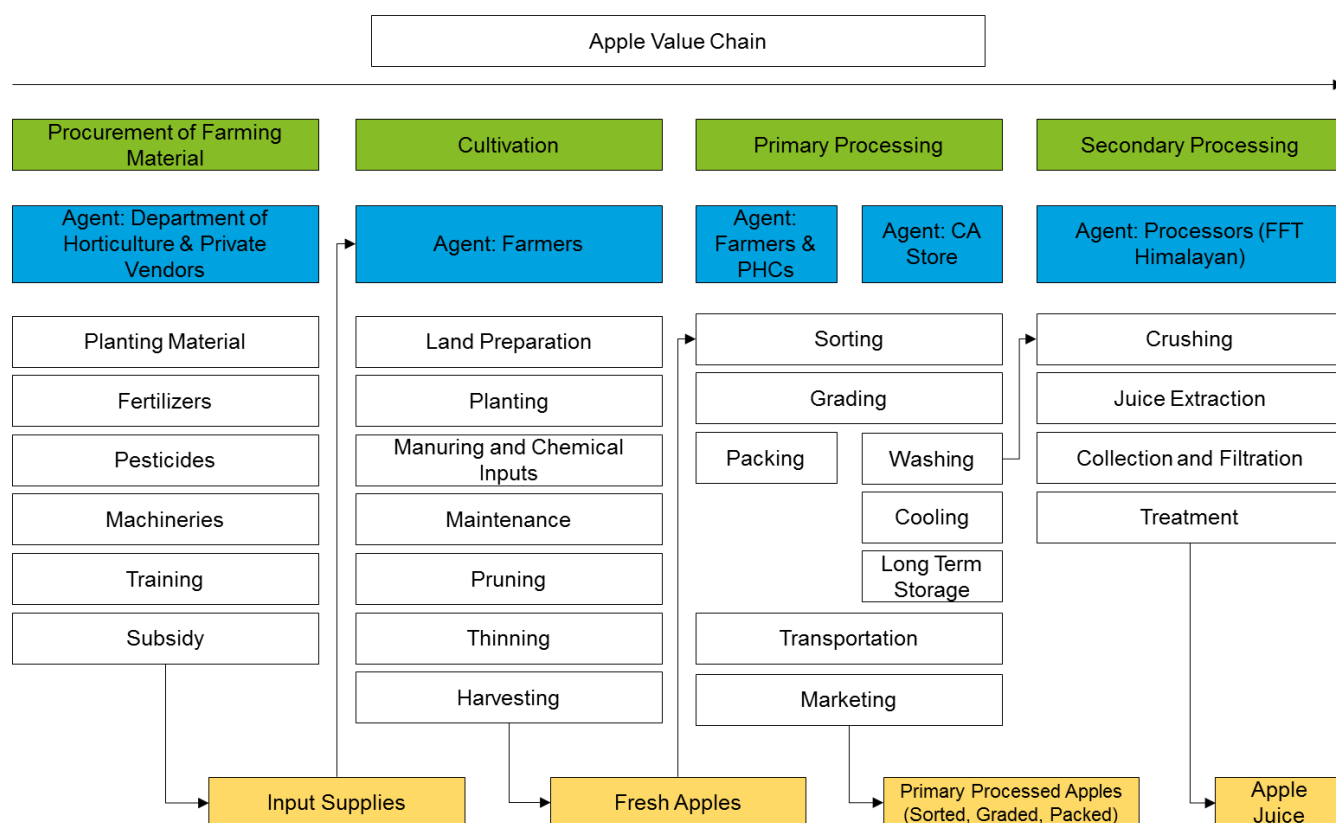
## **Markets and Price information**

The nearest market, where apple is traded, is Niranjapur near Dehradun. Other markets include Saharanpur, Roorke and Haldwani. Distant market includes Delhi, Mumbai, Kanpur, Chandigarh and Lucknow. Aforementioned in detail, there are various marketing channels that are adopted by the farmers for sale of produce. Mostly Grade A produce is sold in distant markets whereas the Grade B quality is sold in market within State. Grade C apple are often disposed off locally to roadside vendors who sell it in local market or to passing tourist vehicles. Except in case of sale to the CA facility, where the fixed price are announced before procurement of produce, the price information is generally obtain based on direct conversation with traders in these markets over telephonic conversation. Farmer lack awareness on market intelligence tools to be used tapping the real time price information in different markets. Often, the farmer reportedly face disadvantaged situation when the produce ultimately reaches the market as the final sale and proceeds are subject to real time prices of produce prevailing in the market at the time of sale.

## Market Infrastructure & Cold Chain

Value addition in terms of tertiary processing is minimal. Reportedly, there is one private firm which as facility for processing, CA storage, reefer vans for transport and network of primary collection centres. However, it's over all capacity is limited to about 1100 MT (as against 25000 MT of the production in the district). Moreover, the usage of this facility is restricted for direct use by the farmers or other stakeholders. Although recently a multi-purpose CA store of 1000 MT capacity along with 200MT cold store has been set-up in Jhala, but it was yet to be operationalized at the time of the study. Bases on discussion with the department officials it was understood that operation & management plan of the new facility is yet to be formalized and it requires engagement of technical manpower/staff to be positioned at site for day to day operation and management. In this context, one of the operationalization model can be capacity building of farmer to formation farmer producer companies/groups/trusts, which may be provide technical and financial assistance under credit linkage scheme for operating the facility. Such intervention would require regular monitoring and hand holding assistance to be provided to the farmer groups. The major APMC markets, where apple is traded, also lack suitable common infrastructure and facility for storage, warehousing, packing of the produce. Some of the private wholesalers have taken their own initiatives and set-up cold store of 120MT and 600 MT but for their own use and purpose. Integrated network of transport facilities are is also relatively weak. None of the farmers reported on use of refrigerated vehicles for transport of produce. Individual farmer is responsible for quality grading and packing of his own produce. For holistic growth and development of the sector, it is important to systematically integrate each of the value chain function. Hub and spoke or cluster development models for aggregation of produce can help in improving operational efficiency, minimize post harvest losses (including loss of quality) and promote value addition along each stage.

Figure 16. Technical Analysis



### 3.4 Economic analysis

Apple orchard begins fruiting from seventh year onwards and reaches the commercial production stage in its fifteen years. The initial investment is estimated about Rs 32,000 that majorly includes cost of planting material and other costs as that for land preparation, weeding and planting. As the plantation matures over the period, the working capital requirement increases towards application of fertilizer inputs and pesticides, pruning activity etc. Since the economic returns only begin after seventh year of orchard establishment, till then the farmer has to depend on his own capital resource and formal/ informal borrowings. In case of funding issues, farmer tend to practice poor crop management practices resulting in lower productivity and thus the returns. Majority farmers in surveyed area reported to be availing credit under Kisan Credit Card Scheme. Beside some others also avail credit as informal advance loan from the traders. The payback period is 18<sup>th</sup> year and IRR is calculated 23%.

The table below details the cost of initial investment and cost of maintenance for both non-fruit bearing stage (upto 7 year) and fruit bearing stage (from 8 to 25 years & above) for non-spur type apple variety.

Table 12: Cost of initial investment of apple orchard (in Rs. / ha)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Land Preparation	10000	6723	6805	6888	6973	7058	7144
Planting	17500	1750	0	0	0	0	0
Fertilizer and Chemical Input	863	4864	5576	6427	7454	8700	10228
Labor for horticultural operation	1050	9923	10419	10940	11487	12061	12664
Cutting/Pruning	0	525	633	764	921	1111	1340
Total Cost	29413	23784	23433	25019	26834	28930	31376
Yield (kg per plant)	0	0	0	0	0	0	0
Gross Return	0	0	0	0	0	0	0
Net Earnings	-29413	-23784	-23433	-25019	-26834	-28930	-31376

Table 13: Cost of maintenance of apple orchard uptill pay-back period & annual return (in Rs. / ha)

Particulars	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18
Land Preparation	7231	7320	7409	7500	7592	7685	7779	7874	7970	8067	8166
Fertilizer and Chemical Input	12115	14463	15938	17563	19354	21327	23502	25898	28539	31450	33263
Labor	13297	13962	14660	15393	16163	16971	17819	18710	19646	22920	24066
Cutting/ Pruning	1910	2721	3878	5073	6635	8679	11353	14849	17910	21602	26055
Picking, Grading and Packing	3078	5387	9049	11877	14326	17279	20840	25136	30318	36567	44105
Box	4221	7387	12411	16289	19647	23696	28581	34473	41579	50149	60487
Loading + Unloading	317	554	931	1222	1473	1777	2144	2585	3118	3761	4537
Transportation	3446	5858	9561	12190	14283	16735	19607	22973	26917	31538	36953
Transport Insurance	129	220	359	457	536	628	735	862	1009	1183	1386
Total Cost	45744	57872	74195	87564	100008	114776	132360	153361	177007	207238	239017
Yield (kg per plant)	3	5	8	10	11	13	15	17	20	23	26
Production (per ha for 250 plant)	750	1250	2000	2500	2872	3299	3789	4353	5000	5743	6598
Boxes (in No.)	38	63	100	125	144	165	189	218	250	287	330
Price (in Rs.)	1149	1172	1195	1219	1243	1268	1294	1319	1346	1373	1400
Gross Return	43076	73229	119509	152374	178533	209182	245093	287168	336467	394229	461907
Net Earnings	-2668	15357	45314	64811	78525	94406	112732	133807	159460	186991	222890

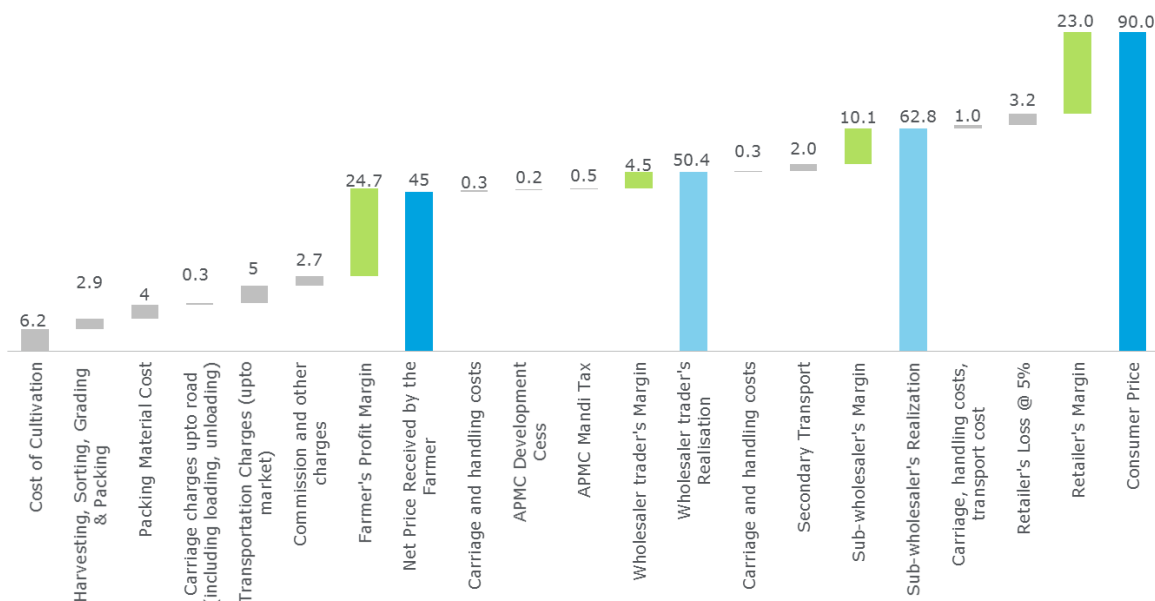
Table 14: Cost of maintenance of apple orchard beyond pay-back period & annual return (in Rs. / ha)

Particulars	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Above 25
Land Preparation	8266	8367	8469	8573	8678	8784	8891	9000
Fertilizer and Chemical Input	35249	36389	37580	38825	40125	41484	42905	44390
Labor	25270	26533	27860	29253	30715	32251	33864	35557
Cutting/ Pruning	31426	37904	44673	52651	62054	73136	86197	101591
Picking, Grading and Packing	53196	64162	77388	88121	100343	114260	130108	148153
Box	72955	87994	106132	120852	137614	156700	178433	203181
Loading + Unloading	5472	6600	7960	9064	10321	11752	13383	15239
Transportation	43296	50729	59438	65748	72728	80449	88989	98436
Transport Insurance	1624	1902	2229	2466	2727	3017	3337	3691
Total Cost	276753	320580	371729	415552	465305	521833	586106	659238
Yield (kg per plant)	30	35	40	43	47	51	55	60
Production (per ha for 250 plant)	7579	8706	10000	10845	11761	12754	13832	15000
Boxes (in No.)	379	435	500	542	588	638	692	750
Price (in Rs.)	1428	1457	1486	1516	1546	1577	1608	1641
Gross Return	541204	634114	742974	821849	909097	1005608	1112365	1230454
Net Earnings	264451	313534	371245	406297	443792	483775	526258	571217

Recently the government department is also piloting Ultra High Density plantation of spur type apple varieties under State Apple Mission. Although the initial investment cost is about Rs 12.4 lakhs. However, the orchard begins to bear fruit from 2<sup>nd</sup> year of plantation. The UHD plantation involves use of high quality planting material, modern scientific package of practices and use of machinery and equipments as power tillers, sprayers, drip irrigation systems, water tanks, anti hail nets, fencing etc for cultivation. Thus the average crop productivity and overall net return are expected to be high. Besides, cultivation of other high yielding dwarf cultivars that yield early harvest may be promoted so that farmers can benefit from harvest early than month of august and fetch best price advantage. Promotion and adoption of such technologies among farmers, requires synchronized efforts for sensitizing and capacity building of the farmers on the technology use, enabling timely supply of quality inputs and planting material, time-to-time monitoring of farmer field and technical advisory, ease of access to credit to enable farmers to sustained operation without government support and for its wider scale adoption

### 3.5 Analysis of price build up

A typical cost build up for per Kg of apple is indicated as below:



In Uttakashi district, the farmers generally sell at Niranjanpur mandi in Dehradun. During peak season, the procurement price of apple varies from Rs.600 to Rs.900 per box. High grade good quality apple also sell between Rs.1000 to Rs 1200 per box. At an average net price realization of Rs 900/box, farmer profit margin is calculated about Rs 25 per kg (assuming net weight of 20 kg per box). The wholesale traders sell the produce at margins ranging 4.5% to 10% to sub-wholesalers between price of Rs 800 to Rs.1000 per box. Best grade apples sell at prices as high as Rs.1500-1800 per box. The sub-wholesaler in turn supplies to the retailer, which in turn sell the produce consumers. The consumer price for an average grade of apple varies between Rs 90 to 120. The farmer's share in the final rupee spent by the consumer is calculated at 50% and that of intermediaries as 42%. However, it may be notable that unlike other value chain systems, the cost of grading, packing, transportation, loading/unloading, commission and other charges is mostly borne by the farmers. Due to lack of proper infrastructure, these costs tend to higher. Thus the net profit margin of the farmer is estimated only 25%.

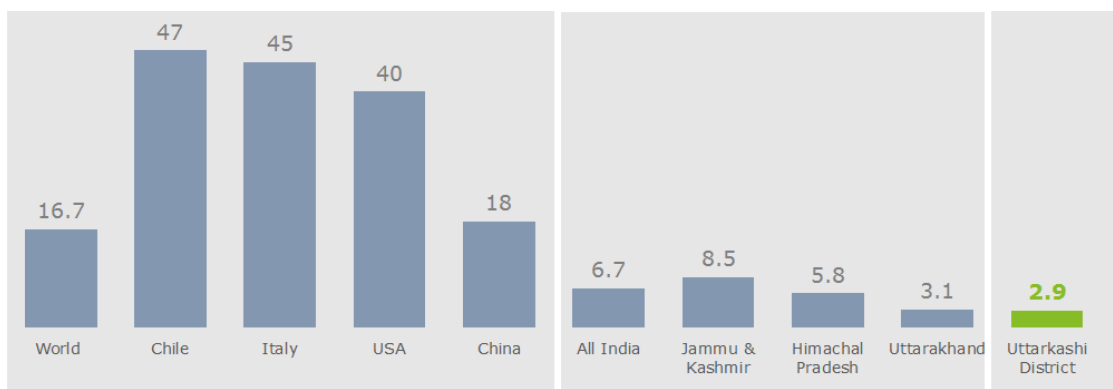
### 3.6 Identified Gaps and Constraints

#### 3.6.1 Production related

- Despite accounting for 11% of the area under cultivation, Uttarakhand as a State contributes only 5% of the total apple production in the country. The average productivity of apple in the State is very low, particularly in Uttarkashi district which alone accounts for one-third of the State production and area. Compared to all India average productivity of 6.7 MT/ha and that of other apple producing States as Himachal (5.8 tons / ha), and Jammu Kashmir (8.5 tons/ ha), the State productivity of apple is 3.1 tons/ ha and that of Uttarkashi district is 2.9 tons/ ha. The State productivity lags far behind the global average and that of China (18 tons/ha), which is the largest producer of apple in the world.

Figure 17. Comparison of Productivity of Apple (in MT/ha), 2014





Source: FAOS (for World Statistics); Ministry of Agriculture (for State-wise Productivity in India)

The issue of low productivity, besides, quality may be attributed to quality of planting material, use of seedling rootstocks, inadequate pollination, poor orchard management, rainfed cultivation, poor canopy management and harvesting practices, changing weather conditions as hail storms, heavy rain, long dry spell, temperature variation etc, resulting in low spur formation, poor coloration and delayed maturity. There is immense scope for improving productivity of apple in the State through technology infusion, introduction of global best practices and various market led interventions.

