ANNEX-G

Post-Harvest Processing and Storage Facilities

THE STUDY ON DIVERSIFIED AGRICULTURE FOR ENHANCED FARM INCOME IN THE STATE OF HIMACHAL PRADESH

FINAL REPORT

ANNEX-G
POST-HARVEST PROCESSING AND STORAGE FACILITIES

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ANNEX-G POST-HARVEST PROCESSING AND STORAGE FACILITIES

G-1 Outline of the Post-Harvest Industry in Himachal Pradesh

In Himachal Pradesh, due to the wide range of altitude and complicated geographical features, diverse agricultural climatic conditions are available. Under these diverse conditions, various kind of agricultural and horticultural products are being produced through the year.

According to the Department of Horticulture, Government of Himachal Pradesh, about 70 to 80% of the fruits produced in the State are marketable surplus, and huge amount of agriculture and horticulture products are exported to other States not only in fresh conditions but the processed foods.

Development of the post-harvest processing industry and appropriate fresh products storage facilities including cold transportation systems will increase the opportunity of utilization of the surplus products in high value, to add the additional values to the products and decrease the abandonment or losses caused by insufficient storage facilities and transportation system.

G-2 History of the Post-Harvest Industry in Himachal Pradesh

In Himachal Pradesh, post-harvest processing activities of agricultural and horticultural products have been started in the end of 1950s under the ICAR (Indian Council of Agricultural Research, organization under Ministry of Agriculture, Government of India) scheme for Setting up "Himachal Pradesh Fruit Canning Unit (himcu)" at temperate zone (Naubahar and Shimla-2) and sub-tropical zone (Dhaulakuan and Sirmour). Objectives of ICAR scheme were as follows;

(1) To develop and standardize fruit and vegetable products based on locally available raw materials.
(2) To conduct training in home scale fruit preservation, especially to house wives.
(3) To conduct community canning service for popularization of preservation and consumption of the processed products during off season.
(4) To manufacture products for sale on semi-commercial scale.
(5) To encourage entrepreneurs for setting up fruit and vegetable processing units.
(6) To provide employment through this scheme specially to women.

During 1970s to 1980s, seven semi-commercial based fruits and vegetables processing industry have also started at these units in different places, to diffuse the new technology of post-harvest processing. Now, above Fruit Canning Units have affiliated to Horticulture Department, Himachal Pradesh, and they are manufacturing various kind of processed foods and selling their products as name of "himcu" brand.



Himachal Cunning Unit (himcu) Processing Plant on Nagrota Bagwan, Kangra District

On the other hand, the Agro Industries Corporation was established in the year 1971 for providing agro-industrial support to the horticulture industry while a specialized organization namely the Himachal Pradesh Horticulture Produce Marketing and Processing Corporation (HPMC) was established in 1975 for taking care of harvest management and processing needs of the industry.

A separate University of Horticulture and Forestry was established in the year 1985 for providing research and development support to horticulture, and another organization namely the Agro Packaging for the Marketing of the Horticulture Produce. Besides this several other organizations namely Himachal Pradesh Cooperative Marketing Federation (HIMFED), Himachal Pradesh State Cooperative Bank, State Cooperative Agriculture and Rural Development Bank, Himachal Pradesh State Agriculture Marketing Board etc. have also been established in Himachal Pradesh, which provide the necessary support to the horticulture industry.

G-3 Grading and Packing

G-3.1 Grading

In the state of Himachal Pradesh, there is no authorized standard on grading for vegetables to be produced in the state. importance and necessity of grading and packing have been disseminated to farmers as well as other stakeholders through a series of extension activities.

Farmers and other marketers (commission agents or buyers) have kept their own local criteria, which is simple. Vegetables like cauliflower, cabbage, peas, tomato are graded or sorted by shape, color, freshness, etc. Sample of local criteria is shown in Table G-3.1.

Table G-3.1 Local Criteria for Grading of Major Vegetables

Commodity	Grade
Cauliflower	1st grade: 500g to 1,000g 2nd grade: 250g to 500g 3rd grade: less than 250
Peas	1st grade: 9 to 11 seeds 2nd grade: 6 to 9 seeds 3rd grade: less than 6 seeds
Tomato	1st grade: Big 2nd grade: Medium 3rd grade: Small
Cabbage	1st grade: Medium size 2nd grade: Big 3rd grade: Small

Source: Interview to APMCs in the H.P., 2007 and 2008

Generally grading and packing activities are conducted by commission agents and/or traders in market yards, although parts of farmers are aware of its importance and advantages.

Meanwhile, the current situations on quality control in other states are shown in Table G-3.2.

Central government has provided internal standard for grading and provisions concerning size for selected vegetables and fruits such as peas, tomatoes, cabbage, cauliflower, sweet pepper, grape, apple, mango, strawberry, pears, etc. as shown in Table G-3.3 to G-3.5. Further it is expected that state government keep her own standard criteria for major vegetables.