- Availability of quality planting material is key to productivity. Use of poor quality of planting material result in non-flowering, poor fruit setting, less yield and poor quality of fruits after 6-7 years of plantation. Mostly the farmer procure plants from various sources as nearby village nurseries, fellow farmers and department of horticulture. Some of the farmers have also been experimenting and developing planting material on their own. Though farmers are keen and willing to procure high quality-planting materials, however, they are constrained by limited sources of quality planting material supply. Presently about 30 nurseries in the State are recognized under the NHB voluntary system of recognition of for production of apple planting material. However, as per NHB most of these nurseries do not have adequate production-related infrastructure and pedigreed mother plants. Majority of these nursery have been graded as one-star to two-star on the assessment criterion laid by NHB. Thus, there is need for both technical and financial capacity building of such nurseries so that they may continuously strive for upgrading their facilities, source and maintain reliable and quality parent material, develop adequate infrastructure for production, adopt technically prescribed methods for propagation, adopt good nursery management practices, undertake proper record keeping and staffing, as per requirement. Whereas the department is maintaining imported rootstock varieties, there seems lack of trust among the farmers on quality of planting material being supplied by the department. At present, most of them dependent on the unregulated private sector nurseries. Thus, for higher output it is critical to promote use of right quality of high yield planting material. Also, the nurseries supplying planting material needs to be well maintained.
- Application of right fertilizer and its dosage can help in maintaining the required balance between the vegetative growth, fruiting and harvesting of the crop. Farmers in the surveyed area usually apply fertilizer without assessing the soil nutrient requirement. Though aware about soil testing and its significance, none of the interviewed farmer had got the orchard's soil sample tested. Some of them stated lack of proximal soil testing facility as the reason. Injudicious use of fertilizers not only adds to the cost of cultivation, but also disturbs the soil PH and neglect of micronutrient requirement resulting in low productivity.

Similar to fertilizer input use, application of pesticides for plant protection are also being used injuriously. Some of the farmers reported 12-15 spray application during the season. When asked about the application practice, many were unclear about the right concentration and time of application.

- Majority farmers have small and scattered land holding and practice rainfed cultivation. Moreover as most of the orchards are located on the hilly slopes, water runoff is high. Lack of adequate irrigation facilities and water storage infrastructure near orchards adds to the constraint. Negligible number of farmers reported to have installed drip irrigation system or have operational systems in place. Promotion of water conservation practices among farmer can help improve input use efficiency of fertilizer, pesticides and water and thus improve productivity.
- Though the farmer were keen to follow the recommend practices, however, there seems lack of field extension functionaries to guide the farmers on technical know-how. As a result, farmers are either dependent fellow farmers or private input suppliers for immediate advice on production related issues, which may be misleading or biased in their own favor. Apart from strengthening departmental human resource capacity, efforts need to be made for improving access of information to farmers through other mechanism. Field oriented training and demonstration on best practices, regular exposure programmes for knowledge exchange between apple growers in other States are among few that emerged during farmer discussion. With increased penetration of mobile telephony and internet availability in the region, use and promotion ICT based application systems may also be looked at tool for information dissemination. Alongside training and capacity building initiatives, regular field level monitoring and assistance is also required to be provided to the farmers to address their crop production related issues.

### 3.6.2 *Post Harvest Management*

- All farmers practices manual sorting and grading of produce. Grading of produce and packing it into boxes as per grade, requires highly skilled workforce. Whereas the farmers informed that they engage skilled worker for harvesting and grading practice. However, traders interviewed on the quality aspect of the produce expressed that the quality of grading and packing being done was not at par with the requirements. Apprehensions about quality of packed produce was sighted as one of the reasons for relatively low market rate of apples being branded and sold under State brand (differing by about Rs 100 per box). In context to the grading aspect, it is further notable that the availability of skilled labor is often short during peak season, as harvesting season in Uttarkhand partly coincides with that of Himachal Pradesh, where the volumes of production is comparatively manifolds. Thus, there is need capacity building of human resource on proper grading and packing practices. Besides, maintaining and providing the traders/ consumers with same quality and grade of apples in the box is also important aspect for winning their trust on quality aspect and brand building.
- Each farmers carry out grading and packing activities at respective orchard level. This leads to high resource cost, improper grading due to shortage of skilled workforce, wastages and time loss. Common service centres as that for collection of produce, sorting, grading, washing, packing are lacking. Only few facilities are available that operate as part of private sector initiative. These too, were reportedly not functional, except one.
- There is only one operational private sector operated cold chain infrastructure, which has about 1000MT CA capacity and 100 MT cold store. Besides the limited capacity, the company procure raw material from only few selected clusters in region. A new cold store of 1000 MT CA capacity and 200 MT normal cold store is being set-up in Jhala with assistance from the

State department and Marketing Board. The facility is yet to be operationalized. In absence of integrated cold chain infrastructure, the produce is sold to the markets at prevailing rates. Lately, a few private companies based outside of the district are also exploring procurement option from the region and offering competitive. Though this offer a good value proposition to the farmers, but these is absence of services for refrigerated trucks to transfer the fruit (which would increase the losses during transport). Alongside, capacity building of workforce is also required for handling of technical operations and maintenance of such facility/infrastructure being constructed or planned.

### *3.6.3 Road connectivity and transportation*

- Transportation infrastructure is thus one of the major concern for marketing of produce in the regions. Most of the apple orchards in the district are distantly located and have with poor road connectivity. For the orchard located very high up in the hills, mules and old installation of aerial ropeway systems are being used for transporting the produce from orchard to nearest road network. Poor connectivity not only adds to cost, time and resource but also limits timely farm operations per and post harvest. Moreover, the remoteness and the difficult road conditions also discourage traders from outside to travel to these clusters.

### *3.6.4 Marketing Related*

- Nearest APMC market is in Dehradun which is more than 200 km away from the leading apple producing clusters the district. There are no APMC regulated mandis in the nearby area. There are also no collection centres, packhouses and other related infrastructure in the cluster.
- Majority of farmers market the produce themselves, and hence, many times the farmers have limited bargaining power. Moreover, the information flow from traders to the farmers are generally not transparent. Except few progressive and large farmers, others are yet to develop profound direct linkages and negotiation skills with wholesaler in distant markets. Majority farmers lack market information about price and demand in distant markets resulting in lower value realization for them. Even though some progressive ones have been able to sell the produce in distant market, they reportedly ended up paying higher commission rates and other charges.
- With growing e-commerce trade, offers immense opportunity for innovative branding and marketing of produce through online trading, but presently remains untapped.

### *3.6.5 Processing*

- Secondary and tertiary level value addition to apple in the State is negligible. Low-grade fruits are mostly sold at throw away price to the local market within district.

### *3.6.6 Others*

- Farmers usually place their demand for packaging material with the department and with the local suppliers. Whereas the department usually supplies packaging material under customized State branding and labels, local dealers pay little attention to the branding requirements, unless specifically demanded by the farmers. Because of weak labelling and branding practices being followed by both farmer and the suppliers, majority farmer end up packing and selling the produce under non-State or conventional branding. There are packaging material manufacturers based out of District Dehradun and Udham Singh Nagar. However, there seems limited direct connect between the farmers and the manufacturing

units. As even the local dealers bring the packing material from outside the district and even from outside the State, it increases the cost. Strengthening of linkages between the packing manufactures and collective group of farmers can help fulfill both quality (branding) and quantity requirements of the farmers in timely and cost effective manner.

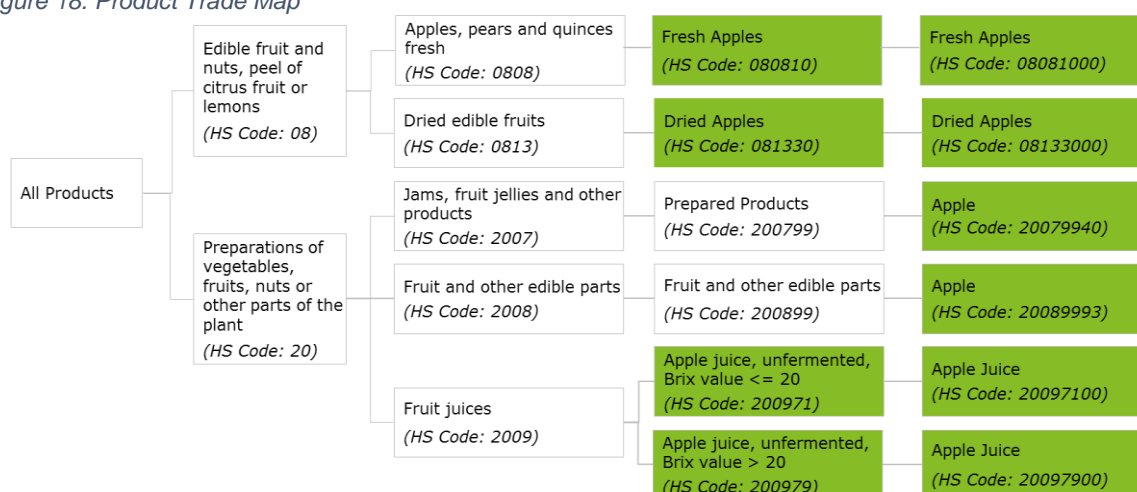
- There is absence of Farmer Groups (including women SHGs). These may be promoted in convergence with various government scheme for collective purchase and supply of inputs, operating common collection centres and pack-houses, which would finally strengthen their bargaining power along the supply chain.

## 4 Demand Assessment

### 4.1 Apple Products Map

Apple is commercially of the most important temperate fruit crop. It is among the mostly widely produced fruits in the world after banana, orange and grape. Apple traded globally in various forms as fresh, dried, canned, juice etc. as depicted below.

Figure 18. Product Trade Map



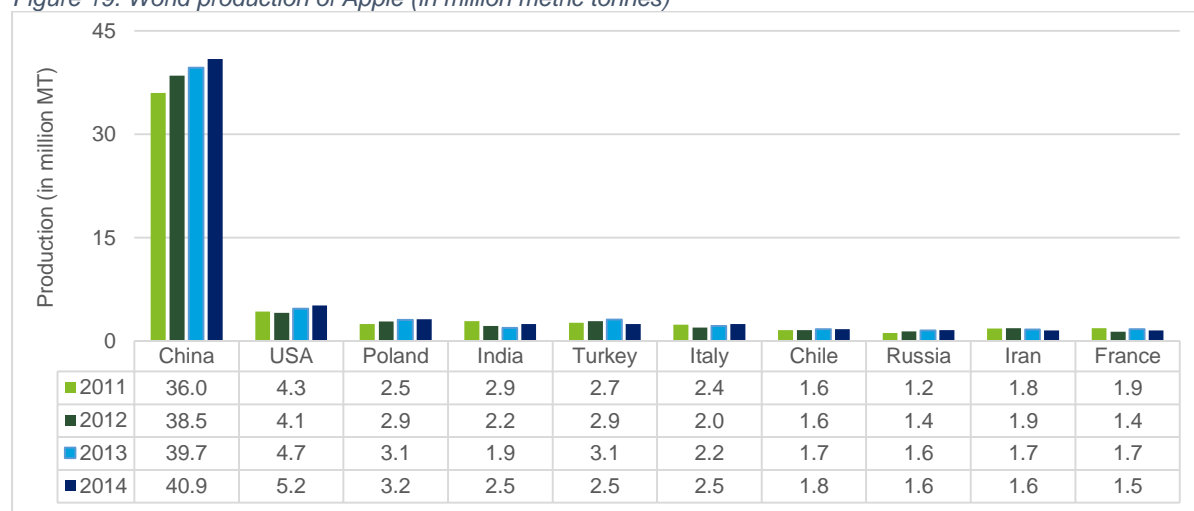
According of USDA<sup>21</sup> it is estimated that almost 85% of the global production is consumed domestically in fresh form in the base countries. Whereas trade of fresh produce is about 8%. At global level, the value addition to apple is restricted to only about 15% of the total global production.

## 4.2 World Trade of Apples

### 4.2.1 World Production & Consumption of Apple

In 2014-15, the global production of apple was 84.63 million metric tonnes. Chinese apple industry increasingly dominate the global production of apple accounting about 56% of the total world production, followed by European Union being world's second accounting 16% (including Poland, Italy, France and Germany being the leading producer) and US being third largest producer (6%)<sup>21</sup>. Among Other producers are Turkey, India, Iran Chile & Russia.

Figure 19. World production of Apple (in million metric tonnes)



Source: FAO

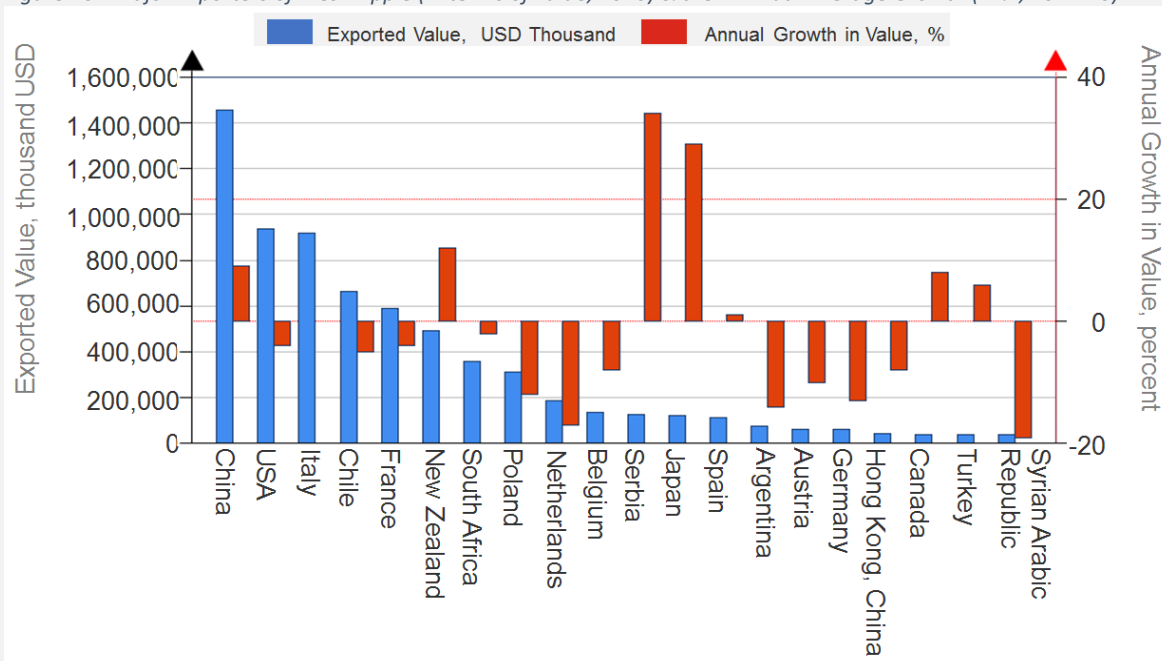
### 4.2.2 Global Import-Export of Apples

#### 4.2.2.1 Global Export Market

Fresh apple is the most prevalent form under global trade of apple. It is exported to different parts of the world, with China (20.2%), USA (13%), Italy (12.8%), Chile (9.2%) and France (8.2%) being the leading exporter of apple, both in terms of quantity and value, accounting over 60% of the total exports. Whereas Chinese apples, in particularly, are mostly exported to Southeast Asian markets including Thailand (13.6%), Philippines (11%), India (10%), Vietnam (9.6%), Bangladesh (8.6%) and to Russia (8%), Indonesia (7%) & Myanmar (6%). The USA apples is major exporter of apples to Mexico (25%), Canada (22%), Taipei, Chinese (8%), India (7%) and Indonesia (5%). Exports from Italy are mostly to Germany (28%), Spain (10%), other countries in European Union, Saudi and UAE. Limited quantities are also exported to India (1.6% of total exports). United State, Brazil & Colombia are the major importers for Chile.

<sup>21</sup> USDA Fresh Deciduous Fruit: World Markets and Trade, June 2017 (<https://apps.fas.usda.gov/psdonline/circulars/fruit.pdf>)

Figure 20: Major Exporters of Fresh Apple (in terms of value, 2016) & their Annual Average Growth (in %, 2012-16)



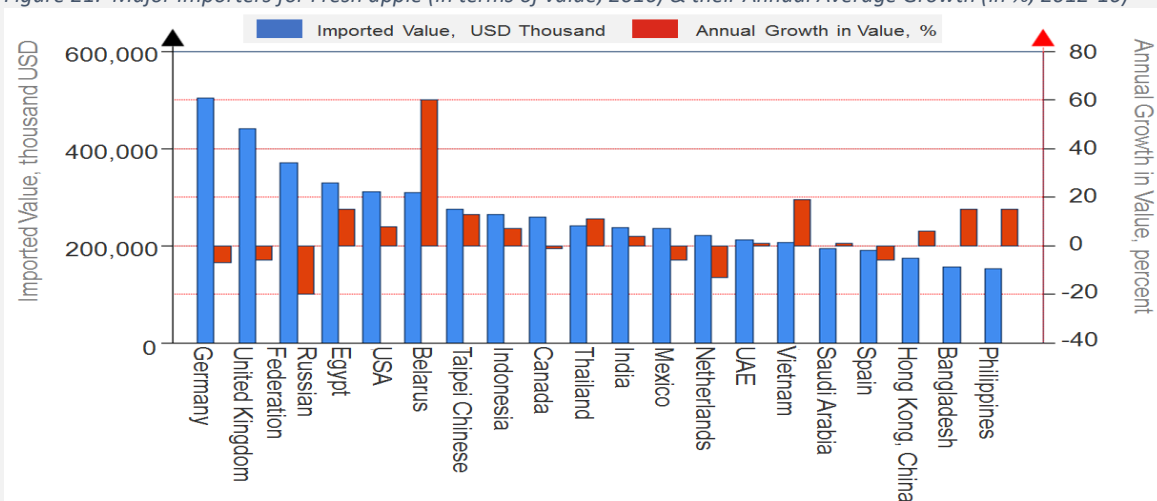
Source: ITC calculations based on UN Comtrade Statistics

It is notable that in recent years, the export sales from USA, Chile and France have posted decline and other countries as Serbia, Japan, New Zealand and China are among fast emerging major apple exporter countries.