Table G-3.2 Current Situations of Quality Control for Vegetables in Other States

Quality Control	State		
	Maharashtra	Haryana	Uttrakhand
Farmers' level	Farmers and traders are unaware of National Guideline regarding the grading and marking for the selected vegetables, fruits and spices under Agriculture Produce (grading and Marking) act, 1937, amended up to 1986 and do not follow any guided procedure for grading. That happens mainly because of the complicated nature of guidelines and the time lost in all these procedures. But this law is strictly followed in export of vegetables. The farmer does not give much attention towards grading their produce as they are more focused towards the volume of the produce. The farmers do not spare time to make perfect grading as they want to save the cost on packing, so they do the grading very casually.	There is no specific criterion laid out at farmer's level. The producer (farmer) according to his knowledge & experience decides the choice of packing material. Small & marginal farmers prefer "*gunny bags*" of plastic/jute origin for general items and smaller to medium bamboo baskets for delicate items like tomato etc. Only a handful of enterprising farmers opt for plastic crates for bringing the produce to the market. However none opts for any kind of grading system of the produce (according to shape/size or quality of the produce). Only grading system adopted at farmer's level is to fill the sack/ box/ basket with a mixture of varying size of the produce but with a fine topping of better quality produce only to attract the buyer at the first sight.	No proper grading system is followed at all.
Market Yard	The Guidelines are adopted by the Government and also amended in 1986 and attached with this report. In practice, it is used by exporters and the super markets who use to sell the produce at higher prices. However now many big companies are buying the produce directly from farmers and market there is kind of awareness that is generated about the size, color, clearness and packing among the farmers. It is also observed that now farmers are becoming conscious about the price benefits. However, under the "Contractual Farming" rules being adopted by farmers in agreement with the organization has to follow the rules and regulations & specifications prescribed by the agencies in agreement with the farmers.	There is no specific criterion adopted at any of the market yards in the state. However it depends on purchaser's/ trader's to adopt the system of packing as per availability and suitability. Generally the produce is traded in the same packing as already used by the farmers to bring their produce to the marketing yard. No system of "Grading" is followed at any of the marketing yards already existing in the state.	There is no mechanism of grading and packaging at the level of market yard due to large being received and sold daily two times. There is no time and space to perform this task.

Table G-3.3 Grading Rules for Peas Settled by Ministry of Agriculture

CRITERIA FOR GRADE DESIGNATION

Grade designation	Grade Requirements	Grade tolerances
Extra class	Pods shall be:- - fresh and turgid; - free from damage caused by hail; - free from damage caused by heating; - with peduncles attached; if removed it should be neatly cut; - well filled containing at least five seeds. Seeds shall be:- - well formed; - tender; - succulent and sufficiently firm, they should become flat without disintegrating when squeezed between to fingers; - at least half of the full grown size but not full grown; - non;-farinaceous; - undamaged without cracks in the skin of the seeds.	5% by weight of peas not satisfying the requirements, but meeting those of Class I grade.
Class I	Pods shall be:- - fresh and turgid; - free from damage caused by hail; - free from damage caused by heating; - with peduncles attached, if removed it should be neatly cut; - well filled containing at least five seeds. Seeds shall be:- - well formed; - tender; - succulent and sufficiently firm, they should become flat without disintegrating when squeezed between to fingers; - at least half of the full grown size but not full grown; - non-farinaceous; - undamaged without cracks in the skin of the seeds.	10% by weight of peas not satisfying the requirements, but meeting those of class I grade.
Class II	Pods - - shall be fresh and turgid; - with peduncle attached; if removed it should be neatly cut; - shall contain at least three seeds; - may be riper than those in Extra class grade, over mature pods are to be excluded, the pods may have following defects; provided they retain their essential characteristics as regards the quality, the keeping quality and presentation; - slight skin defects, injuries & bruises provided they are not progressive and there is no risk of the seeds being affected; - slight defects in shape; - slight defects in colouring; - some loss of freshness. Seeds may have- - slight defects in shape; - slight defects in colouring; - slightly harder; - slightly damaged.	10% by weight of peas not satisfying the requirements of the grade but meeting the minimum requirements.

Table G-3.4 Grading Rules for Cabbage by Ministry of Agriculture

CRITERIA FOR GRADE DESIGNATION

Grade designation	Grade Requirements	Grade tolerances
Extra class	Headed Cabbage shall be of good quality and possess all the characteristics typical of the variety, they should be compact, having regard to the species. Headed Cabbages, according to the variety, must have firmly attached leaves. They should be uniform in shape and colour Store headed cabbages may have some of their outer leaves removed. Green Savoy headed cabbages and early headed cabbages, taking into account their variety, must be properly trimmed, but in doing so a number of leaves may be left for protection. They may have following slight defects:- - small cracks in the outer leaves, - slight bruising and light trimming of the outer leaves, provided that it does not affect the good condition of the produce.	5% by number or weight of headed cabbages not satisfying the requirements for the grade, but meeting the requirements for Class I grade.
Class I	Headed Cabbage shall be of good quality and possess all the characteristics typical of the variety. They should be compact, having regard to the species. Headed Cabbages, according to the variety, must have firmly attached leaves. They should be uniform in shape and colour Store headed cabbages may have some of their outer leaves removed. Green Savoy headed cabbages and early headed cabbages, taking into account their variety, must be properly trimmed, but in doing so a number of leaves may be left for protection. They may have following slight defects:- - small cracks in the outer leaves, - slight bruising and light trimming of the outer leaves, provided that it does not affect the good condition of the produce.	10% by number or weight of headed cabbages not satisfying the requirements for the grade, but meeting the requirements for Class II grade.
Class II	Headed Cabbage which do not qualify for inclusion in the Class I grade, but meet the minimum requirements. They may have following defects. - Cracks in the outer leaves, - More of the outer leaves may be removed, - Larger bruises and the outer leaves may be more extensively trimmed, - Less compact.	10% by number or weight of headed cabbages not satisfying the requirements of the grade but meeting the minimum requirements.

Provisions concerning sizing;

Size is determined in relation to net weight. The minimum weight of headed cabbage shall not be less than 200 gms.

Size Code	Weight in grms.
A	201 - 600
B	601 - 1200
C	1201 and above

Table G-3.5 Grading Rules for Tomato by Ministry of Agriculture

CRITERIA FOR GRADE DESIGNATION

designation	Grade Requirements	Grade tolerances
Extra class	Tomatoes shall be of superior quality. They shall have firm fresh and must be characteristics of the variety as regards shape, appearance and development. They must be free of green backs and other defects. Very slight superficial defects may be there provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.	5% by number or weight of tomatoes not satisfying the requirements of the grade, but meeting those of Class I or exceptionally, coming within the tolerances of that grade.
Class I	Tomatoes shall be of good quality. They shall have reasonably firm flesh and shall be characteristics of the variety as regards shape, appearance and development. They must be free of cracks and visible green back. The following slight defects may be there provide these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package: slight superficial defects may be there provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package. - a slight defect in shape and development; - a slight defect in colouring; - slight skin defects; - very slight bruises	10% by number or weight of tomatoes not satisfying the requirements of the grade, but meeting those of Class II or, exceptionally, coming within the tolerances of that grade.
Class II	Tomatoes shall be reasonably firm flesh and shall be character(but may be slightly less firm than in class I) and must not show unhealed cracks. Following defects may be there provided the tomatoes retain their essential characteristics as regards the quality, the keeping quality and presentation. - defects in shape, development and colouring; - skin defects or bruises, provided the fruit is not seriously affected; - healed cracks not more than 3 cm. in length.	10% by number or weight not satisfying the requirements of the grade but meeting the minimum requirements. In case of trusses of tomatoes, 10 % by number or weight of tomatoes detached from the stalk.

PROVISIONS CONCERNING SIZING:-

Sizing is determined by the maximum diameter of the equatorial section in accordance with following table. The provisions shall not apply to "cherry" tomatoes. The minimum size is set at 35 mm for "round and "ribbed" tomatoes and 30 mm for "oblong" tomatoes:

Size Code	Diameter (in mm.)		
	Minimum*		Maximum
1	from 30	to	34
2	from 35	to	39
3	from 40	to	46
4	from 47	to	56
5	from 57	to	66
6	from 67	to	81
7	from 82	to	101
8	from 102		and over

Market price is varied, depending on local grading criteria. As a result, it is possible to get more value of their produces. Difference of wholesale price depending on quality is shown in below photos:

Date: January 9, 2008
Tomato (bad quality)
Market: Lower Bazar, Shimla
Price: Rs. 5/kg

Date: January 9, 2008
Tomato (lower quality)
Market: Lower Bazar, Shimla
Price: Rs. 8/kg

Date: January 9, 2008
Tomato (normal quality)
Market: Lower Bazar, Shimla
Price: Rs. 10/kg

Date: January 9, 2008
Tomato (good quality)
Market: Lower Bazar, Shimla
Price: Rs. 12/kg

Date: June 15, 2007
Potato(lower quality)
Market Yard: Dhali, Shimla
Price: Rs. 6/kg

Date: June 15, 2007
Potato (higher quality)
Market Yard: Dhali, Shimla
Price: Rs. 9/kg

Date: June 1, 2007
Cabbage (three types)
Market Yard: Dhali, Shimla

Date: June 1, 2007
Cauliflower (three types)
Market Yard: Dhali, Shimla

G-3.2 Packing

Packing materials like plastic crates have been subsidized by the Marketing Board (see the first left photo). While it is easy to comprehend the difference of quality between the following strawberries, these grading and packing should undertaken by the farmers' as their responsibilities, otherwise it is difficult to comprehend the preference of consumers and improve quality of their produce.

Containers to be subsidized by Marketing Board
It is possible to reduce transportation loss.

Strawberry in Maharashtra
Well- sized and well-shaped with good package

Strawberry in Himachal Pradesh
Uneven Size and Shape with simple plastic package

G-3.3 Farmers' Training for Improvement of Grading and Packing

(1) Farmers' Awareness Camps[1]

Farmers are not getting adequate yields and returns in relation to their hard work due to inadequate knowledge about post harvest handling and marketing. Thus farmers awareness camps are being organizaed to make them aware of post-harvest management, agricultural marketing, market regulation etc. The officials of H.P. Marketing Board, Market committees, Directorate of Agriculture and Horticulture, Agriculture/ Horticulture University, etc. also participate in these camps as resource personnel. During the year of 2005-06, 1739 farmers have been imparted training, by spending Rs. 172,941. Further during the year of 2006-07, 800 farmers have been imparted training by spending Rs. 80,000.

(2) Farmers' Exposure Visits[2]

Agricultural universities and related institutes throughout the country are constantly developing improved and scientic techniques of post-harvest management. By and large, the farmers in the adjoining areas of these institutes/ organizations are availing these opportunities, Not only their crop yield has increased but their income has also increased significantly. But the farmers located at distant places are not able to reap the benefits of technology advancements. Therefore, it is necessary to expose such farmers to such technology advancement by taking them to such centres of excellence. Keeping in view these facts, the Board has started organizing farmers exposures visits with the help of National Horticulture Board, During the year of 2005-06, 15 farmers went on Study Tour/ Exposure visits, while 123 farmers have during the year of 2006-07.

[1] Extracted from Activities of H.P. State Agricultural Marketing Board 2007 and 2008
[2] ditto

G-4 Post-Harvest Activities

After harvesting at the field, vegetables and fruits are commonly transferred to the markets in consumption area through the distribution channel as shown in Fig. G-4.1.

Post-harvest activities, such as sorting, grading and packing works are done at producer's house or collection center managed by producers' cooperatives/groups or market yard managed by APMC etc. as mentioned in Fig. G-4.1.

Sorting work is made to reject damaged, spoiled, discoloured or immature produces from mix with sound and matured goods. Grading work is done mainly to classify the produces according to the size at present. Regarding packing work, some part of fruits such as apples is packed into corrugated carton box, and vegetables are mainly transported by plastic box or gunny bag.

Regarding storage, large scale cold storage facilities for fruits are operated by both semi-governmental sectors and private sectors.

Previously, the most part of the distribution work of vegetables and fruits are managed by private traders and APMCs. However, recently, some advanced producers' groups have started progressive trials as follows.