#### 4.2.2.2 Global Import Markets

The import market for fresh apple is very diverse. Germany, UK and Russian Federation are the biggest importer of fresh apple in terms of quantity, respectively accounting for share of 7.1%, 5.6 & 5.1%. However, there has been a significant drop in terms of its import quantities in these countries the last 5 years (2012-16), particularly in Russia. On other hand countries as Belarus and those in Southeast Asia as Vietnam, Bangladesh, Philippines, Thailand and Indonesia have seen a significant annual growth (at rate above 10%) in apple imports.

Figure 21: Major Importers for Fresh apple (in terms of value, 2016) & their Annual Average Growth (in %, 2012-16)



Source: ITC calculations based on UN Comtrade Statistics

## 4.3 Domestic Demand and Trade

### 4.3.1 Production and Consumption of Apples in India

India's annual average production of apples is about 2.3 million tonnes from an area of about 300 thousand hectare. India ranks 4<sup>th</sup> in terms of global apple production (by volume). However, the percentage share of India in global production of apple is only 3%. Although harvested area across the country has expanded, however declining average yields across all major apple producing State have slowed total annual production growth across the country.

Apple generally remain slightly more expensive throughout the season compared to other domestically produced fruits as mangoes, banana, oranges etc. Due to high price, the fruit has relatively lower per capita consumption in India and consumption is mostly limited to middle to higher income group. According to National Survey Report by Ministry of Statistics and Programme Implementation published in June 2014, the annual per-capita consumption of apple varies along urban and rural sections of the country. In 2011-12, average per-capita consumption in a year for urban is 2.32 kg while rural has only 0.71 kg. Considering the urban-rural ratio to be 31.16% to 68.81% as per Census 2011, the weighted average per capita consumption of fresh apple in India is calculated 1.225 kg per annum equivalent to total consumption of 1.6 million tonnes per annum. Thus, it is estimated that only about 70-75% of the fresh apple fruit (including imports) is consumed domestically, while rest is either processed<sup>22</sup>, exported or wasted.

Table 15: Estimated Consumption of Apple in India

Particulars	Quantity (in 1000 MT)	% of Total Availability
Total Apple Production (A)	2133	
Add: National Import of Apple (B)	198	
<b>Net Availability for Domestic Consumption (A + B)</b>	<b>2331</b>	
Less: Estimated consumption of fresh apples on per capita basis (C)	1625	70%
Less: Estimated volume available for processing based on national average percent of fruit processing (D)	46.6	2%
Less: National Export of Apple (Incl. Other apple product equivalent) (E)	20	1%
Balance: Estimated as wastages (A+B-C-D-E)	639.2	27%

Source: APEDA & National Horticulture Database 2014-15

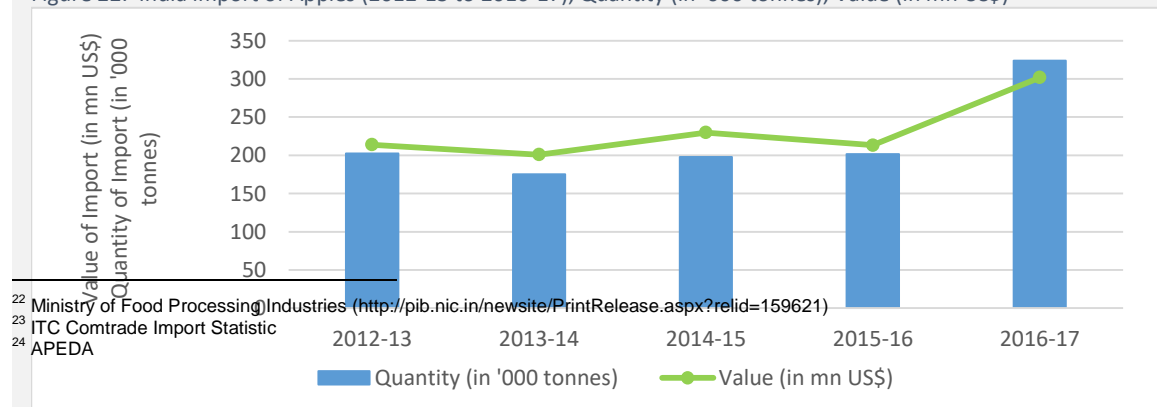
Note: Reliable data sources are unavailable to estimate the exact percentage or volumes of apple being processed domestically.

Considering that, the overall level of processing in perishable products in India is estimated only at 2.1% in fruits and vegetables, the same has been considered herewith for purpose of estimation.

### 4.3.2 Import of apples in India

India import of apples though small but has increased significantly over the years at last five year CARG of 7%<sup>23</sup>. India has emerged as largest importer of apples in the Asian region. Infact, apple account for about 40% of the total quantity and value of India's fresh fruit import<sup>24</sup>. It is notable that the surge in imports is despite the fact that India imposes high tariff (50 per cent) on imported apples. Increasing imports is thus indicative of increasing disposable income of consumers in both urban and rural markets and rapidly transforming demand for quality and variety of apples.

Figure 22: India import of Apples (2012-13 to 2016-17), Quantity (in '000 tonnes), Value (in mn US\$)



Source: APEDA

<sup>22</sup> Ministry of Food Processing Industries (<http://pib.nic.in/newsite/PrintRelease.aspx?relid=159621>)

<sup>23</sup> ITC Comtrade Import Statistic

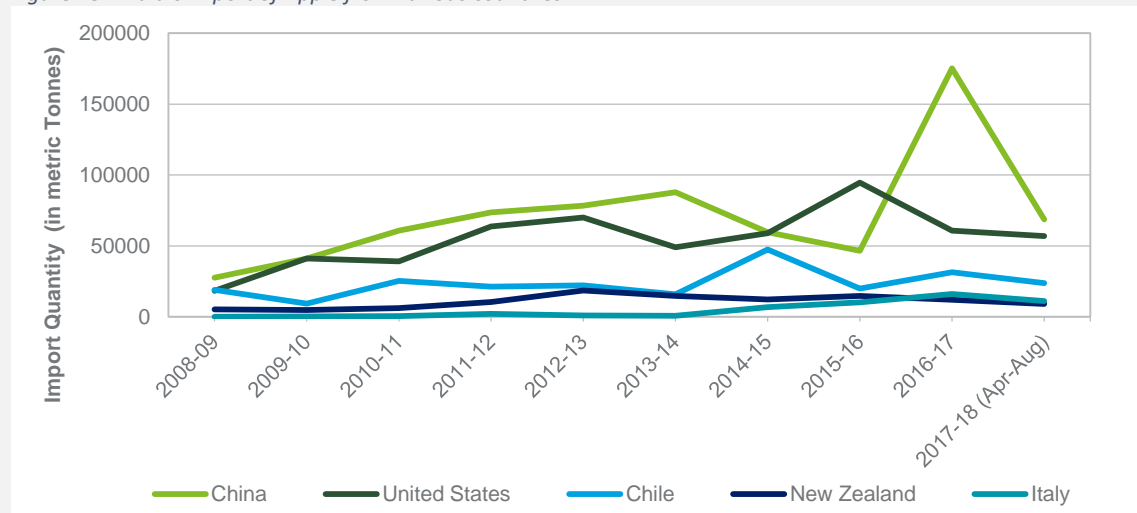
<sup>24</sup> APEDA



On an average, USA has been the largest supplier of apples to India (average 30%). However, imports from China has shown increasing growth in recent year (average 40%). Imports from these two countries including Chile account for around 80-90% of the apples imports into the country. New Zealand and Italy are among the other major importers. In this context, it is notable that this year Indian Government has placed an embargo on import of apple from China due to phytosanitary non-compliance (contaminated lot of imports).

India's imports of wide varieties of apples. Common varieties include Red Delicious (majority from Washington US and from Chile), Royal Gala (mostly from Chile and New Zealand), Fuji (majorly from China and some from US), Granny Smith (mostly from US, some from Italy and limited quantities from France and South Africa), some quantities of Golden Delicious (from Italy), Pink Lady (from China), Pacific Rose (from New Zealand). Based on the study discussion at wholesale fruit market & retailers in Delhi, it is learnt that while the acceptability of these imported varieties is gradually increasing, Red Delicious from Washington is the most preferred followed by Royal Gala, Fuji and Granny Smith. The traders interviewed during the survey were also of opinion that packaging of imported apples is of much higher standard resulting in low levels of latent damages. In addition, the quality of fruits is adjudged far better compared to domestic produce in terms of uniformity in colour, size and shape as well as shelf life largely because of a superior cold chain and supply chain infrastructure. The imported apples are mostly transported in refrigerated containers until they reach the wholesale markets in major cities as Delhi, Mumbai, Chennai, Kolkata, Bangalore, Ahmedabad or Others.

Figure 23: India's import of Apple from various countries



Source: APEDA

Further, the wholesalers in these national markets also have relatively easy access to available cold store facilities due to better developed market infrastructure. Because of the significantly higher price, the wholesaler also tend to hold the material in the cold storage until onward sales to maintain its quality in terms of freshness, crispness and juicy content.

Figure 24: Major Imported Apple Varieties

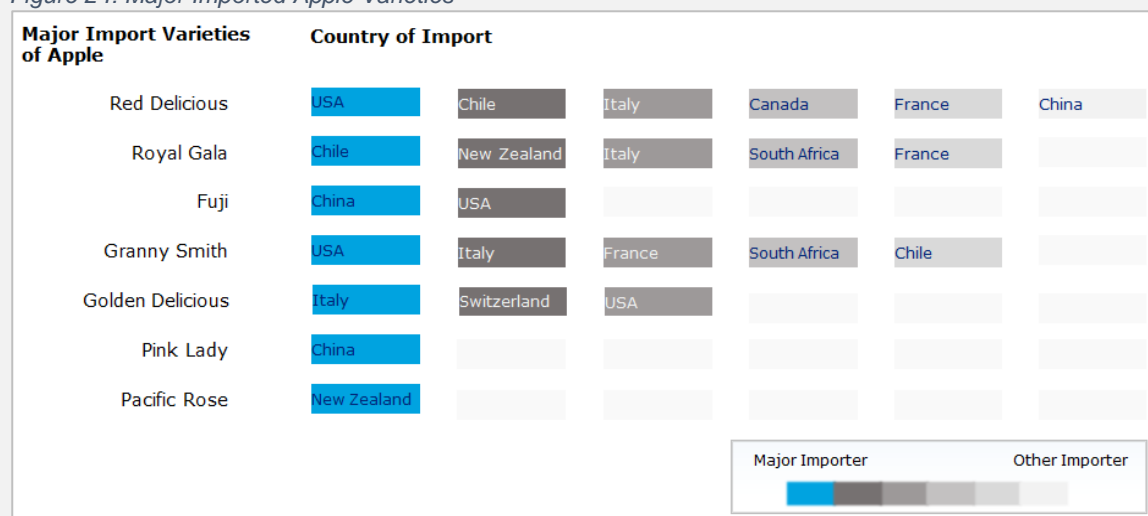


Table 16: Imported Apple varieties from major Suppliers

Country	Variety	Port of Discharge	Standard Packing size
US	Red Delicious, Granny Smith	Nhava Sheva/ Chennai	18Kg
China	Fuji	Nhava Sheva/ Chennai	20Kg
Chile	Royal Gala	Nava Sheva / Chennai	20Kg
New Zealand	Royal Gala, Red Delicious, Pacific Rose	Cochin/ Chennai/ Krihnapatnam	18 Kg
Italy	Granny Smith, Red Delicious	Nhava Sheva	18 Kg

Source: Assessment based on Field Survey and Secondary Data Sources

It is notable that though there has been increasing influx of imported apples in the country. However, at current stage imported apples does not seem to be competing with the domestic produce for reasons as higher price mark-ups, difference in seasonal arrival and quality of produce. Imported apples are mostly sold at significantly higher retail prices, which may be attributed to high tariff rates and greater trading margins of importers due to relatively lower marketing costs as the produce is well graded and packed and losses are minimal. The marketing cost for importer in this case is limited to cost of clearing, transportation and handling, temporary cold storage, if required.

Table 17: Retail price of Imported and Domestically Produced Apples

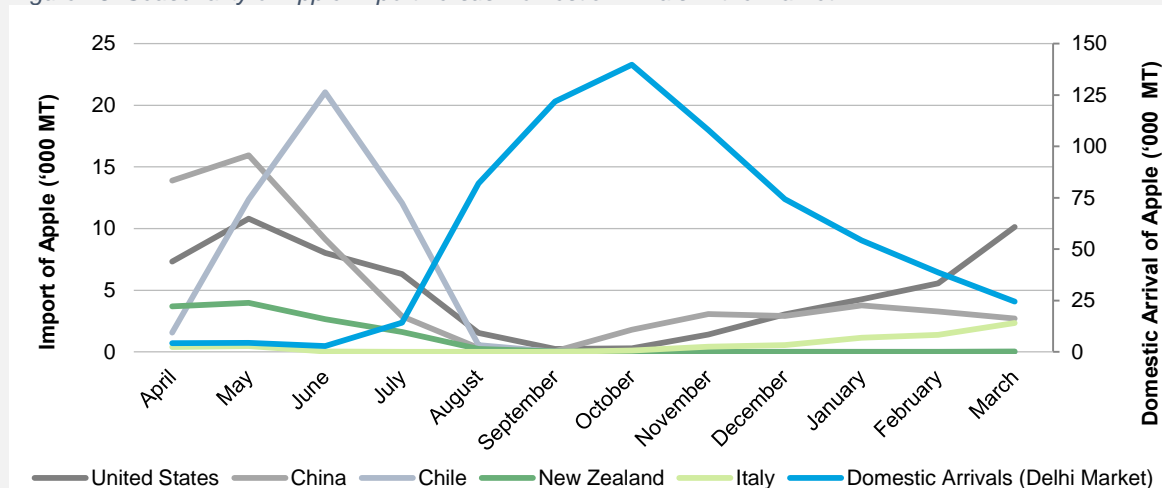
Imported Apple		Domestic Apple	
Brand	Retail Price (approx.)	Brand	Retail Price (approx.)
Washington Apple	Rs 275-300/ Kg	Kinnaur	Rs 200/kg
Royal Gala	Rs 375/ Kg	Kashmir	Rs.120/kg
Fuji	Rs 210-230/ Kg*	Shimla, Uttarkhand & Other	Rs 80-110/ Kg
Granny Smith	Rs. 600-700 for 6 pcs		

Source: Assessment based on Field Survey and Secondary Data Source

As on date, the Fuji apple retail price is about Rs 400/ kg. This may be due to low supplies of the variety due to embargo imposed by the Government of India of import of apples from China, which is the main importer of fuji apples for India.

Besides better quality, it is further notable that the bulk of imports arrive in Indian market during April to June. The imports drop at the onset of peak harvesting months for domestic production (August to November) and then again rise with lean season in December continuing till June next season.

Figure 25: Seasonality of Apple Import versus Domestic Arrivals in the Market



Source: APEDA, APMC (Azadpur)

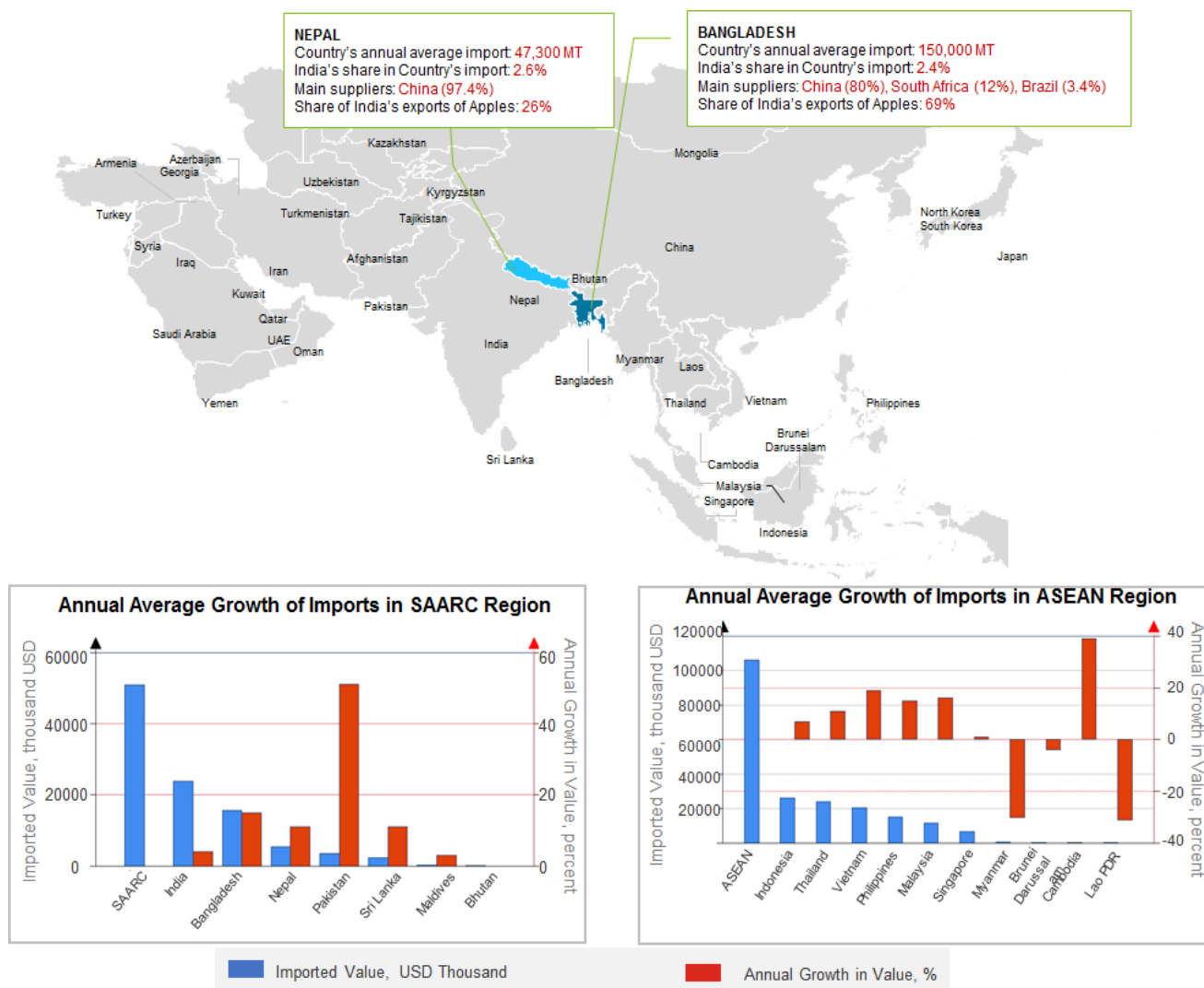
High price of imported apples rather provides a window of opportunity for growth the the domestic apple production to be enhanced both in terms of productivity and quality and bringing them at par with the import. Commodity-focused interventions are required to be implemented across all apple producing regions in the country in 'mission' mode, particularly in Uttarkhand where despite significant area coverage, apple production is lagging due to poor production practices, low level of technology access, lack post-harvest and marketing infrastructure and weak market linkages. As a result even the high quality produce of the State as that from higher hill regions in Harshil, Sankri, Aarkhot are failing to entirely reach the consumer markets at right price. New high yielding apple cultivars to be introduced that are at par with international standards and suitable for high-density plantation and would boost production multi-folds. Moreover, it is notable that India apples are available for only a short period of 4 month (July/Oct), whereas demand for apple is throughout the year. Therefore, the post-harvest practices of sorting, grading, and packing also need to be upgraded alongside with the cold chain supply network to increase produce shelf-life, reduce wastages, increase marketable surplus and also expand trading window for domestic produce to be marketed during off-season supplies.

#### 4.3.3 Export of apples from India

Despite significant area coverage and production, India's export of apple is less than 1 percent of the total production of apple. The growth has moreover been negative indicative of widening gap between production versus exports. Key export destinations for Indian apples are Bangladesh (69%) & Nepal. (26%). However, India's share in these export markets is miniscule 2.5% and about 80-95% of market is predominantly catered by China.

During last five years (2015-16), the global export sales of apples to Bangladesh were on average approximately 150,000 tons, but in value and quantity have grown at rate of 15%. This may be attributed to increasing number of middle and upper call of consumers in the country that are gradually demanding higher value and diversified products. Bangladesh produces a wide variety of tropical fruits, but not apples. Bangladesh is a therefore a robust market for export of apples, particularly in more affluent urban centers like Dhaka and Chittagong. Similarly, Nepal has also recorded growth rate of 12% in past five year on import of apples. Other ASEAN countries Thailand, Vietnam & Philippines are among other potential regions for that have recorded high annual average growth of apple imports in last five years. These countries have also registered an annual growth of 10% in value and quantity during 2012-2016. Thus, there is significant potential for India to increase current levels of apple export to these markets due to significantly high demand.

Figure 26: Potential export market for Apple



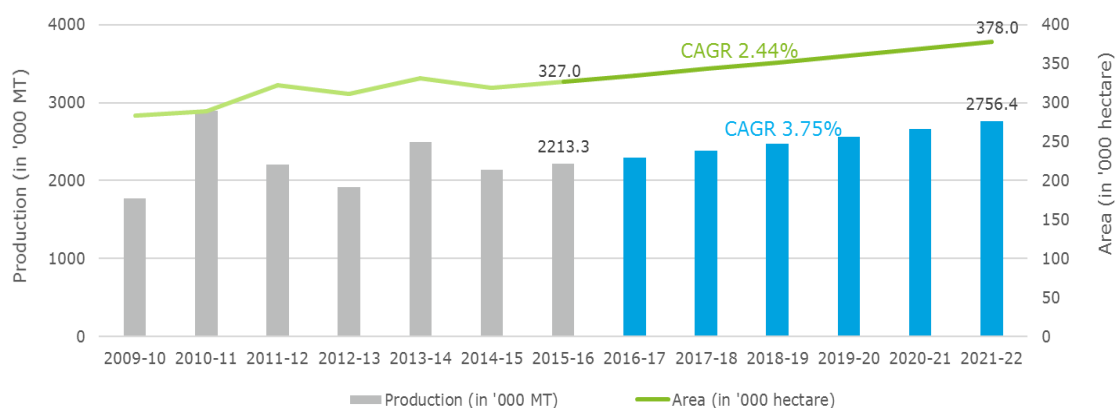
Source: ITC Comtrade data Analysis

#### 4.3.4 Potential opportunity for Uttarakhand

Based on the above analysis, it is understood that the demand side presents a significant opportunity to boost the country's overall production at both domestic and international market level. Particular to Uttarkhand, it is observed that due to low production base and lack of value addition capabilities, the State has clearly not been able take advantage of the potential opportunities. The existing gaps and deficiencies in the sector need to be immediately addressed to transform the sector to become more productive, efficient and profitable.

Further, in this context it is important to understand and estimate the targeted area and production increase at national level, so that the State and district level plans for sector development may be designed accordingly and streamlined incremental growth may be achieved. Based on area and production trend analysis, it is observed that during last five years the area and production of apple in the country has increased at a compounded annual growth rate of 2.44% and 3.75%, respectively. It is being assumed that during the next five year, the sector would at minimum would continue to perform as per current growth trends. Thus, applying the calculated compounded growth rate to project the targeted growth for next five years, the area and production of apples at national level is estimated to increase by 16% and 25%, respectively.

Figure 27: Projected Area and Production of Apple at National Level (2016-17 to 2021-22)



Source: Analysis of National Horticulture Data Base

Allocating these incremental targets to the State in ratio of its current share in country's total area and production base, the targeted coverage and production volume for the State is estimated as below. Correspondingly, the incremental volumes have been calculated at District level for Uttarkashi in ratio of District's current share in State production and area under apple cultivation.

Table 18: Projected Area and Production of Apple at State & District Level (2016-17 to 2021-22)

At State Level: Uttarakhand	% share of India Total	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Area ('000 ha)	11%	36.0	36.8	37.7	38.7	39.6	40.6	41.6
Production ('000 MT)	5%	110.7	114.8	119.1	123.5	128.1	132.9	137.8
At District Level: Uttarkashi	% share of State Total	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Area ('000 ha)	25%	8.8	9.0	9.3	9.5	9.7	10.0	10.2
Production ('000 MT)	23%	24.9	25.9	26.8	27.8	28.8	29.9	31.0

Source: Analysis of National Horticulture Data Base

It may be noted in the above table that while the annual average area increase under apple cultivation in the State is projected about 1000 ha per year, the production levels are subject to increase based on technological interventions that would be implemented and adopted by the growers during these years. Modern farming techniques along with introduction of ultra-high density cultivation for spur type varieties will increase area and production. Presently, the postharvest infrastructure facilities like pre-cooling facilities, storage facilities, collection centers, grading/sorting, washing/cleaning facilities and pack houses, etc., are not present. These facilities are necessary to prevent quality loss due to temperature variation, moisture loss etc. Farm level interventions in the identified clusters may boost the production. Incentives for farm level pre-processing facilities such as pre-cooling facilities, cooling facilities, collection centers, grading and sorting systems and pack houses, etc. will reduce wastage and ensure proper price realization by the farmers. Presently, the harvested produce is dispatched to the markets within and outside the State. Therefore, there is an opportunities to establish proper storage facilities near to the producing areas. Development of proper storage facilities will again reduce wastages. As other fruits and vegetables are also available in abundance, a multi fruit processing units with focus of apple processing with strong institutional support will boost the demand for apple. There is also scope of organizing farmers' cooperatives, Self Help Groups (SHGs) and other community organizations for setting up mini- processing units. Government facilitation is required for the success of such units. There is also need to provide assistance by Government for market development and brand building of apple produced by the State. All these factors are interrelated and cannot be planned and implemented independent each other. Thus, there is need to undertake an integrated and concerted approach to develop the apple value chain in the State under mission mode.

## 5 Recommendations/ Proposed Action Plan

It is evident from the overall sectoral assessment that apple is a vital horticulture crop for Uttarkashi District due to its importance in terms of livelihoods and income generation for the farmers. In addition, there is huge potential for processing of apple in the region, which can give a major boost to the economy of State. As elaborated in earlier section of the report, there are plenty of opportunities for interventions right from the farm level to final marketing of the produce.

The Mission for Integrated Development of Horticulture recognizes the important role of developing existing apple value chain in the District. Various centrally and state sponsored schemes have provided the necessary stimulus to the sector, which has enabled the achievement of a healthy growth rate in the past. However, to compete sustainably in global market and under liberalized trade regime, necessity is recognized to focus on both productivity enhancement as well as value chain development for increased profitability and improved market access.

Having studied the challenges and constraints faced by the sector, a holistic approach comprising of combination of both *soft* and *hard* interventions is proposed to be implemented for increasing apple production and productivity in the region and facilitating value addition.

- Soft interventions are proposed to be implemented across the district and would consist of discipline-specific short term training & exposure visit envisaged to enhance the technical skill for growers as well as technician, extension workers, entrepreneurs and other operating in the sector. Such interventions are proposed to be delivered through institutions specialising in the subject area.
- Hard interventions are majorly being proposed to complement cluster specific requirements based on the assessed need. Hard interventions under the programme shall primarily aim at creating tangible developmental assets to support the various node of cotton value chain under participatory approach system.

An effort has been made to align the activities with the overall objective of horticulture mission and initiatives being undertaken by other agencies (State governments, bilateral and multilateral organisations).

Integral with the objective of the interventions, the proposed soft & hard interventions are focused on forging the vertical as well as horizontal linkage along the apple value chain. Placing the proposed interventions in the value chain context, the soft & hard interventions have been categorized into 4 components viz.

- a) Production related
- b) Post-harvest
- c) Processing (transformational)
- d) Overarching (horizontal linkage).

Table 19: Summary - Rationale of proposed action plan

Component	Objective	Constraints	Required Intervention	Recommended Action Points
<b>Production Related</b>	Increasing productivity through technology dissemination at grass root level	<p><b>Planting Material</b></p> <ul style="list-style-type: none"> <li>• Accessibility to quality planting material</li> <li>• Limited number of nursery</li> <li>• Absence of hi-tech apple nursery</li> <li>• Lack of quality certified planting material</li> </ul> <p><b>Cultivation Practice</b></p> <ul style="list-style-type: none"> <li>• Low adoption of recommended package of practice due to lack of know how, training and exposure</li> <li>• Inefficient nutrient application due to lack of nearing facilities for soil testing facility. Micro-nutrient application not prevalent</li> <li>• Injudicious use of pesticides</li> <li>• Lack of water availability on orchards</li> <li>• Integrated pest management not widely practiced</li> <li>• Weak decision support system in place to guide the farmer on management of insect pest &amp; diseases</li> <li>• Extension activities primarily managed through Department of Horticulture which is constrained by limited outreach due to resource constraint and hilly topography</li> </ul> <p><b>Other constraints</b></p> <ul style="list-style-type: none"> <li>• Crop loss due to harsh weather as hailstorm</li> <li>• Damage due to animal attack on crop (wild boars, monkey, bear)</li> <li>• Access to finance</li> <li>• Low level of pollinizer</li> <li>• Old &amp; senile orchards</li> </ul>	<ul style="list-style-type: none"> <li>• Supply of elite planting material to the growers</li> <li>• Transfer of technology and knowledge on best practices for cultivation and crop management through training, demonstration</li> <li>• Creation of critical mass of trainers/ extension agents/ field functionaries to expedite information dissemination</li> <li>• Development of community water storage/ harvesting structure near to farms for production purpose</li> <li>• Improving access to other inputs as drip irrigations system, anti-hail nets, chemical inputs etc</li> </ul>	<p><b>Hard Interventions (Infrastructural Assistance):</b></p> <ul style="list-style-type: none"> <li>• Setting-up of three-tier Centre of Excellence for propagation of planting material, training, demonstration &amp; technology dissemination <ul style="list-style-type: none"> <li>- Tier I - Strengthening of existing Government Facilities to be developed as apex model centres (2 sub-centres)</li> <li>- Tier II - Establishment of five(5) hi-tech nursey near to production clusters / Upgradation of ten (10) nursery infrastructure to meet the accreditation norms</li> <li>- Tier III – Development of ten (10) model farms at growers level (front-line demonstration units)</li> </ul> </li> <li>• Area Expansion through establishment of 1000 ha new orchards and rejuvenation of 500 ha senile/ old orchard</li> <li>• Creation of eighteen (18) community water resource infrastructure for farmer use (in conjunction with MGNREGS)</li> <li>• Pollination support through Beekeeping targeting 150 No. of beneficiary with 50 colonies per benefecery</li> <li>• Setting-up of two (2) mobile soil testing facility</li> <li>• Supply of 200,000 sq m of anti-hail nets to apple growers</li> </ul> <p><b>Soft Interventions:</b></p> <p><b>Training</b></p> <ul style="list-style-type: none"> <li>• Training of 20 nursery growers</li> <li>• Training of 10 farmers undertaking demo plantations</li> <li>• Training of 1500 farmers (including women) beneficiary under Area expansion</li> <li>• Training of 15 master pruners who'd train other grower</li> <li>• Training of 18 Facilitator (ToF) including the extension officers, dept. field functionaries, village agent or progressive farmers</li> <li>• Exposure tours within &amp; outside State for growers/ technical staff/ field functionaries</li> </ul> <p><b>Knowledge Management</b></p> <ul style="list-style-type: none"> <li>• Designing e-module and content on apple production which would allow extension agents and farmers to continue to access the informational videos, notes, other information as upcoming training schedules, sourcing of planting material etc.</li> </ul> <p><b>Research:</b></p> <ul style="list-style-type: none"> <li>• Adaptive Research &amp; Development of Improved Technologies</li> </ul>



Component	Objective	Constraints	Required Intervention	Recommended Action Points
<b>Post-Harvest Management &amp; Value Addition</b>	<p>Improving value realization at farm level and building sector competitiveness through improved post-harvest handling and value addition</p> <p>To enhance the market for the produce and initiate further value addition</p>	<ul style="list-style-type: none"> <li>Hilly terrain and inadequate labour limits the timely post harvest evacuation of the produce</li> <li>Lack of farm level infrastructure to support evacuation</li> <li>Manual sorting grading of produce</li> <li>Lack of market infrastructure for collection, aggregation &amp; storage</li> <li>Quantum of processing is very low in the cluster and is confined to cottage and small scale industries</li> <li>In the absence of processing industries farmers do not have enough market to sell their produce and during the glut are resorting to distress sale</li> </ul>	<p>Development of post harvest infrastructure near to the farmer</p> <p>Aggration of producers to improved bulk capacity</p> <p>Development of cold storage facility to prevent distress sale at time of glut.</p> <p>Encouraging private sector investments into processing in the State</p>	<ul style="list-style-type: none"> <li>Creation of Farmer-linked and operated value added centres (2 centres)</li> <li>Promotion of Farmer Groups/ FPOs in three production clusters. Formation of two(2) Farmer group/ FPOs with 100-150 members each and one farmer group of 50-75 (in small production cluster)</li> <li>Setting-up of Value Added Centres for seamless backward and forward linkage <ul style="list-style-type: none"> <li>Forging of Backward Linkages</li> <li>Collection Centre for Sorting, Grading &amp; Packing (1 per center)</li> <li>Cold Store (100 MT, 1 per centre)</li> <li>Reefer Van (4 van of 4MT capacity each per centre)</li> </ul> </li> <li>Minimal Processing Unit (1 per centre)</li> <li>Augmenting Pack House &amp; Cold Chain Infrastructure <ul style="list-style-type: none"> <li>Setting up Modern Integrated Pack House</li> <li>Cold Storage with CA (1000 MT)</li> <li>Reefer Van (4 van of 4MT capacity each per centre)</li> </ul> </li> <li>Setting up of Multi-Fruit processing Infrastructure</li> </ul>
<b>Overarching</b>	To address the cross-cutting sectoral issues in all nodes of the value chain	<ul style="list-style-type: none"> <li>Scope for policy level assistance to encourage greater farmer integration in downstream value chain</li> <li>Absence of overall governing body to oversee marketing and processing of horticulture produce</li> <li>Absence/ Limited branding of Uttarakhand Apples as products</li> </ul>	<p>Drawing learnings from best policies in other States for development of apple value chain</p> <p>Establish of governing body to undertake marketing and processing related interventions</p> <p>Branding of produce through sustained campaigns</p>	<ul style="list-style-type: none"> <li>Encouraging Scheme/Policy Reforms for Development of Horticulture sub-sector</li> <li>Establishment of Uttarakhand Horticultural Produce Marketing and Processing Corporation</li> <li>Increasing Branding Recognition</li> <li>Development of Project Management &amp; Monitoring Framework</li> </ul>

## 5.1 Production Related

Those activities focussing on increased productivity by way improving planting material supply, transferring best practices, strengthening of extension systems etc are covered under this component. The activities would include training / capacity building & setting up of infrastructure facilities related to dissemination of production technologies.

### 5.1.1 Hard Interventions: Infrastructural Assistance

#### 5.1.1.1 Setting-up of three-tier Centre of Excellence for propagation of planting material, training, demonstration & technology dissemination

Timely availability, adequate and regular access to disease free, true to the type quality planting material is preliminary for improving apple production in the State. It is particularly significant in case of fruit crops which have a long gestation period and productivity performance are known only in later stages. Besides, knowledge and practical exposure to best practices for cultivation is also important. It is notable that Uttarkashi district has a huge government owned garden facility based at Jermola that stocks, maintains and propagates elite cultivars for various temperate fruit crops including apple. The facility also maintains mother plant of imported apple varieties. Despite such huge facility, access to quality mother stock still remains a big challenge for the nursey grower, which is indicative of existing systemic gap. Similarly, access to extension services on know-how on best practices for orchard management is also limited. The district has only one KVK located at Chinyalisaur, which is relatively distantly located from the production clusters and thus extension activity is limited to fewer of the field functionaries deputed by the Department of Horticulture. As a part of overall strategy for supplying quality planting material, especially in view of the fact that its demands is likely to grow by 15-30% in the next five years, there is need to strengthen the entire network of planting material development and distribution in the District. This require development of one foundation block of non-pedigree plants of commercial cultivars. These foundation trees at the block to be further multiplied and the multiplied plants are then to be certified to become mother trees. Consecutively, the satellite nurseries (preferably in the private sector) to provide good planting material to growers sourced from the mother tree. The foundation tree block can be in one the existing nursey in the government sector with proper isolation and protocol follow up. This is one of the established global best practices. In this context, three tier model is proposed to be developed that would integrate the existing government research sub-station in the region, with the network of nursey and farmer providing a governance structure and financial and administrative implementation and monitoring of on-ground activities.