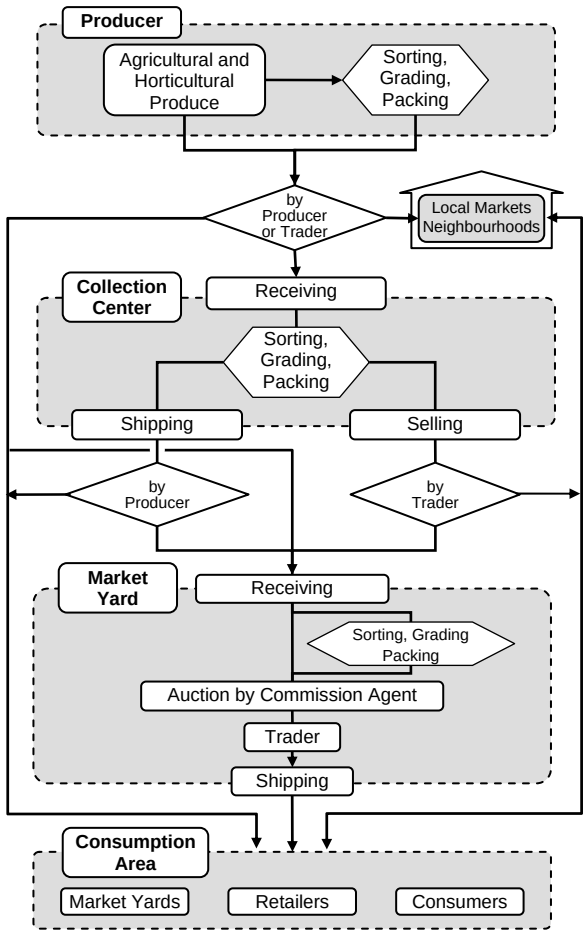

Fig. G-4.1 Post-Harvest Activities in Distribution Channel of Agriculture Produce

(1) Kullu Fruit Growers Association

This association consists of about 25,000 members (almost all of apple producers in "Kullu Apple Valley") and promoting fruits production in the valley.

The association is distributing some portion of their produces (mainly apples) directly to the big consumption area such as Chandigarh or Delhi etc. by hiring the trucks by themselves. These transactions are carried out not through APMCs but private traders. The association purchases and distribute insecticides, pesticides, fungicides and also carton boxes and other packaging materials to the member of the association in lower prices than standard market price. These are one part of the agricultural cooperative activities at the initial stage.

(2) Exotic vegetables producers' groups in Karsog Block, Mandi District

In this area, there are about 30 farmers' groups who are producing exotic vegetables such as lettuce, Chinese cabbage, celery, leek, coloured capsicum, summer squash etc., and these gropes are being formed by farmers themselves. These groups have their own collection spaces where collection, sorting, grading, weighing, packing and forwarding works are carried out by the groups.

One farmers' group purchased two refrigerated vans with bank support recently and they are

transporting their produces to Delhi directly every day in crop season. During harvest season, they are sending 3 tonnes of their produces to Delhi every day. Other group has also two refrigerated vans on rental bases, and also transporting their produces to Delhi and Chandigarh. Final destinations of those exotic vegetables are mainly five-star hotels for consumption by foreigners or higher class urban people. Market information of Delhi or Chandigarh are sent to the group leader time to time from their liaison members who are staying in Delhi etc. Based on their information, produces are transported to most profitable markets.

Mean annual income of these group member is said to be about Rs.150,000 for approximately 0.3ha and this income is quite high compared with other standard vegetable growers'.

As mentioned above, in recent years, distribution channels of agro-produces have been diversified and advanced producers' group can open profitable distribution channel by themselves. From now on governmental sectors are requested to provide f special financing with low interest for the producer groups.

Coloured capsicums are sorted and graded according to their sizes.

Foldable plastic carton box. Vegetables are transported to Delhi or Chandigarh etc. kept in the boxes.

Refrigerated van. : Products are transported to the large consumption areas directly.

G-5 Present Condition of Post-Harvest Industry

In the State, food processing activities are established mainly based on the fruits and vegetables. Almost all of them are the traditional and conventional products, such as jams, juices, juice concentrates, squashes, purees, dry fruits, candies, pickles and many kinds of fruit wines etc.

Dry fruits and pickles etc. are usually processed mainly by house wives as one of the housework for their self consumption or sold in small limited areas, while comparatively larger scale industrial processing such as juice concentrate, fruit wine or large scale potato chips manufacturing are done by State Processing Industry or Private Sector's Industry.

In 2004/05 season, about 1 million tons of vegetables and about 700,000 ton of fruits, total about 1.7 million ton of vegetables and fruits were harvested in the State.

Meanwhile, about 130 places of fruit, vegetable, medicinal plant and mushroom processing units have been established in the State as shown in Table G-5.5. Total initial designed processing capacity is announced 88,000ton annually as shown in Table G-5.1. However the actual result is not clear, especially, majority of the vegetable processing is managed by small scale units or housewives, and therefore collection of the detailed capacity of vegetable processing is quite difficult. However, it is definite that the ratio of quantity which processed from raw agriculture or horticulture products are still low.

The State Government is realizing their many plans for the diversification of the fruit and vegetable processing industry for the manufacture of value added products including fruit wines and ciders.

Assuming that above middle and large scale processing plants are working in full designed capacity, it is calculated that about 5% of the total produces are processed by them.

With regard to the producer's selling price, it is a fact that the selling prices at market yard to traders or direct selling to consumers are generally higher than the prices as processing materials. Therefore, farmers intend to sell their fresh produces at market yard etc. not for processing materials. However, some quantity of the produces belong to not-suitable for transaction at market, such as bad shape, damaged, out of size for fresh eating purpose are inevitably. In case of over-production of apple, farmers are suffering from falling prices.

Agro-processing facilities are also useful and beneficial in order to utilize such not-suitable produces for fresh eating purpose or in the event of over-production.

Details of the fruits and vegetables processing plants of each district are shown on Attachment G-1 and new food processing plants being setup in the State are shown on Attachment G-2.

G-5.1 Outline of Processing Industries for Fruits and Vegetables in Himachal Pradesh

Not only for the strengthening the post-harvest industries for the Governmental or semi-Governmental organization, the Government of Himachal Pradesh is promoting private enterprises for the establishment of post-harvest management Infrastructure for the horticultural produce of the state.