#### **Tier I – Strengthening and scaling up of existing Government Facilities to be developed as apex model centres (at research level) for elite mother plant production**

The existing government facilities such as that at Jermola to be developed and promoted as apex model centre that would actively involve in import and multiplication of rootstocks and cultivars for supply to network of nurseries for propagation and onward sale to farmers. Besides, enhancing the availability of disease-free genetic material, the centre would also act as premise for training and demonstration the relevant practices suitable for adoption. A portion of premise at KVK Chinyalisaur to also be developed for extending similar services to the farmer. It is proposed the while the facility at Jermola would cater to the requirements of production cluster in Naugoan, Purola and Mori Block. The facility at KVK Chinyalisaur would cater to the requirement Blocks Batwari, Chinyalisaur & Daund. Required technical guidance to be provided through Central and State Level government agency as State Agriculture university, National level research institutions and other relevant public sector agency. National and International collaboration should also considered for bring in technical expertise on globally best available technology and practices being adopted in other apple producing nations (as US, Chile, China, Netherlands, Australia). In accordance with MIDH norms, 100% assistance to maximum of Rs 50 lakhs is being budgeted towards acquisition of technologies including import of planting material from other countries for evaluation and mass multiplication in order to increase production & productivity of horticulture crops

## Tier II – Establishment of hi-tech nursey / Upgradation of nursery infrastructure to be developed as satellite units for planting material prorogation

Presently about 30 nurseries in the State are recognized under the NHB voluntary system of recognition for production of apple planting material<sup>25</sup>. As per NHB records, the total production capacity of these is estimated 471,960 mainly propagating Red Chief, Oregon Spur and Royal Delicious varieties, accounting over 50% of the total. Out of these 10 nurseries (excluding Government Garden in Jermola) are located in the Uttarkashi district and have production capacity equivalent of 2.4 lakh plants. However, these nurseries are small and have one to two star rating per NHB grading criteria implying that these have minimal required nursery infrastructure as per NHB. This is indicative of huge gap in existing nursery infrastructure in the District, as none of the existing nurseries have five star rating implying absence of hi-tech nurseries that are fully compliant to the nHB accreditation norms for production of planting material. Such situation has limited the farmers access to good quality certified disease free planting material of true to type varieties as a result of which production, productivity and quality of the of produce suffers heavily. Aforementioned the farmers from the district are majorly dependent on private farms and nurseries in neighbouring districts of Himachal for procurement of quality planting material.

Currently the District has about 9038 hectare of area in the district is under apple crop. Considering target increase of atleast 15-30% in area under apple cultivation in next five year, would require and estimated area expansion at rate of 3 to 5% as projected below:

Area Expansion Scenario		Unit	Current Area FY15-16	Cumulative Y-o-Y					% increase over base year	Annual Average Area increment
				Year 1	Year 2	Year 3	Year 4	Year 5		
at 3 %	Cumulative	in ha	9040	9311	9591	9878	10175	10480	16%	300 ha
	Y-o-Y Increase	in ha		271	279	288	296	305		
at 5 %	Cumulative	in ha	9040	9492	9967	10465	10988	11538	28%	500 ha
	Y-o-Y Increase	in ha		452	475	498	523	549		

Considering different scenarios of area expansion, the total average annual planting material requirement is estimated to range 3 to 5 lakhs plants per annum.

Annual rate of area expansion per year (in ha)	% Area covered under moderate to high density plantation/ha				Est. annual requirement of planting material	Current Availability	Additional requirement	No. of new Nursery
	400	625	1111	4444				
300 ha per year considering area expansion at rate of 3% per year	50%	20%	20%	10%	297480	2.4 lakhs plants	57480	2
	40%	30%	20%	10%	304230		64230	2
	40%	20%	30%	10%	318810		78810	2
	30%	30%	30%	10%	325560		85560	2
	20%	30%	30%	20%	446880		206880	4
500 ha per year considering area expansion at rate of 5% per year	50%	20%	20%	10%	495800		255800	5
	40%	30%	20%	10%	507050		267050	6
	40%	20%	30%	10%	531350		291350	6
	30%	30%	30%	10%	542600		302600	6
	20%	30%	30%	20%	744800		504800	10

It is notable from the analysis that the existing nursery have limited production capacity viz a viz the projected 15-20% increase in demand of planting material in coming year. Thus, there is need for upgradation of all 10 existing nurseries in the district. It is also suggested to set up of 5 modern hi-tech nursery, preferably under private sector, to cater to projected increase in requirement of planting material. The nurseries set-up under the grant assistance are proposed to be networked with the apex model centre, which inter alia would be responsible for regular review and monitoring of the performance and production of quality planting material at these nurseries so as to ensure that these operate efficiently and effectively. The ultimate objective is to make these unit self-sustaining and to be able to cater to the needs of the farmers within as well as outside the State. Apart from acting as

<sup>25</sup> <http://nhb.gov.in/nursery/report/nurseryreport.aspx?enc=2Rzq7QTztU0WcPljFUyO+w==>

satellite station or a spokes of the apex model centre, the upgraded nurseries with requisite infrastructure may also be utilized as demonstration units.

In accordance with MIDH norms, credit linked back-ended subsidy @ 40% of cost to be provided to private nursery grower for setting up of hi-tech nurseries in the district. The cost of hi-tech nursery is estimated Rs 25 lakh/ ha with minimum capacity to produce 50,000 plants per hectare. Similarly, for upgrading infrastructure at the existing small nursery assistance @ 50% of cost to be provided maximum of Rs. 5.00 lakh/nursery for nursery of 4 ha. The cost of upgradation of nursery infrastructure to meet the accreditation norms is Rs 10 lakh/ nursery of 4 ha. The plants produced to be mandatorily certified by the nursery for their quality and as per NHB norms. In addition to these, adequate provisions also needs to be made for training particularly the small private nurseries growers.

### **Tier III – Development of model farms at growers level (front-line demonstration units)**

As third layer of information dissemination, a minimum of 2-3 innovators/progressive apple farmers to be identified per block for setting-up of front line demonstration units i.e. a total of 10 farmer to be identified and engaged as 'change agent' for dissemination of technology at grass route level. The identified farmers should have farm land of size more the 0.4 ha to 1 ha (which is as per NFSM guidelines). The plot should be at an easily accessible location, preferably along roadside. As under the government assistance the setting up unit at farmer land is only partly fund, therefore the selected innovator farmer should also have capacity and willingness to invest part cost for the setting-up of the facility at his/her farm. The adopter farmer to be provided required technical training on package of practices. Emphasis to be laid on demonstration of high & ultra-high density apple orchard plantation techniques, use of IPM/INM, organic farming etc. In accordance with MIDH cost norms, 75 % of cost in farmers field to be provided as financial assistance for total cost of Rs 25 lakhs per 1 ha. Besides, additional finances to be budgeted for conducted field days at these model farms, where in an independent team of subject matter specialist/ associated scientists should also visit these production clusters, particularly during critical production period so other farmer may voice their production related issues and proper and timely technical advisory may be issued.

The proposed three-tier to be implemented with joint efforts and under supervision of technical experts/ subject matter specialist from public sector technical agencies as State Agriculture University, KVK, ATMA and Department of Horticulture. Reputed NGOs or private agencies that may have experience in horticultural project development and requisite technical manpower may also be

#### **Box 1. SPV for management of Progeny-cum-Demonstration Centres in Himachal Pradesh**

With a view to ensure adequate availability of elite planting material to the growers in the State of Himachal Pradesh, a conscious decision has been taken by the State Government to hive off selected nurseries/ Progeny cum Demonstration Orchards in the State and re-organize them into Special Purpose vehicle (SPV). The Special Purpose Vehicle (SPV), Himachal Pradesh Nursery cum Demonstration Orchards Development & Management Society (HPSAMB) has been registered as autonomous body established under the societies act. The main objective of the Society is to develop and manage PCDOs or farms of Horticulture and any other Department as may be authorized and transferred to it by the Government of Himachal Pradesh from time to time spread across various districts of the State. Presently about 35 sites of various crop types including 19 for apple have been identified to be developed through the SPV. The society is responsible for creating need based infrastructure at these nurseries/ PCDOs including land development, creation of assured irrigation facilities, strengthening of existing building, stores, fencing, propagation of elite planting materials etc.

This SPV would be operated on commercial basis, and it would reinvest the funds generated, into the operations and maintenance of the organization, and the SPV is expected to become a financially viable organization after the first three years of operations. As the need arises and based on the performance assessment at midterm, the legal status of the SPV would be changed from Society to Company. Further, international and national consultants will be recruited to provide technical assistance on the best available technology and practices adopted in horticulturally advanced countries of the world

involved wherever possible.

#### 5.1.1.2 Area expansion through establishment of new orchards and replacement of Senile plantations.

##### ***Establishment of New Orchards***

As estimated in the earlier section, to keep-up with the minimal projected national growth, an estimated in next five years a total area of about 5000 ha needs to be brought under apple cultivation across the State. In ratio of district's contribution to the State production and setting a target to atleast increase the current acreage by 15-30%, a minimum of 2500 ha land is required to brought under apple cultivation in the district. This implies that at a pace of 5% annually growth in area expansion, 500 ha or of new area need to be developed annually in the district. Moreover, for increase production, more emphasis needs to be placed on adoption of high density cultivation of apple by the farmers. In view of this it is suggested that atleast 600 ha of area should be targeted to be developed on pilot basis under MIDH over a period of next 3 years. Supporting establishment of these new orchards as pilot sites would help in sensitization of peer farmer groups to adopt to high density plantation.

In accordance with MIDH norms, assistance to be provided to the beneficiary farmers at 40% of the total cost subject to maximum of Rs. 0.60 lakh per hectare towards setting up high density apple plantation with integrated drip packages for meeting the expenditure on planting material, cost of drip system, INM/IPM, canopy management etc. Area expansion to be done in conjunction with Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) under which cost on labour component of work such as digging, fencing etc could be met.

##### ***Rejuvenation/ Replacement of Senile Plantation, Canopy Management***

In absence of formal records, it is difficult to assess the exact number/ acreage of orchards that are turning old and senile across the district. However, considering that the total area under apple cultivation in the district has increased over the years at a compounded annual growth rate of 2% (between 2008-09 to 2016-17, as the area increased from 7400 ha in 2008-09 to 9080 ha in 2016-17), about 20-30% of the orchards are estimated to be of less than equal to 10 years age. Whereas a significant area of plantation in the region is estimated to be more than 10-15 years age. It is estimated that about 20-30% of the existing apple orchards i.e. about 2000 ha of area are aging plantation and would sooner need replacement/ rejuvenation interventions. In view of this, it is suggested that atleast 300 ha of area may be targeted on pilot basis to be replaced with high density plantations in next 3 years.

In accordance with MIDH norms, techno-financial assistance to be provided at 50% of the cost subject to maximum of Rs 20000/ ha limited to 2 hectare per beneficiary for rejuvenating/replanting senile plantations through use of proven technologies, canopy management and re-planting with improved varieties. The activity may be implemented either through individual farmers or formal/ informal farmer groups.

#### 5.1.1.3 Creation of structures for Water storage and harvesting

Majority farmers are dependent of rainwater for irrigation of the orchards. Besides, water is also by the farmer at the time of spray application at the orchards. High altitude location of the orchards limits the capacity of farmers to transport water from source to upto to plantation site. Very few farmers in the surveyed region have deployed drip systems or have on-farm facility for water harvesting. It is thus proposed for water harvesting structure to be set-up at community level. In addition, considering the large spread of plantations in remote location in high hills, it is suggested for individual farmer to be also provided assistance for setting up of water storage infrastructures.

In accordance with MIDH, 100% of cost to maximum of total cost of Rs 25 lakhs/ unit to be provided for community water storage structure for each structure to irrigate atleast 10 ha of command area.

The individual farmers may be encouraged to apply individually for seeking assistance of 50% of the cost for maximum total cost of Rs 1.8 lakhs/ ha for setting up of water storage infrastructure including (300 micron plastic/RCC lining).

#### 5.1.1.4 Pollination support through Bee Keeping

Most of the apple varieties need cross-pollination for production of seed and setting of fruit. Inadequate pollination result in lower fruit setting. Planned and managed pollination is an important aspect of apple production. Apple orchards require adequate number of pollinizer varieties to be planted in between the commercial cultivars. It is observed that growers do not tend to maintain the appropriate ratio of pollinisers as recommended. Heavy use of pesticides (eight to ten sprayers) over the past decades has also affected the population of natural pollinator insects as bees, butterflies and moths. Thus, low productivity of the apple in Uttarakhand is vulnerable to pollinator loss. Infact, it is also reported by the Beekeeping Project of ICIMOD (2012) that decline in productivity of apple in the Himalayan region is due to pollination failure.

Honeybees are known to play a vital role in enhancing crop pollination and thus improving productivity. It is suggested for honey bee keeping should be promoted in production cluster. As the district has about 9000 hectares of land is under apple cultivation, which need about 30000 colonies of bees for its effective pollination<sup>26</sup>. As very few farmers in the production clusters are observed to be practicing apiculture there is a wide gap in the number of colonies required for pollination alone. Farmer should be encouraged to undertake bee keeping at apple orchards. Commercial beekeepers in the State (including in plain regions outside district) may be encourage to rent their bee colonies to growers for apple pollination at chargeable fees. In this context, it is notable that there is also increasing demand of honey bees as alternative pollinators in the neighbouring State of Himachal, where beekeeper from Haryana and Uttar Pradesh are already in business of renting colonies to orchardists in Himachal. Bee Keeping may thus as well be promoted as an entrepreneurial development models under which local youth and women group may be encouraged to take up bee-keeping as enterprise development venture for renting of colonies as well as honey bee production.

In accordance with MIDH, 40% of cost at maximum of Rs.2000 per colony of 8 frames limited to 50 colonies per beneficiary to be provided bee keeping. Assistance to also be provided for bee keeping equipment including honey extractor, food grade container at rate of 40% of the cost limited to one

#### **Box 2. Use of honey bees for pollination in Apple orchards**

##### *Bee Pollination benefitting apple growers in Himachal*

Farmers in Himachal Pradesh are using honeybee colonies for apple pollination. *Apis mellifera* is the main bee species used for pollination, but some farmers also use *Apis cerana*. A system of renting and hiring bee colonies is in place in which both the Department of Horticulture and private beekeepers rent bee colonies to apple farmers. The Department of Horticulture assesses the demand for honeybee colonies for apple pollination and arranges supply with the private beekeepers. Reportedly, the Department of Horticulture rents *Apis mellifera* colonies at the rate of Rs 250 per colony (Rs200 as security and Rs50 as rent). Private beekeepers charge Rs 800 (Rs 500 as security, and Rs 300 as rent). Only a few farmers keep their own colonies for pollination; there are not enough beekeeping entrepreneurs in the area to meet the heavy demand. In order to encourage establishment of honey bees colonies, the State government is providing 30 percent additional subsidy to the beekeepers, besides 40% subsidy from the Central Government

##### *Decline of bees forces China's apple farmers to pollinate by hand*

In another case in south west China, where wild bees have been eradicated by excessive pesticide use and a lack of natural habitat, the apple growers have been forced to hand-pollinate their trees, carrying pots of pollen and paintbrushes with which to individually pollinate every flower, and using their children to climb up to the highest blossoms. Hand pollination is expensive, laborious and time-consuming

<sup>26</sup> 50 colonies may effectively cover an area of about 200m <https://www.intechopen.com/books/beekeeping-and-bee-conservation-advances-in-research/fruit-tree-pollination-technology-and-industrialization-in-china>



set of Rs. 20,000 per beneficiary.

#### 5.1.1.5 Establishment of Soil Testing Lab (STL)

While the farmers are aware about benefits of soil testing service, however, the farmers interested to avail such services expressed accessibility to distantly based soil testing laboratories as major constraint. Time taken between collection of samples and receipt of recommendations by the farmers is too long. Keeping this in view, it is proposed to set-up mobile soil testing facilities near to farm, which would encourage the farmer to adopt to this important practice and judiciously apply the fertilizer in a balanced and efficient manner. Promotion of this activity would also benefit growers cultivating other agricultural crops in the region

For the purpose, 100% assistance to be provided to public sector agency under the Soil Health Management (SHM) Scheme of National Mission For Sustainable Agriculture (NMSA). Involvement of private sector participants as agri-clinics, NGOs, Cooperative Societies and agri-entrepreneurs may also be encouraged for setting-up of Static or mobile soil testing facilities. In accordance with the NMSA norms for assistance - in case of static STLs 60% of the project cost, subject to a limit of Rs.45 lakh, to be provided as subsidy for purchase of machinery & equipment, chemicals & glass wares, miscellaneous laboratory articles and contingencies. In case of mobile STLs, financial assistance from DAC shall be 60% of the project cost subject to a maximum of Rs. 45 lakh per Mobile STL.

#### 5.1.1.6 Supply of Anti Hail Nets to growers

Increasing variability in the climate and changing pattern of precipitation have already exposed the State apple growers to the damage of the crop by the environmental factors such as the hail. The impact of the hailstorm in the apple belts can be understood by the fact that this year more than 70% crop has been reportedly lost to damage due to hail storm. Hail storm not only inflict direct injury to buds, flowers and leaves but also damage the developing fruits and spurs as well. It is suggested for increased quantities of Anti-hail nets be made accessible to the farmers, well-in time. In accordance with MIDH cost norms, 50% of cost at Rs 35 / sq.m limited to 5000 sq.m. to be provided per

#### **Box 3. Apple growers in Himachal turn to anti-hail nets for crop protection**

Apple remains the most important fruit crop in the State. The annual production of apple in the State is estimated about 625 thousand metric tonne. In recent year the changing weather condition is heavily affecting the crop. It is estimated that every year hail damages the crop quantitatively at the blooming stage and then later qualitatively at the fruit maturity/production stage. It is estimated that every year there is 20 to 30% loss of the fruit produce associated with the hail in the fruit production belts of the state. To combat the challenge, State government had earlier promoted installation of Anti-hail guns, failing which a majority of growers are now turning to netting of orchards for protection of canopy from increasing heat stress, frosts and hail. Reportedly farmers in the main apple producing belts as Rorhu, Theog Kotghar, Narkanda have adopted the technology to cover atleast 60-70% of their orchard to render protection from hail damage. Anti-hail nets are considered more effective and cheaper. To promote adoption, the State Government has also enhanced the subsidy on anti hail nets to 80 percent out of which 30 percent is being borne by the State.

beneficiary.

#### 5.1.2 Soft Intervention: Training & Capacity Building

##### 5.1.2.1 Training-cum-exposure programme

#### **Training**

It is observed from the study that apple being major means of income in the production clusters, the grower are keen to invest time in learning and adopting best practices for improving farm productivity. But due to limited access and awareness, majority farmer follow traditional practices or learn from success of fellow mates. During the group discussion farmers also urged the need for training on



various aspects of orchard management and exposure to best practices being adopted at farm-level in other States as Himachal & J&K. It is suggested for a detailed and phased schedule to be developed by the State for capacity building of different production stage agents including nursery grower, farmers (including women), pruners, training facilitators (including extension officers, dept. field functionaries, village agent or progressive farmers).

- Training of nursery growers: For ensuring availability of high quality planting to the farmers, it is critical to sensitize and training the nursery growers on basic compliance related to nursery infrastructure, production system and quality parameters and good nursery management practices.
- Training of farmers undertaking demo plantations: The farmers proposed to be associated with the network of centre of excellence to be trained well on proper management of elite plant material in their orchards by adopting improved package of practices for achieving highest productivity level.
- Training of farmers (including women): The farmer to be provided training on productivity enhancement techniques like high density plantation, IPM, INM, water management, pollination practices, canopy management, organic practices (vermi-composting), rejuvenation of old orchards, maturity indices, and post-harvest handling to extend shelf life and maintaining quality.
- Training of pruners: Proper pruning and tree training are vital for optimum quality and production. Short duration certificate trainings to be organized for selected number of farmers from each production block to be trained as master trainer in training and pruning techniques for management of apple orchards. These trained pruners would be responsible for carrying out further demonstration and training to the farmers who are willing to rejuvenate their orchard.
- Training of Facilitator (ToF) including the extension officers, dept. field functionaries, village agent or progressive farmers on the latest horticultural practices, nursery production, canopy management of high density orchards and other productivity enhancement technologies

Integrating the efforts and for greater impact of various proposed interventions, it is suggested that beneficiary farmers selected for these training should be the ones undertaking various production related activities proposed as sub-components of Production related interventions. Emphasis to be placed on ensure atleast one-third women participation. In addition to this context, a thorough post-training follow up and monitoring mechanism also needs to be put in place to ensure on-field application of techniques by the beneficiary farmers. As current extension system of Department of Horticulture is assessed to be constrained by limited manpower resource availability in the region. Thus, the proposed training programme are suggested to be implemented with joint effort of Department of Horticulture, State, and Central level technical agencies. Collaborations with International institute and private sector may also be sought for technical consultancy on global best practices.

In accordance with MIDH norms, cost assistance of upto Rs 1000/day per farmers to be provided for trainings conducted within the State (including transport). Cost assistance on actuals to be provided for trainings that would be conducted outside State. For training of nursery growers budget of Rs 15 lakhs to be set aside under the MIDH cost norms for HRD for Gardener. This financial assistance would be extended to the technical agency which would be implementing the Gardener training. For training of technical staff/ field functionaries, assistance of Rs 300/ day per participant is being budgeted (TA/DA would be additional as admissible). Possibility of convergence under scheme for Agri Sector Skill Development initiative may also considered.

### **Exposure visit/ Study Tours**

Regular exposure visit/ study tours to be organized within & outside State for growers/ technical staff/ field functionaries to the apex research institutes, university farms, farms of the ICAR, model private farms to study best practices. It is also suggested that apart from government functionaries, the most

progressive farmers should also be nominated at State level for participating in exposure visits/ study tours outside the country to study the best horticulture production technologies. Under MIDH 100% cost assistance to be provided for exposure programme as per actuals to maximum of Rs 4 lakh per participant for study tour outside India (including air fare). Tour/ Course related fee charges (If applicable) are to be also borne under Mission Management cost norms of MIDH.

#### 5.1.2.2 Knowledge Resource Management

As a part of medium to long term mission strategy, the technology packages that would be disseminated to the field functionaries and farmers during the training programme should be well documented in printable formats and video graphed to develop electronic modules and content. This electronic information can be used to develop mobile friendly web-based portal for information dissemination using IT network. Development of such tools would allow ready availability and easy accessibility of knowledge information on standard protocols for orchard best management practices. Also the field functionaries and the farmers trained under programme would have continual access to knowledge information taught to them during the training programme. In addition, the documented information can be rigorously used as knowledge tool by trainer when conducting class-room based farmer training or field based interactions with the farmers. Once the e-tool is up and active, it may also be used for dissemination of other information as upcoming training schedules, beneficiary registration, enquires, feedback or grievance on the ones already attended, sourcing of planting material etc. The tool may also be used for sharing of short stories / interviews/ voice of farmer success. Under MIDH Mission Management component 100% cost assistance of upto Rs 1 lakh/ district to be budgeted for development of technology package. With use of IT there are immense

#### **Box 4. Training of Smallholder Apple Farmers in China for Sustainable Production and Domestic Market Access under 'Training of Trainer' model reinforced by e-learning portal**

Shandong and Shaanxi Provinces are among the largest apple producing regions in China. The apple farmers in these provinces are mostly small growers and are faced with many intertwined problems across all aspects of apple production. With an objective to improve the well being of smallholder apple farmers, particularly women, programme on 'Training of Smallholder Apple Farmers in China for Sustainable Production and Domestic Market Access' has been launched. The programme is being implemented with combines the efforts of the Cornell International Institute for Food, Agriculture and Development (CIIFAD) at Cornell University and UC Davis, in partnership with the National Apple Research System in China, Shandong Agricultural University, Northwest A&F University, and the Provincial Agricultural Extension Bureaus of Shandong and Shaanxi Provinces, China. The project is being implemented on 'train the trainer' model, where the provincial extension agents learn new techniques under courses taught by Cornell University faculty, who in turn then share new information to the smallholder farmers they work with. The project is expected to train 2,000 extension agents and 200,000 smallholder apple farmers (including half of these to be women). For sustained learning, an e-China Apple website is being developed to create freely accessible repository of field videos and fact sheets on best practices, e-learning modules, basic tools for calculating nutrient requirement, pest identification. The objective is to allow extension agents and farmers to continue to access the information presented by the project team through presentations, interactive learning activities and academic papers.

Related Link: <http://echina-apple.com/>

possibility. With progress and subject to acceptability and farmer response, the e-tool may be put to wider usage by evolving it to integrate information for other temperate crops prevalent in the region. It may also be linked with other related digital service platforms as that on market information, soil health cards, input resource suppliers, particularly accredited nursery for planting material.

#### 5.1.2.3 Adaptive Research & Development of Improved Technologies

Agriculture is inherently vulnerable to climatic variability due to excessive dependence on temperature and rainfall condition. The vulnerability is intensified in case of Uttarakhand as the Himalayan mountain ecosystem is already facing serious challenges posed by climatic change. Apple is one of

the most important commercial fruit crop in the State grown in the higher and mid Himalayan region. Increasing aridity, warmer winter season and variability in receiving precipitation and snow are notably serious challenges being posed by climatic change that are affecting the productivity of apple in the region as these critically distress the induction of dormancy, bud break and flowering in apple. Various report already suggest decline in apple production in Uttarkashi due to a reduction in the required chilling period<sup>27</sup>. It has also been observed during the field study that apple cultivation in various production clusters is gradually moving at higher altitude. In fact, several progressive farmer are already adapting to warmer temperature in lower hills and are moving from apple to off-season vegetables.

To overcome the adverse effect of fluctuating weather conditions proper selection of suitable cultivars is required. Besides, new varieties on clonal rootstocks need to be tested and evaluated in different agro-climatic condition to overcome the problems of low productivity. Management practices also needed to be improved with focus on maintaining soil moisture and countering temperature changes. In terms of adoption response – in the lower elevation, there is an opportunity for cultivation of others crops / or apple cultivars that are suitable for changing conditions. In addition, mechanization of orchard operations under hill agriculture system, which is presently limited to use of knapsack and power sprayers, is required to be developed further, particularly for improving efficiency of other various orchard operation in high-density plantation. In this context, it is suggested to support applied research and development work for studying impact of changing climate on temperate fruit crop production and then developing mitigation strategies to adapt to climate change scenario. For 100% assistance to maximum of Rs 100 lakh/ project is available under MIDH for State and Central level agency under ICAR, CSIR, SAUs and others location specific Institutes to take up work in this area, with specialized focus on apple. It is however, suggested that assistance may be separately availed under ICAR, subject to further detailed discussion to be undertake with such technical agency and associated stakeholders

## 5.2 Post Harvest Related

As observed from the study due to absence of post-harvest facilities for primary processing (such as grading and sorting) and lack of optimally distributed cold chain infrastructure (including forward linkages through refrigerated transportation) the quality of marketable surplus produced in the state gets hampered and also results in excessive wastages. Non-uniformity in voluminous supplies and quality of raw material further limits the growth of downstream industry within the State. It is thus important to augment the post-harvest related practices through development of required functional infrastructure and capacity building of the user. It is envisaged that such interventions would also help in improving value realization at farm level through better handling techniques and building sector competitiveness for enhanced market access.

### 5.2.1 Hard Intervention: Infrastructure Assistance

#### 5.2.1.1 Creation of Farmer-linked and operated Value Added Centres

#### **Promotion of Farmer Interest Groups (FIGs) and Farmer Producer Organization (FPO)**

Small scale of operations is an important aspect of the problems associated with apple growers in the State. Due to smaller requirement of inputs (as elite planting material, plant protection inputs, machinery and equipment, technology access, packing material), individual farmers either end up paying higher procurement price or purchasing inferior quality of these produce. Lack of local dealership, further cause long delays and aggravates the problems. Further transporting of produce in small quantities to urban markets is not very viable, so the farmer end up selling their price at lower margins in regional markets and suffer disadvantages of high transaction cost. Thus, absence of collectivization, small scale of operations significantly reduces the bargaining power in procurement of inputs as well as sale of output (Kirsten and Sartorius, 2002). Lack of capital and education, coupled

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<sup>27</sup> State Agenda for Climate Action. State Climate Change Centre, Uttarakhand Forest Department, [http://www.acclimatise.uk.com/wp-content/uploads/2017/07/Agenda-for-Climate-Action\\_Full-Report\\_21.12.16.pdf](http://www.acclimatise.uk.com/wp-content/uploads/2017/07/Agenda-for-Climate-Action_Full-Report_21.12.16.pdf)

with poor access to adequate information (Gulati et al., 2007), leads to a different set of problems, including the use of obsolete harvesting technologies, affecting the productivity, and poor post-harvest infrastructure (Desai and Joshi, 2014), resulting in 25-30% of the produce being wasted.

In view of this, it is suggested that to begin with atleast three (3) Farmer Interest Group/ Producer Organization/ Company should be promoted in each of the three production cluster belts of the district. Considering the existing production volumes, cluster-wise size of FIGs/FPOs is suggested as follows:

**Table 20: Promotion of Farmer Interest Groups**

<b>Production Cluster/ Block</b>	<b>Apple Production</b>	<b>No. of Farmer Group to be promoted</b>	<b>Targeted no. of member per Farmer Group</b>
Cluster 1. Mori	10567	1	100-150
Cluster 2. Naugoan & Purola	11010	1	100-150
Cluster 3. Bhatwari, Dunda, Chinyalisaur	4271	1	50-75

As collective, these Farmer Group(s) would estimate the requirement of the various inputs such as fertilizers, pesticides in the area under consideration; determine the estimated production flow during the season and accordingly schedule the work operations for the season. This would including bulk purchase of inputs for supply to individual members (including machinery and equipment, anti-hail nets, branded packing material etc), linking farmer to government as well as private sector facilities for procurement of quality planting material, soil testing facilities and technology access. On the market side, the members of farmer groups are expected to benefit by realizing higher prices for respective produce as aggregated sale of produce would create a larger critical mass providing economies of scale, savings in transaction costs, and strengthened negotiation positions

A suitably qualified technical agency should be engaged vide bid process to assist the department in mobilization of producer groups and formation of FPO. The required financial assistance for mobilization and formation of Farmer Groups and for their capacity building to be availed as per norms of SFAC

#### **Box 5. Progressive Growers Association (PGA), a cooperative society of young apple orchardists in Himachal Pradesh**

Progressive Growers Association (PGA), a cooperative society comprising of young apple growers from production belts of Shimla, Rohru, Jubbal, Kotkhai, Chopal, Rampur, Kotgarh, Kullu and Kinnaur. PGA is an initiative formulated by the younger generation of apple orchard owners in Himachal with an objective to work unitedly for promote self-dependency in accessing and adopting best of new technologies and modern scientific practices for increase apple productivity in the region. Several have already moved towards high and ultra-high density plantations of clonal root stock and changing the from existing low-colour varieties to high-colour strains. Several young farmers associated with PGA are also importing apple rootstock plant material from foreign countries to boost apple productivity.

Started in 2013 with just 4 member, PGA has about 130 plus members of association, mostly under 35 years age. Besides, the association also has 4600 plus followers on the social network sites used for regular update on PGA's initiatives and information dissemination to greater masses. The association is governed and totally funded by associated growers under the supervision of an internally elected panel who approves the budget and look after the various operations of the organisation. Besides, information dissemination the association provides support services to members in purchase of bulk input material, facilitates training and experimental trials under guidance of international experts from Netherland, USA

Related Link: <http://www.pgafarmers.com/> ; <https://www.facebook.com/PGAfarmers/>

#### ***Setting of Value Added Centres for seamless backward and forward linkage***

Apart from formation of farmer groups, it is also important to develop their capacity and skills for effective and seamless backward and forward integration. In this context, it is suggested to set-up value added centres near to the apple production farms. These value added centre is conceived as small scale aggregation point and primary processing facility that should preferably be managed and

operated by the FPO for use by associated members. The value added centre to be developed and equipped as Integrated facility for providing end-to-end services to the farmers including:

#### Back-end services

- Procurement and supply of chemical inputs
- Procurement and supply of equipment and machinery including power tiller, sprayers, anti-hail net,
- Sourcing of quality planting material
- Access and coordinating with soil testing facilities
- Coordinating and organizing farmer trainings in collaboration with research institutions, private agencies, national/international scientist on cultivation practices, harvesting, pruning and tree training, canopy management, post harvest management including sorting grade best practices
- Organizing exposure visits, experimental trials etc
- Procurement and supply of re-usable crates for collection of produce
- Hiring of professionally trained pruners for pruning and tree training
- Hiring of professional sorting and grading agents
- Procurement and supply of branded packing material

#### Forward-end services for value addition & market distribution of product

- a) *Collection Centre (Sorting, Grading & Packing):* With an objective of strengthening the farm level post harvest infrastructure availability, It is suggested for the Value Added Centre to house a facility infrastructures for collection, sorting and grading and packing of produce. It is anticipated that near to farm accessibility of such aggregation facility will help in minimizing post-harvest losses and reduce cost which is otherwise incurred in transportation as in case of integrated pack house, produce will be moved in re-usable open crates from farm to receiving area of the facility. Beside, with proper grading, packing and handling in place, the overall value of processed lot would improve. Aggregation of produce in bulk will also enable the producers to partner with other agribusinesses and empowering them actively seek out and access new and alternative markets including reserving sizable volume of space in CA facilities at reasonable rates. Aforementioned, these value added centre would be integrated with the FPOs. Thus, bulk aggregation at value added centre will enhance the collective bargaining power of the farmers in both backward and the forward value chain linkages.

The unit capacity of an collection centre is estimated as 15 MT per day with an output from 1.25MT/hour sorting grading line, running for effective working time of 12 hours a day

Table 21: Calculating operational capacity of aggregation facility at Value-added centre

Assumption	Output
Crate load per farmer	500 crates (equivalent 1-2 box/ tree)
No. of farmer per FPO	100 farmer
Total load per FPO during season	750 MT (500 crates X 15 MT Wt. X 100 farmers)
Assuming 60% production during first month	450 MT/ month
Daily average load	15 MT / day
Minimum required machine capacity (considering effective work time of 12hr)	1.25 MT / hr (equivalent to 62 box of 20 kg wt.)

- b) *Cold Store:* Assuming per day handling capacity of 15 MT a cold store of atleast 100 MT capacity is also suggested to be installed at the centre to facilitate short term temporary storage of the produce, particularly during peak production period. It is notable that the farmers in most of the apple growing regions are also into potato cultivation and cultivation of other temperate fruit crops as peaches etc. The facility created may thus be put to multiple crop use during non-apple production season.
- c) *Reefer Vans:* In order to complement the so graded and packaged produce, the centre should be equipped with 4 reefer vans of 4 MT capacity to be used for procurement as well as distribution of produce to consumption markets.

- d) *Minimal Processing units:* As a part of phased development an add-on facility for minimal processing may be set-up for minimal processing low grade of apple and value addition in form of products juice, beverage, jam, jelly, nectar, wine, pulping, waxing etc.