Principal large and middle scale fruit and vegetable processing industries operated in the State are shown in Table G-5.1

Table G-5.1 Principal Large and Middle Scale Vegetable and Fruit Processing Industries in H.P. State

Sector		Particulars	Approx. Capacity (ton/ year)	Remarks/Products Manufactured.
Governmental or Semi-Governmental Sector	**A. Governmental Sector**	**Fruit Processing Units in the Department of Horticulture** (himcu, 8 units)	600	Fruit Juice, Pickles etc.
	B. Corporate Sector	**Horticulture Products Marketing Corporation (HPMC)** **1. Fruit Processing Plant Parwanoo, Solan** **2. Fruit Processing Plant Jarol, Solan** 3. Fruit Processing Plant Jabli, Mandi	22,500 2,500 1,000	Juices Conc., Juices, Pulp, Jams, Jellies, Marmalades, Fruit Wines, Apple Cider, and other conventional fruit and vegetable products.
	C. Co-operative Sector Units:	(7 Units)	600	Conventional Fruit and Vegetable products.
	Public Sector sub-total		***27,200***	***(31%)***
	D. Independent Private Sector Units	**(a) Big units (9units)** 1. Shivambhu International, Mahesh Nagar, Oel, Una. 2. Himalaya International Ltd.. Poanta Sahib, Sirmour. 3. Green Valley , Kala Amb, Sirmour. 4. Noble Agro Foods, Kala Amb,Sirmour 5. Mahan Dairies Ltd.,(F&V division) Kunja, Paonta Sahib. 6. Himland Agro Foods Ltd., HPSIDC Area, Baddi, Solan 7. Himachal Fruit Products, Badri Nagar, Paonta Sahib 8. Himgiri Food Products, Una. 9. Shri Ram International, HPSIDC Area, Baddi, Solan (b) Other units (55units)	15,000 8,600 2,000 1,800 1,200 1,490 1,240 2,160 1,000 16,170	Fruit Juice, Frozen Vegetables, Pickles etc. Frozen Vegetables, Potato Frozen Vegetables, Jams, Juices, Ketchup Pickles. Sauces, Jams etc. Fruit Drink, Squashes Squashes, Syrups Tomato ketchup, Jams, Juices, Pickles, Vinegar etc. Conventional Fruit Products.
	E. Joint Ventured Private Sector	1. Himalayan Vege Fruits Ltd., Jabli, Solan	10,000	Fruit Juice Conc., Pure Fruit Juices, Canned Fruits, Jams, Jellies etc.
	Private Sector sub-total		***60,660***	***(69%)***
Grand Total			***87,860***	***(100%)***

Source: Department of Horticulture, Himachal Pradesh. "Present Status of Fruits and Vegetables Processing Industries and Available Post Harvest Infrastructure in Himachal Pradesh"

From this table it is found out that about 70% of the agro-processing industries is carried out by the private sector.

It is prospected, in future, the ratio of the processing industry managed by the private sectors will be more increased, and the task of Governmental sectors will be shifted from direct operation of the plants to plan and control the total management of the processing industry. Governmental sectors will be requested to provide land and infrastructures such as preparation of road, electricity and water etc.

for processing industrial zone. Favourable taxation system and special financing system with low interest for the private sectors etc. are also expected in order to encourage the investors to build processing plants in the State. It is also important to disseminate production information to the investors in P.P.P. workshop or other channels. Summary of post-harvest processing plants in each district are shown in Table G-5.2.

Table G-5.2 Agro-Processing Plants in each District

District	Total Processing Capacity in the District (tons/year)	Percentage in Total	District	Total Processing Capacity in the District (tons/year)	Percentage in Total
Bilaspur	120	0.1%	Mandi	2,774	3.2%
Chamba	707	0.8%	Shimla	520	0.6%
Hamirpur	276	0.3%	Sirmour	**16,835**	**19.5%**
Kangra	569	0.7%	Solan	**40,409**	**46.9%**
Kinnaur	100	0.1%	Una	**23,680**	**27.5%**
Kullu	260	0.3%	***Total***	***86,250***	***100.0%***

Source:Department of Horticulture, Himachal Pradesh. "Detail of the Fruit/Vegetable processing units in Himachal Pradesh"
Note:State total capacity in this Table is 86,250tons/year is different from grand total in Table G-5.1 of 87,860tons/year due to different collection sources.

From this table, it is understood that about 94% of the plants are concentrated to south western districts such as Solan, Una and Sirmour, and most of the processing plants are located far from production areas. This situation indicates that location of the processing plants are preferable for the plant operators/investors not at the material producing area but at the area nearby the consuming area or flat land. However, at present, huge amount of the material produces (mostly apples) have been damaged during transportation from production area to processing plant, due to long drive on the bad conditioned roads. (According to the Department of Horticulture, about 33% of the apples and stone fruits are lost during transportation. *Source: The Tribune (Newspaper) 10th September, 2008*) In order to avoid these constraints, and also to invite private processing sectors to the State, rehabilitation and appropriate maintenance of roads is indispensable.

(a) Fruit processing

In Himachal Pradesh, many kinds of fruits are planted and harvested as shown on below Table G-5.3.

Table G-5.3 Main Fruits Produced in the H.P. State

Type by climate	Kind of Fruit
Temperate fruits	Apple, Pear, Peach, Plum, Apricot, Almond Cherry, Almond, Walnut, Chestnut, Hazelnut, Strawberry etc.
Sub-tropical fruits	Citrus, Mango, Litchi, Guava, Papaya etc.

Source: Department of Horticulture, Himachal Pradesh

Production of main fruits on 2004/05 season and their percentage are shown in Table G-5.4. As understood from this table, more than three forth of total fruits production is occupied by apple. Accordingly, exceptionally huge ratio of total fruit processed products is held by apple based items, including apple based alcoholic drinks as wines or ciders.