It is suggested that at least two Value Added Centres should be set-up based on above suggested model. One Centre each to be set-up in Production Cluster 1 (Mori Block) and Cluster 2 (Naugon & Purola). These clusters are being suggested to host the facility considering the relatively higher apple production in these regions.

Creation of farmer-linked and operated value added centres in the district is anticipated to encourage increased number farmers to associate with the established FPO to avail services of Value Added Centre, which in turn would feed into its increased economic viability. For successful implementation of this model, the FPO created under assistance from MIDH would require continued handholding in development of the required infrastructure. It is therefore suggested that a suitably qualified technical agency should be engaged via bid process to assist the department in integrated development of this activity including - mobilization of producer groups into FPO, facilitating setting up of required infrastructure and procurement of machinery, capacity building of FPOs for managing and operating the facility, handholding assistance for period of about two years. In accordance with MIDH cost norms, the cost assistance for the activity sub-components to be provided as follows:

- Formation of Farmer Groups : As per SFAC norms
- Setting-up of Collection Centre (sorting/grading/packing): Credit linked back-ended subsidy @ 55% for estimated cost of Rs 15 lakhs towards development of functional infrastructure for collection, sorting/ grading, packing units etc. equivalent to Rs 8.25 lakhs
- Reefer Vans Refrigerated Transport vehicles Credit linked back-ended subsidy @ 50% of total cost estimated Rs. 26.00 lakh for 9 MT (NHM & HMNEH), equivalent to Rs 11 lakhs for 4MT capacity vehicle calculated on prorata basis
- Cold storage at 50% of cost of Rs.15 lakh/unit for a storage capacity of 30 MT equivalent to Rs 50 lakhs for 100 MT unit
- Minimal Processing Credit linked back-ended subsidy @ 50% of capital cost of Rs 25.00 lakh/unit i.e. equivalent to Rs. 12.5 lakhs.

Alternatively assistance may also be made available under Scheme for Creation of Backward and Forward Linkages by Ministry of Food Processing Industries (MoFPI) for maximum project cost of Rs 5.00 crore @ 50% of the eligible project cost.

#### 5.2.1.2 Augmenting Pack-house & Cold Chain Infrastructure

Presently the district has two Integrated Pack House with CA storage facility at two locations. This includes one private facility based in Naugaon of 1100 MT capacity Cold storage capacity with 1000 MT controlled atmospheric storage and 100 MT being normal cold storage. A similar type facility has reportedly been set-up in Jhala (Bhatwari Block) which has CA storage of 1000 MT and normal cold storage of 200 MT. These existing capacities are envisaged to be insufficient, considering that the total annual average production of Uttarkashi District exceeds 25000 MT per annum and is further projected to increase with more number of farmers adopting high density apple cultivation. In consideration of this, it is assessed that continual interventions are required for augmenting the cold chain infrastructure in the State. It is expected that improved accessibility to cold store facility will reduce seasonal gluts, extend the marketing period by withdrawing some supplies from the fresh spot market and storing them for off-season marketing at higher price. Thus, following modern infrastructure is proposed to be set-up to augment District level capacity:

- a) *Setting up Modern Integrated Pack House:* The Value Added Centre is proposed to be equipped with modern facility infrastructures for mechanized sorting and grading of produce.



- Covered receiving area for arriving produce to be offloaded and undergo pre-selection and weighing.
- Enclosed covered sorting and grading area equipped with mechanised handling and cleaning equipment.
- Mechanized roller or belt based sorting and grading system to allow working personnel to selectively pick and choose produce for next activity
- Mechanised washing and drying lines.
- Designated packaging area where produce is manually packaged into market lots.
- DG set to produce power for equipment operations. As add on technology, alternate energy options (bio-mass based generators, solar powered generators, etc.) may also uses.

The unit capacity of an Integrated pack-house is estimated as 20 MT per day with an output from 2.5MT/hour mechanized sorting grading line, running for effective working time of 8 hours a day

- b) *Establishment of integrated cold chain:* Integrated with the pack-house facility a multi-commodity cold storage of 1000 MT capacity is also proposed be constructed. The cold storage facility should also equipped with atleast 4 refer vans of 4 MT capacity for movement of produce from farm to project site and onward dispatch to wholesale markets

It is suggested that the proposed facility should be created in Mori block of the district, which is one of the major apple-producing region of the district. The annual production of apple in Mori block exceeds 10000 MT contributing 40% of the District production of apple. Despite such significant production, the region lacks in facilities as integrated pack houses and cold chain infrastructure. Moreover, the apple produced from this region directly competes for quality and price with apple produced in Himachal, due to same harvesting season. In consideration of such scenario, the region is expected to benefit with improved accessibility to such facility. It is suggested for such facility to be operated through private entrepreneur/ firm. It is further suggested as part of overall State strategy, the cold store interventions coming up in other districts of the State should also be allowed to avail financial assistance for add-on facility as CA component etc to create additional capacity across the State. In accordance with cost norms of schemes, the cost assistance for the activity sub-components to be provided as follows:

- Setting-up of Modern Integrated Pack House: Credit linked back-ended subsidy @ 50% for estimated cost of Rs. 50.00 lakh per unit with size of 9Mx18M equivalent to assistance of upto Rs 25 lakhs.
- Cold storage with Controlled Atmosphere Technology: Credit linked back-ended subsidy @ 50% for unit cost of Rs 10000/ MT equivalent to total cost of Rs 100 lakhs of which assistance @50% equals Rs 50 lakh/unit



- Reefer Vans Refrigerated Transport vehicles Credit linked back-ended subsidy @ 50% of total cost estimated Rs. 26.00 lakh for 9 MT (NHM & HMNEH), equivalent to Rs 11 lakhs for 4MT capacity vehicle calculated on prorata basis

#### **Box 6. Case of Adani Agrifresh in Himachal**

Adani Agrifresh Limited, a subsidiary of Adani Enterprises, was setup in 2006 for integrated storage, handling and transportation infrastructure for fresh produce in the state of Himachal Pradesh. After the APMC Act 2005, which deregulated the marketing channel, Adani setup modern controlled atmosphere storage units in Himachal Pradesh to directly procure apple from farm gate, store apple during peak season and supply high quality apple in the off-season at higher price.

Before Adani's operations in the State, the traditional marketing of apple in the State was routed through commission agents in traditional APMC markets. This supply chain was inefficient due to daily variation in demand and supply, poor means for price discovery to the farmers based on word of mouth, which was often unreliable and insufficient to decide whether to sell it on the market or not. Moreover, such system did not incentivize farmers to follow best practices in apple cultivation. Adani diagnosed these problems apple production and marketing system and designed a new value chain design for handling and distribution of apples. With an investment of Rs. 2 Billion, the firm setup three controlled atmosphere stores in Rampur, Sainj and Rohru with total capacity of 23500 MT. By passing the channel of commission agents the company started to procure directly from farmer. Under the set mechanism, Adani announces its procurement price for different grades of apple in advance for weekly period enabling growers with a choice. The farmers who wish to supply are registered as 'suppliers' in their database. Adani is providing various services to apple growers. These include input supplies through agriculture input stores, called "Farmik Shoppe" where grower may buy genuine and quality input supply like insecticides, fungicides, farm equipment, saplings, nets, tools etc. at reasonable rates. Crop experts at Adani also trained growers in scientific cropping and post-harvest practices with the aim of building a preferred-buyer relationship. This is one way that Adani build loyalty among farmers. Besides, reusable plastic crates are provided to the farmers during harvesting season for collection of produce, which is sorted, graded and readied for market using fully automated handling systems. Adani has contracts with more than 150 hub operators with capacity to serve about 11000 growers who are interested in selling to Adani. Thus success of the model is reflective from the fact that in 2015, Adani's procurement were 26000 MT, which is 5% of the total apple produce of the state.

The company provides approximately 8% higher rates as compared to the prices offered to farmers in the traditional APMC market. Farmers who supply to Adani Agrifresh do not have to bear the cost of packaging and transport and save on cost of forwarding agent commission, state tax, labour, and loading and unloading charges. Moreover, Adani makes payment to the farmers in their bank accounts within 10 days of the receipts of the produce. Adani sells 80% of their apples after the month of December when domestic supply is exhausted and import starts. The price of apple are kept at par with the imported ones while it is sold as a higher price (30% premium) as compared to the local ones due

#### **5.2.1.3 Setting-up Multi-fruit Processing Infrastructure (with focus on Apple)**

With an objective to increasing the level of processing and value addition to reduce wastages, it is suggested to set-up a multi-fruit processing unit with a focus on apple. Alternatively, the existing food processing units in the State may be encouraged for expansion of existing facility for processing of apple fruit crop. Moreover as a part of integrated initiative, the Value Added Centres, existing and proposed CA storage facility in the region should be encouraged and linked up with the initiative.

Required assistance should be availed under the Scheme for Creation/Expansion of Food Processing/Preservation Capacities by Ministry of Food Processing Industries (MoFPI). Central & State PSUs/ Joint Ventures/ Farmer Producers Organization (FPOs)/ NGOs/ Cooperatives/ SHG's/ Pvt. Ltd companies/ individuals proprietorship firms engaged in establishment/ upgradation/ modernization of food processing units in the State should be sensitized and encouraged to take-up the initiative. In accordance with the norms of the Scheme, 50% of the eligible project cost subject to a maximum of Rs. 5.00 crore to be provided as financial assistance i.e. upto Rs 25 crores

Alternatively, it is also suggested as part of overarching intervention that a State Marketing & Processing Board should be established which can take up the interventions for processing of all type of surplus fruits produced in the State.

### 5.3 Overarching

The overarching interventions refer to the activities being proposed which are expected to address the cross-cutting sectoral issues in all nodes of the value chain

#### 5.3.1.1 Encouraging Policy Reforms for Development of Horticulture sub-sector

The apple value chain in Himachal Pradesh is significantly developing well. Various add-on initiatives have been taken up by the State Government of Himachal Pradesh to support the integrated development of the sector through policy and scheme level interventions. Some of these are highlighted below:

- For productivity enhancement & sustainable growth of the sector, improved varieties and rootstocks of Apple are being imported into the State
- Under Apple rejuvenation project financial assistance is provide for uprooting of old plantation
- Honey bees play an important role in pollination of Horticulture produce. For establishing Honey bees colony's Central Govt. is already providing 40 percent subsidy but in addition to that the State Govt.is also providing 30 percent additional subsidy.
- To protect crops especially Apple from hail storms, government has enhance the subsidy on anti-hail nets to 80 percent.
- Beside the soil health card scheme, Government has established 11 Soil Testing Laboratories and seven mobile soil testing labs to provide services in interior and far-flung areas
- Government has introduced Rajiv Gandhi Micro Irrigation Scheme which is targeting 8,500 hectare area to be brought under Drip/ Sprinkler irrigation system and benefiting 14,000 farmers
- Government has introduced Weather Based Crop Insurance Scheme, covering Apple
- For transporting the Horticulture produces through HRTC Buses Govt. has provided concessional rates of transportation
- Government is creating cold chain network by constructing Controlled Atmosphere (CA) stores and automatic packing- cum- grading units in major fruit growing areas. In this direction to attract private players for development of controlled atmosphere stores in rural area, land is being provided at a token lease money of Rs. 1/-.

Recently, the Government has launched world Bank funded “Himachal Pradesh Horticulture Development Project” with an out lay of Rs.1,115 crore and will be implemented in next seven years. The project focuses on providing new technologies to the Horticulturist for increasing the productivity and capacities with a specialized focus to boost apple sub-sector in the State

Taking cue from the policy initiatives being undertaken in other States for promotion of apple value chain, it is suggested that the State level policy in Uttarakhand should be re-visited with objective of facilitating greater value realization at farm level. Some of the areas where the State Government can provide additional assistance over financial support from the centre, particularly to farmer beneficiary groups is suggested as follows:

Table 22: Analysis of policy environment in the State

Area of Intervention	Unit Cost under MIDH	Pattern of Assistance	Suggestions on Add-on Assistance by the State
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	Area of Intervention	Unit Cost under MIDH	Pattern of Assistance	Suggestions on Add-on Assistance by the State
<b>A.</b>	<b>Plantation Infrastructure Development</b>			
1)	<b>Production of Planting Material</b>			
	Upgradation of existing nursery	Rs. 10 lakh/ nursery of 4 ha	@50% to maximum of Rs.5.00 lakh/nursery	As majority of the existing nursery are small grower owned, it is suggested that additional cost assistance of upto 25% should be provided by the State to the Farmer / Farmer Group(s)
	Setting-up hi-tech nursery	Rs. 25 lakh/ha.	@ 40% of cost	To encourage entrepreneurs to set-up hi-tech nursery of elite planting material, additional cost assistance of 10% may be extended by the State to the beneficiary entrepreneur.
2)	Establishment of new orchards including high density plantation (for apple) with integrated package for drip irrigation	Rs 1.5 lakhs/ ha	@40% of cost in 3 instalments of 60:20:20	To rigorously promote high density plantation of apple across the State, it is important that more and more number of farmers should adopt this technology. It is suggested for the State to provide additional assistance of 40% to the farmer for taking up high density plantation. Remaining 20% cost to be borne by the farmer
3)	Rejuvenation/ Replacement of Senile Plantation, Canopy Management (considering 20-30% replacement)	Rs 0.4 lakhs/ ha	@ 50% of the cost for maximum of upto 2 hectare per beneficiary	It order to promoted high density plantation in the region, it is suggested for the State to provide 30% add-on assistance to the farmers for high density cultivation. Remaining 20% cost to be borne by the farmer
4)	Creation of structures for Water storage and harvesting			
	Water storage infrastructure at individual farms	Rs 1.8 lakhs/ ha	50% of the cost	Apple is the most important temperate fruit crop in the State. Crop is cultivated in high hills under rainfed condition. Majority of farmers have scattered land holdings which are remotely located. Vagaries of changing weather make the apple growers even more vulnerable. It is therefore important for more number of farmers to adopt water conservation technology. It is suggested that in order to encourage individual farmer to practice water conservation, the State should be provided additional assistance of upto 30% to the farmers for setting up water storage infrastructure.
5)	Protected cultivation: Supply of Anti Hail Nets to growers	Rs 35 / sq.m	50% of cost	In recent year, there has been frequent cases of extensive crop loss in apple due to hail storms. As mentioned earlier, this year more than 70% of the crop has been damaged due to hail affecting the overall production and farmer returns. It is suggested State government should provide additional assistance of upto 30% to farmers on procurement of anti-hail to protect the crop
6)	Pollination support through Bee Keeping	Rs.2000 per colony of 8 frames i.e Rs. 1 lakh for max. 50 colonies per beneficiaries	40% of cost	Aforementioned, bee keeping is vital for productivity in Apples. Significant initiatives by the Government of Himachal is already proving to be benefitting large group of farmers. It is suggested for State Govt. in Uttarakhand should also provide 30% additional subsidy as part for keeping of bee colonies.
<b>B.</b>	<b>Integrated Post Harvest Management</b>			

	Area of Intervention	Unit Cost under MIDH	Pattern of Assistance	Suggestions on Add-on Assistance by the State
1)	Functional Infrastructure for Collection Centre with Sorting, Grading & Packing units	Rs 15 lakhs/ unit	@ 55% of total cost	As majority apple growers in the State are small and marginal, collectivization into farmer groups can play a vital role in improving economies of scale of production and post production management of produce. Presently, there are very few Farmer Groups in the State. In order to encourage more number of farmer to mobilize into group(s) and for Farmer group(s) to own, operate and manage minimal processing and value addition at their own level, it is suggested that additional assistance from State must be extended for these intervention for sharing cost in ratio of 60: 40, where Farmer Groups contribute 40% of the total project cost
2)	Cold Store	Rs. 15.00 lakh/ unit of 30 MT capacity	@50% of total cost	
3)	Refrigerated Transport vehicles	Rs. 26.00 lakh for 9 MT	@50% of total cost	
4)	Primary / Mobile/ Minimal processing unit	Rs 25.00 lakh/unit	@50% of total cost	
6)	Transport Subsidy	NIL	NIL	Currently about 10-15% of the produce is being sold outside the State directly by the farmer. Whereas as the rest of the produce sold with the State channels through commission agents and traders. To encourage direct market linkages and support farmers to explore alternative markets, it is suggested that State government should provide transport subsidy @ 50% of the cost to the Farmer Group(s). This would encourage non-member farmers to mobilize into groups, besides farmer would be able to derive direct benefit out of the scheme.

#### 5.3.1.2 Establishment of Uttarakhand Horticultural Produce Marketing and Processing Corporation

It is suggested that in line with existing pattern of assistance as in case of H.P. Horticulture Produce Marketing & Processing Corporation in Himachal Pradesh J&K State Agro Industries, an Uttarakhand Horticultural Produce Marketing and Processing Corporation may be established in the State. The Corporation to operate with the objective of marketing, forwarding, warehousing, distribution of horticultural inputs, cold storages and processing all types of surplus fruits produced in the State. Some of the functions and activities that may be performed with establishment of such board could be:

- Centralized grading and packing shed at various locations equipped with facility for transporting of produce from orchard to packing shed
- Cold store facilities close to fruit production areas.
- Transit warehouse
- Multi-fruit processing for manufacturing of products as apple concentrate, juice, mixed fruit jams, fruit squash, canned fruits, fruit syrup, pickles etc
- Sale of processed products
- Manufacturing/ Procurement and Sale of CFB cartons for packaging
- Purchase and marketing of fruits (including apples) under Market Intervention Scheme (MIS)

The above facilities of Corporation may be made available to the growers on fee basis.