Table G-5.4 Production and Ratio of Main Fruits Produced in the H.P. State

Kind of Fruit	Apple	Other temperate	Mango	Nuts & others	All fruits
Production (tons)	527,601	59,542	59,739	45,129	692,011
Ratio	76.2%	8.6%	8.6%	6.5%	100.0%

Source: Department of Horticulture, Himachal Pradesh. (arranged by JICA Study Team)

The temperate fruit processed items account for more than 90% of the total fruit processed items (most of part is apple), against the share of about 7 % for the sub tropical fruits.

According to the Directorate of Industry, Himachal Pradesh, the total processing capacity of the fruits in the State is estimated at about 75,000 ton (Processing Industry in Himachal Pradesh, 2003" issued by Directorate of Industry, Table-5 on page III-8).

From the above mentioned Table G-5.1, total processing capacity of fruits and vegetables in Himachal Pradesh is about 88,000 tons. Through the interview study, most of the large scale processing plants are mainly processed fruits produces. Therefore it can be understood that fruit processing is mainly carried out by commercial based larger scale plants, while most of vegetable processing is done under small scale base such as women's group of the villages.

In addition, the new Industrial Policy 2004 which was announced by the State Government in December 2006, focuses on industrial development in following potential sectors of the State.

-1. Agro-horticulture produce based industries,
-2. Local resources based industries and
-3. Development of rural industries

Based on above policy, the State Government has designated fruit based wineries and cider manufacturing units as thrust industries.

Regarding relationship between apple production and agricultural processing capacity by districts, the following figure shows that the major apple production districts are Kullu, Shimla and Kinnaur, however the major processing facilities are located on Solan, Una and Sirmaur District where are comparatively flat area than the other districts and close to the major consuming areas and convenient to procure the bottling and packaging materials etc. (Green arrows are estimated transportation lines of agro produces for processing)

From the above, it is clear that almost of all processed agro products are transported from their harvested areas to the major processing area located on south western area of the state, and they are not processed at their harvested area.

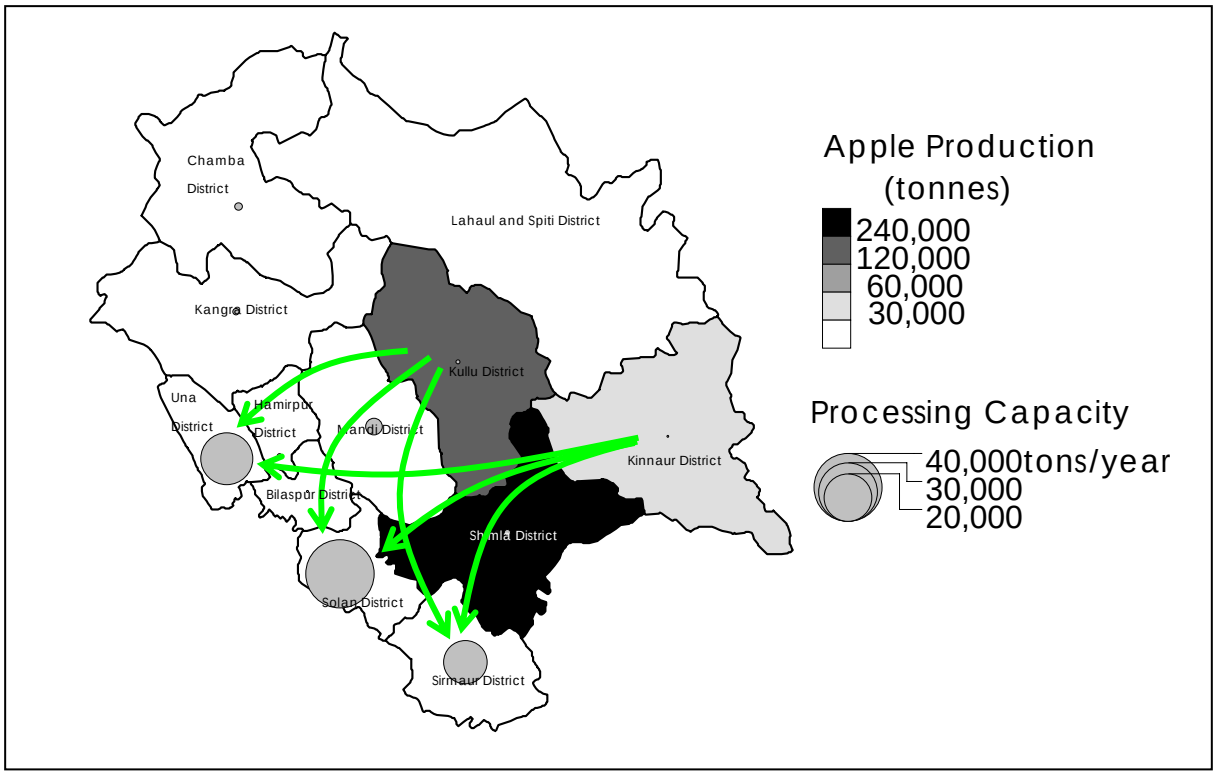

Fig. G-5.1 Apple production and Agriculture Produce Processing Capacity by District

(Tonnes per year)

Source: 1. Apple Production: Department of Horticulture, Himachal Pradesh, 2004/05
2. Processing Capacity: Department of Horticulture, Himachal Pradesh, 2001

Meanwhile, development of agro-processing facilities establishes the job opportunities for neighboring inhabitants. At Parwanoo area in Solan District, there is the largest fruits juice plant in the State is operated by HPMC (Annual capacity is about 22,500tons) In this plant about 85 regular staffs are working through the year, and about 100 to 150 casual labors are working at busy harvesting season.

If agro-processing plant were located at production areas, packaging materials such as bottles, cans or cartons should be transported to the remote production area and processed products should be transported to main consuming areas where is Punjab State etc. Considering the present situation of the road conditions in the State, it is too bad to transport the goods mentioned above.

From the above mentioned situation, it is not appropriate and realistic to invite large or middle scale agro processing plant to the production area at present. It is recommendable to organize small scale processing groups for pickles etc. by house wives.

At Kangra District, many small women's groups succeed to process and sell pickles etc. From such group activities, the village development also can be brought.