#### 5.3.1.3 Increasing Branding Recognition

Agriculture based produce is mostly considered as commodities. A commodity is a product so basic that it cannot be differentiated in the minds of consumers (Keller et al., 2008). Branding of produce as 'products' is the key make the consumer perceive the differentiating factor of product such that it

convinces the consumer the product varies sustainably in quality and is worth higher prices than same unbranded products. Thus, brand building is an integral part of marketing strategy for making the supply chain of the targeted product sustainable and profitable. Contributing 90% of the India's total production of apple, the produce from J&K and Himachal have made a differentiating mark in the market due to its quality. Various apple varieties from these State are marketed in name of region in which they are grown as Shimla apple, Kinnaur, Kashmiri apple. On other hand, in absence of brand image, the apple growers from Uttarakhand face significant challenges in marketing their produce at equivalent premium. Although the State has relatively low production scale, however, there is significant potential for branding of the apple produced in the State. While some efforts have been made towards branding and marketing of apples from Harshil (Uttarkashi), the product is yet to gain significant recognition at national level markets. As the State plans to upscale the production and improve quality of apple produced in the region, branding of Uttarkhand apple is critically needed to help the growers get deserving recognition in the existing marketing set and are privileged to get best price for their produce.

As a preliminary measure, the practice of labelling of packaging as well fruit product need to be taken up. Besides, the quality of packaging material also need to be revisited in terms of its physical appearance, standards to reduce latent damages and branding. Emphasis need to be laid on ensuring that each lot of apple produce in the State should be marketed in specially designed packing material branded with the State logo and with same or better quality of packaging material. In addition, emphasis to be laid on electronic, print media, hoardings, creating awareness along the distribution network through buyer seller meets, organizing annual festival/exhibitions/ road shows to sensitize the consumers about the goodness and taste of Uttarakhand apples. Possibilities of Geographical Indication for branding and marketing of Harshil apples should also be explored. Brand building based on GI would help state apple to gain increased and distinct shelf space in both domestic and international market. Creation of direct marketing linkages with private FMCG companies, food retail chain and e-commerce companies should also be promoted.

#### **Box 7. Branding Initiatives**

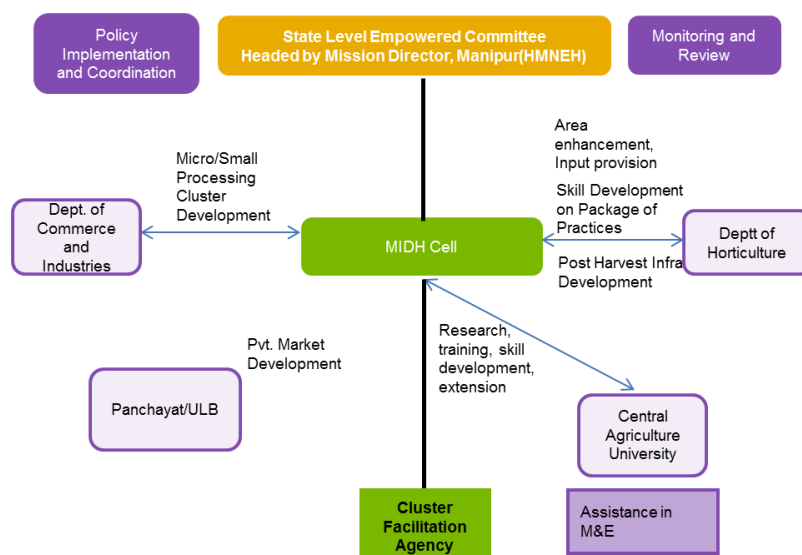
*The Washington Apple Wagon Tour, 2016*

Among various apple imported to India, Red delicious varieties being imported from Washington hold a significant market share. Reportedly, India is the 4<sup>th</sup> largest export market for Washington apples after Canada, Mexico and Taiwan. Of late, apple imports to India from China, New Zealand, Chile and Italy has increased. The apple imports from these countries are offering tough competition to apples imported from Washington. As a result, the market share of Washington apples has significantly declined from 40-50% in recent past to current 20-25%. In order to regain the market share the Washington Apple Commission (WAC), which an industry initiated self-governing body made up of apple growers and packers from Washington, launched a two-month long road show campaign 'The Washington Apple Wagon Tour' covering over 90 cities across India, especially Tier II & III. The aim of the mega campaign was sensitize the India consumers about the goodness and taste of Washington apple varieties available in India

#### **Development of Project Management & Monitoring Framework**

In order to develop the apple value chain in district, it is essential to create a strong, responsible, and responsive institutional structure. This is more so important when we consider the fact the core value chain actors (grower) do not have adequate resources both in terms of finance and knowledge to improve their current situation. Thus, in the absence of a dedicated institutional structure the core objective of value chain development in the cluster may not be achieved.

#### **Proposed Institutional Structure**



As can be seen from the above diagram successful realisation of the cluster development objective shall, to a large extent, be dependent on the successful co-ordination among relevant departments and use of existing institutions like Central Agriculture Universities, Panchayats/Urban Local Bodies. While it is expected that the entire implementation shall be driven by MIDH cell as the nodal agency, in view of the involvement of multiple agencies, it is proposed that a state level steering committee headed by Mission Director, HMNEH be formed to ensure timely project execution and co-ordination among all concerned stakeholders. The committee may have representatives from different line departments such as Commerce and Industries, Agriculture and other agencies such as Agriculture University, Lead Bank, Panchayat Chairperson from the cluster area. It may also include some farmer representatives. The major tasks of the committee may include:

- Facilitating inter-departmental co-ordination
- Finding out/suggesting points of convergence
- Appointment of Cluster Facilitation Agency
- Monitoring and periodic review of the progress
- Setting or re-aligning strategic goals as per the requirement

Considering the fact that the proposed value chain development project adopting a cluster approach is complex in nature (considering both the involvement of multiple stakeholders and the quantum of cross-cutting activities), it is also proposed that a professional Cluster Facilitation Agency (CFA) be appointed to assist the nodal agency MIDH Cell in overall implementation of the value chain development activities. The CFA is expected to bring in required technical inputs, knowledge and market interface to assist the state. Specifically, the functions of the CFA may include:

- Organising the farmers into Farmer Interest Groups/Producer Groups so as to bring in collective action in production as well as marketing. This common action may also lead to economies of scale during post harvest management activities.
- Assess the Capacity Building/Skill Development requirement of the farmer members
- Organising and delivering Skill Development related activities
- Assisting the Farmer Interest Groups/Producer Groups in procurement of required inputs either through direct linkage with the suppliers or through leveraging available schemes of Govt. of Manipur or both
- Assessing the requirement of common post-harvest/processing infrastructure for the farmers; developing a business case for the infrastructure so as to mobilize commercial funding, wherever available
- Assessment of the requirement for private markets including space and other infrastructure; Co-ordinating with Panchayats and Nodal agency for development of private markets; development

of a operation and maintenance mechanism for such markets; development of a business case for mobilizing commercial finance, wherever required

- Identify and develop sustainable market linkages for the produce
- Analyse Identify points of convergence among various schemes and suggest the nodal agency appropriate mechanism to leverage the convergence points
- Identify technologies/best practices which can be replicated in the cluster for overall value chain development
- Assisting the nodal agency in input/grant disbursement
- Assisting the nodal agency in monitoring the progress of the projects
- Represent the nodal agency in different forums, wherever required

## **6 Financial Outlay**

The state being remote with limited connectivity and various infirmities, there is a need to provide adequate level of finance and technical support to promote apple value chain development in the State. The proposed strategy calls for an integrated approach adopting a program mode for developed of various production clusters in the State. Along with the enhanced levels of assistance, the state may also have to build physical infrastructure along the value chain as also supplement the efforts/assistance to strengthen value chain activities.

The total cost of suggested interventions is estimated Rs 3218 Lakhs. Out of which 55% of budgetary support of Rs 1773 lakhs may be sought under various Central Government Scheme. Whereas as of the remaining 20% of the cost of Rs 602 Lakhs is proposed to be facilitated under support from the State Government or alternatively, this may also be facilitated through international multilateral developmental agencies or industry association in public private partnership mode. The remaining 25% of the cost of Rs 843 lakhs would be the beneficiary's share of the total cost. Accordingly, the total financial outlay for the intervention is estimated Rs. 2375 Lakhs with the Centre to State share of 75:25. In terms, value chain intervention 80% of the financial outlay is budget for production related intervention and 20% for post harvest. It is envisaged that the proposed intervention would be implemented in phased manner over duration of 3 years and total proposed financial outlay would be utilized accordingly.



Project components		No. of Units	Cost per Unit (Rs. In Lakhs)	Estimated Total Cost (Rs. In lakhs)	GoI (MIDH/other schemes)		Proposed Outlay from State Government	Remark
					Patter of Assistance	Financial Assistance (in lakhs Rs)		
<b>A. Production Related</b>								
Infrastructural Assistance								
a	Setting-up of three-tier Centre of Excellence for propagation of planting material, training, demonstration & technology dissemination							
	1. Strengthening and scaling up of existing Government Facilities to be developed as apex model centres for elite planting material production	2 sub-units under the project	Rs. 50 lakhs/ Project	50.0	@100% to maximum of Rs.50 lakhs per project	50.0	-	
	2. Establishment of satellite units							
	• Upgradation of existing nursery	10 No.	Rs. 10 lakh/ nursery of 4 ha	100.0	@50% to maximum of Rs.5.00 lakh/nursery	50.0	25	As majority of the existing nursery are small grower owned, it is suggested that additional cost assistance of upto 25% should be provided by the State to the Farmer / Farmer Group(s)
	• Setting-up hi-tech nursery	5 No.	Rs. 25 lakh/ha.	125.0	@ 40% of cost	50.0	12.5	To encourage entrepreneurs to set-up hi-tech nursery of elite planting material, additional cost assistance of 10% may be extended by the State to the beneficiary entrepreneur.
	3. Development of Model Farms	10 No.	Rs. 25 lakhs per FLD for 1 ha	250.0	@75 % of cost in farmers field	187.5	-	
b	Area expansion through establishment of new orchards and replacement of Senile plantations							
	1. Establishment of New Orchards with assistance for meeting the expenditure on planting material, integrated drip system, INM/IPM, canopy management etc	600 ha	Rs 1.5 lakhs/ ha	900.0	@40% of cost in 3 instalments of 60:20:20	360.0	360	To rigorously promote high density plantation of apple across the State, it is important that more and more number of farmers should adopt this technology. It is suggested for the State to provide additional assistance of 40% to the farmer for taking up high density plantation. Remaining 20% cost to be borne by the farmer

Project components		No. of Units	Cost per Unit (Rs. In Lakhs)	Estimated Total Cost (Rs. In lakhs)	GoI (MIDH/other schemes)		Proposed Outlay from State Government	Remark
					Patter of Assistance	Financial Assistance (in lakhs Rs)		
	2. Rejuvenation/ Replacement of Senile Plantation, Canopy Management (considering 20-30% replacement)	300 ha	Rs 0.4 lakhs/ ha	120.0	@ 50% of the cost for maximum of upto 2 hectare per beneficiary	60.0	36	It order to promoted high density plantation in the region, it is suggested for the State to provide 30% add-on assistance to the farmers for high density cultivation. Remaining 20% cost to be borne by the farmer
c	Creation of structures for Water storage and harvesting							
	1. Creation of community water storage structure	10 No.	Rs.25 lakh/ unit	250.0	100% of cost to irrigate 10 ha of command area	250.0	-	-
	2. Water storage infrastructure at individual farms	To be applied individual ly	Rs 1.8 lakhs/ ha	-	50% of the cost	-	-	Apple is the most important temperate fruit crop in the State. Crop is cultivated in high hills under rainfed condition. Majority of farmers have scattered land holdings which are remotely located. Vagaries of changing weather make the apple growers even more vulnerable. It is therefore important for more number of farmers to adopt water conservation technology. It is suggested that in order to encourage individual farmer to practice water conservation, the State should be provided additional assistance of upto 30% to the farmers for setting up water storage infrastructure.
d	Pollination support through Bee Keeping	150 No. of beneficia ry with 50 colonies	Rs.2000 per colony of 8 frames i.e Rs. 1 lakh for max. 50 colonies per beneficiaries	150.0	40% of cost	60.0	45	Aforementioned, bee keeping is vital for productivity in Apples. Significant initiatives by the Government of Himachal is already proving to be benefitting large group of farmers. It is suggested for State Govt. in Uttarakhand should also provide 30% additional subsidy as part for keeping of bee colonies.
e	Establishment of Mobile Soil Testing Lab (STL)	2 No.	Rs.45 lakh	90.0	100% assistance to be provided to public sector (under NMSA)	90.0	-	

Project components		No. of Units	Cost per Unit (Rs. In Lakhs)	Estimated Total Cost (Rs. In lakhs)	GoI (MIDH/other schemes)		Proposed Outlay from State Government	Remark
					Patter of Assistance	Financial Assistance (in lakhs Rs)		
f	Supply of Anti Hail Nets to growers	200000 Sq m (20 ha)	Rs 35 / sq.m	70.0	50% of cost	35.0	21	In recent year, there has been frequent cases of extensive crop loss in apple due to hail storms. As mentioned earlier, this year more than 70% of the crop has been damaged due to hail affecting the overall production and farmer returns. It is suggested State government should provide additional assistance of upto 30% to farmers on procurement of anti-hail to protect the crop
Capacity building Intervention								
a	Training programme							
	1. Training of nursery growers (6 training days per participant)	20 No.	Rs 1000/day per farmers	1.2	100% assistance	1.2	-	
	2. Training of farmers undertaking demo plantations (18 training days per participant)	10 No.	Rs 1000/day per farmers	1.8	100% assistance	1.8	-	
	3. Training of farmers ( 6 training days per participant)	1500 No	Rs 1000/day per farmers	90	100% assistance	90	-	The component of training should be linked with capacity building of beneficiary farmers being targeted under Area expansion
	4. Training of pruners (6 training days per participant)	15 No.	Rs 1000/day per farmers	0.9	100% assistance	0.9	-	
	5. Training of Facilitator (6 training days per participant)	18 No.	Rs 300/ day per participant	0.3	100% assistance	0.3	-	
b	Exposure visit							
	1. Study tours within State	As per actual	As per actual		100% cost assistance		-	
	2. Study tours outside	As per actual	As per actual		100% cost assistance		-	
c	Knowledge Resource Management	1 unit	Rs 1 lakh/ district	1.0	100% cost assistance	1.0	-	

Project components		No. of Units	Cost per Unit (Rs. In Lakhs)	Estimated Total Cost (Rs. In lakhs)	GoI (MIDH/other schemes)		Proposed Outlay from State Government	Remark
					Patter of Assistance	Financial Assistance (in lakhs Rs)		
d.	Adaptive Research & Development of Improved Technologies	1 unit	Rs 100 lakh/project	To be sought as per ICAR	100% cost assistance	To be sought as per ICAR	-	It is suggested that detailed discussions should be undertake with the State AUs and other research bodies for convergence of the initiate with that already underway or planned by ICAR institutions in context to temperate fruit crops
<b>B. Post Harvest &amp; Processing Related Infrastructure</b>								
a.	Creation of Farmer-linked and operated Value Added Centre							
	1. Promotion of Apple Grower Group/ Trust/ Association/ FPOs	3	As per norms issued by SFAC/		As per norms issued by SFAC/			
	2. Setting up of value added centre (2)							
	• Collection Centre with Sorting, Grading & Packing units (15 MT per day with an output from 1.25MT/hour)	2	Rs 15 lakhs/unit	30.0	@ 55% of total cost	16.5	4.5	As majority apple growers in the State are small and marginal, collectivization into farmer groups can play a vital role in improving economies of scale of production and post production management of produce. Presently, there are very few Farmer Groups in the State. In order to encourage more number of farmer to mobilize into group(s) and for Farmer group(s) to own, operate and manage minimal processing and value addition at their own level, it is suggested that additional assistance from State must be extended for these intervention for sharing cost in ratio of 70: 30, where Farmer Groups contribute 30% of the total project cost
	• Cold Store (1 cold store; 100 MT)	2	Rs 50 lakhs for 100 MT unit	100.0	@50% of total cost	50.0	20	
	• Reefer Van ( 4 vans; 4 MT)	8	Rs. 26.00 lakh for 9 MT	92.4	@50% of total cost	46.2	18.48	
	• Minimal Processing units (1 unit)	2	Rs 25.00 lakh/unit	50.0	@50% of total cost	25.0	10	
b.	Augmenting the Cold storage infrastructure							
	1. Setting up Modern Integrated Pack House (20 MT per day with an output from 2.5MT/hour)	1	Rs 50.00 lakh per unit	50.0	at 50% of cost	25.0		
	2. Establishment of integrated cold							

Project components		No. of Units	Cost per Unit (Rs. In Lakhs)	Estimated Total Cost (Rs. In lakhs)	GoI (MIDH/other schemes)		Proposed Outlay from State Government	Remark
					Patter of Assistance	Financial Assistance (in lakhs Rs)		
	chain							
	<ul style="list-style-type: none"> <li>Cold storage with Controlled Atmosphere Technology (1000MT)</li> </ul>	1	Rs 10000/ MT	100.0	50% of the capital cost	50.0		
	<ul style="list-style-type: none"> <li>Refrigerated Transport vehicles (4 MT per Vehicle)</li> </ul>	4	Rs. 26.00 lakh for 9 MT	46.2	50% of cost	23.1		
c	Setting-up Multi-fruit Processing Infrastructure (with focus on Apple)	1	Rs 5 crores	500	at 50% of eligible project cost	250		
d	Transport Subsidy	To be applied by individual	-	50	At 50% of cost	-	50	Currently about 10-15% of the produce is being sold outside the State directly by the farmer. Whereas as the rest of the produce sold with the State channels through commission agents and traders. To encourage direct market linkages and support farmers to explore alternative markets, it is suggested that State government should provide transport subsidy @ 50% of the cost to the Farmer Group(s). This would encourage non-member farmers to mobilize into groups, besides farmer would be able to derive direct benefit out of the scheme.
SUB-TOTAL (Rs. In Lakhs)						1773 (55%)	602 (20%)	843 (cost to be borne by beneficiary) (25%)
GRAND TOTAL (Rs. In Lakhs)				3218		Rs. 2375 Lakhs (Required Financial Outlay)		