It is very important to prepare the good environment where above women's groups etc. can be active easily.

(b) Vegetable processing

As mentioned above, vegetables are processed under comparatively small scale groups or by housewives in their houses. Detail of the present situation of the processing of vegetables etc. is

mentioned below.

According to the Directorate of Industry, Himachal Pradesh, followings are remarkable and features of vegetable processing activities. ("Processing Industry in Himachal Pradesh, 2003" issued by Directorate of Industry, lower part of page I-1)

(1) Potato

The potato based processing infrastructure does presently not exist. In 2004/05 season, Himachal produced about 150,000 tons of potatoes which is mostly utilized as seed potato and table vegetable. About 30,000 tons of quality potato suitable for chips production is produced in the Kangra valley and can be provided as the raw material to the potato chip making industry.

Recently Horticulture Department had approved the proposal of Regal Snacks Pvt. Ltd, for setting up a unit for the manufacture of Potato Chips in District Una.

(2) Maize

Annual maize production of the State in 2004/05 season was about 636 thousand tons. Out of which about 200,000 tons is estimated as the marketable surplus. When the cultivation of the hybrid maize varieties will be diffused and popularized, production will be greatly increased and the marketable surplus can be increased to 350 to 400 thousand tons.

Maize can be processed not only for direct food material or livestock feed but also for much kind of industrial materials. Sukhjit Starch and Chemicals Ltd. is setting up the processing plant for the manufacture of maize starch and other kinds of maize based food and industrial materials and livestock feed in district Una having the processing capacity of 150 tons per day of material maize.

In addition, Baby Corn is cultivated many areas in the State. This kind of maize is one of the important locally available raw materials, which can be processed into bottled or canned boiled baby corn, which is the one of the much promising export item.

(3) Other vegetables; as ginger, mushroom and hop

Ginger produced of the State could be usefully utilized for the manufacture of the value added products like ginger powder, ginger candy, dry ginger, ginger chutney, ginger appetizer etc. The present annual production of dry Ginger in the State is 20,600 tons, and out of which about 8,000 tons is marketable surplus.

In Himachal Pradesh, white button mushroom (*Agaricus Bisporus*) is being produced with its current annual production of 5,300 tons. Agro climatic conditions obtaining in the sub mountainous regions of the State, great potential exist for the development of the mushrooms both for fresh consumption, processed food and export. Industrial mushroom processing has been done by HPMC at Jarol, Mandi district and Parwanoo, Solan district. And Himalayan Foods, private enterprise, is also processing the mushroom at Paonta Sahib, Sirmour district.

In India, District Lahaul and Spiti in Himachal Pradesh is only district, which is producing common hop commercially, since the cold and dry climate condition of the some areas in the district are quite suitable for its cultivation. Since high yield and aromatic varieties of hop are introduced from abroad recently, production is increasing in cultivation area of the district.

Hop is mainly used in the brewing industry. The Himachal Pradesh is producing 42.5 tons of dry hop, whereas the total demand of Indian brewing industry is over 500 tons per annum. A Hop Processing Plant for the manufacture of hops pellets with a processing capacity of 1tons of dry hop

per day, has been established by the joint sector by Aromatrix Flora Pvt. Ltd., Baddi in Solan district.

(4) Honey

In Himachal Pradesh about 1,200 tons of honey is produced annually. The State Government has established a Honey Processing Unit at Kandrori, District Kangra with a processing capacity of 120 tons of honey per year. In addition Dabur (India) have also established honey processing facilities in their plant at Baddi, District Solan.

(5) Factory By-Products from Processing Industries

A large quantity of apple pomace is available as factory by-products in the processing industries established in the State. At present, those pomace are only for utilized as the livestock feed.

When the appropriate technology will be introduced and becomes available, the apple pomace and citrus peels could be utilized for the pectin manufacturing which is used in food processing industry. Pectin is presently being imported from other countries.

G-5.2 Large and Middle Scale Food Processing Industry

(a) Food processing industry managed by Governmental or semi-Governmental sectors

Major large and middle scale food processing plants located in the State are shown on Table G-5.5.

Table G-5.5 Food Processing Plant by Districts (as of 1st March, 2007)

Materials of the Processing Plant	Cereals Grains	Fruits	Vegetable	Medicinal Plants	Mushroom	Milk	Total Established Units
Typical Products / District Name	Flour malted/ health food, biscuits, bread	Juice, Jam, Jelly, Chutney, Squash, Fruit Wine	Chutney, Pickles, Puree	Medicines Herbs		Milk Dairy Products	
1 Bilaspur	5	4		3	1	1	14
2 Chamba	2	8					10
3 Hamirpur		5		2			7
4 Kangra	15	12		17		2	46
5 Kinnaur							0
6 Kullu	12	8		4		6	30
7 Lahaul & Spiti							0
8 Mandi	27	10		12			49
9 Shimla	27	7		1			35
10 Sirmour	53	7	1	5	1	5	72
11 Solan	44	7	3		2	1	57
12 Una	21	7		2			30
Total	206	75	4	46	4	15	350
		Sub-total except grains and milk = 129					

Source: Department of Industry, Himachal Pradesh "Processing Industry in Himachal Pradesh, 2003)

(1) Himachal Pradesh Fruit Canning Unit (himcu)

As mentioned on Table G-5.6 and Attachment G-1, "Himachal Pradesh Fruit Canning Unit" under Horticulture Department, is manufacturing and selling their processed products as the brand of "himcu".

At present, 8 Fruit Canning Units and 5 Community Fruit Processing and Training Centers are conducted. Details of the Units and Training Centers are shown on Table G-5.7.

Encouraging with the performance of these units, several post-harvest processing plants in governmental, semi-governmental, cooperative and private sector have been established during 1990s. In addition, after training at Community Fruit Processing and Training Centers, women make processed food at their homes for mainly for self consumption and sometimes sell in small scale local market.

Table G-5.6 Fruit Canning Unit under Horticulture Department

No.	Name / Location	Year established.	Typical produces	Processing Capacity (tons/year)
1	Naubahar, Shimla	1958	Apple juice, chutney, jam, cider, wine (plum, grape, peach) rhodo squash, cinder vinegar etc.	200
2	Dhaulakuan, Sirmaur	1964	Litchi, kiwi and strawberry products. Sarson Ka Saag, Brahmi sy etc.	200
3	Rajgarh, Sirmaur	1968	Canned peach and pears, garlic pickle, rhodo squash etc.	100
4	Rajpura, Chamba	1968	Canned peach, Chamba chukh etc.	100
5	Nagrota Bagwan, Kangra	1978	Various pickles and chutneys, litchi and lemon jam and preserves, various fruit drinks, Brahmi Sy etc.	200
6	Nihal, Bilaspur	1980	Lemon squash, ginger chutney, mango products etc.	100
7	Shamshi, Kullu	1981	Olive oil, olive preserve with salt, kiwi and apple juice, tomato products etc.	200
8	Reckong Peo, Kinnaur	1982	Apple juice, jam, apricot products etc.	100

Source: Horticulture Department, Himachal Pradesh (arranged by JICA Study Team)

Table G-5.7 Community Fruit Processing and Training Centers

(under control of the Fruit Technologist, Nagrota Bagwan)

1	Tauni Devi, amirpur	2001	• Main purpose is to demonstrate and training regarding small scale food processing for women. • In 2007 about 280 women participated in the training session held at these Community Centers, Naubahar, Shimla. Training period is 1 to 3 days and all trainings (including materials fee) are free of charge.
2	Nadaun, Hamirpur	2001	
3	Dehra, Kangra	2001	
4	Nurpur, Kangra	2001	
5	Kinoo, Una	2001	

Source: Department of Horticulture, Himachal Pradesh. "Present Status of Fruits and Vegetables Processing Industries and Available Post Harvest Infrastructure in Himachal Pradesh"

(2) Himachal Pradesh Horticulture Produce Marketing and Processing Corporation Limited (HPMC)

HPMC is organization undertaken by Horticulture Department, State Government of Himarchal Pradesh. HPMC has fruit processing plants, grading and packing centers and cold storage facilities etc. which are shown in Table G-5.9.

They also have Regional offices not only in the State but many big cities in India. Details of the organization are shown in Table G-5.8.

Main activities (followings are mentioned based on apple transaction) of HPMC are as follows;

- State Government purchases material apples for processing from farmers in fixed price which is decided prior to the starting of every harvest season, according to Market Interventions Scheme (MIS).
- Government has an obligation to purchase all apples which farmers bring to the collection centers.
- Apples account for more than 90 percent of all processing materials.

Table G-5.8 Organization of HPMC

Head office		Nigam Vihar, Shimla		
Regional office inside Himachal Pradesh				
	Shimla Regional office	Nigam Vihar, Shimla District ***visited***		
	Sub office	1. Jorol Tikkar	6. Tutupani	11. Sarahan
		2. Oddi	7. Rajgarh	12. Theog
		3. Gumma	8. Jubbal	13. Nerwa
		4. Rohru	9. Chopal	14. Sheelghat
		5. Reckong Peo	10. Gopalpur	
	Kullu Regional office	Bhuntar Kull District		
	Sub office	1. Bhunter	3. Chail Chowk	5. Patlikuhl
		2. Chindi	4. Dalash	
	Kangra Regional office	Kangra, Kangra District		
	Sub office	1. Baijnarth	2. Chamba	3. Kandrori
Fruit Processing Plant with Manager (Details are shown in Table G-5.9)				
	Fruit Processing Plant Parwanoo, Solan District			
	Fruit Processing Plant Jabli, Solan District			
	Fruit Processing Plant Jarol, Sundernagar, Mandi District			
Cold Storage with Manager				
	Cold Storage, HPMC (Details are shown in Table G-5.9)			
Regional office outside Himachal Pradesh				
	Chandigarh office	Manimajra, Chandigarh		
	Delhi office	Lawrence Road I/A, Delhi		
	Azadpur Market office	Azadpur Subzi Mandi, Delhi		
	Chennai office			
	Mumbai office			
	Kolkata office			

Source: HPMC. (arranged by JICA Study Team)

Table G-5.9 Facilities of HPMC

No.	Location	Capacity (tons)			
		Packing and Grading houses	Grading Houses	Cold Storage	Fruit Processing Plant
1	Gumma, Teh. Kotkhai, Shimla	5,000		1,000	
2	Rohroo, Teh. Rohroo, Shimla	5,000		1,000	
3	Oddi (Kumarsain), Shimla	5,000		1,000	
4	Jarol (Kotgarh), Teh. Kumarsain, Shimla	5,000		1,000	
5	Patlikuhal, Kullu	5,000		1,000	
6	Parwanoo, Solan			3,000	25,500
7	Tutu Pani, Shimla		1,000		
8	Rajgarh, Sirmour		1,000		
9	Chindi, Mandi		1,000		
10	Chail Chowk, Mandi		1,000		
11	Bhuntar, Kullu		1,000		
12	Reckong Peo, Kinnaur		1,000		
13	Jabli, Solan				1,000
14	Jarol, Sundernagar				2,500
15	Delhi			4,250	
16	Mumbai			2,250	
17	Chennai			2,000	

Source: HPMC. (arranged by JICA Study Team)

(b) Food processing industry managed by private sectors

Many well known food industrial companies in private sector are setting up fruit and vegetable processing plants in Himarchal Pradesh. Details are shown on Attachment G-1.

Based on the new Industrial Policy 2004 (development of fruit based wineries and cider manufacturing), 4 private sectors are manufacturing fruit based wine and cider (shown on Table G-5.10) and proposals for the manufacturing of fruit based wines and cider etc. which were applied to the State by some numbers of the private sectors have been permitted. (shown on Table G-5.11)

Table G-5.10 Newly Established Companies to Manufacture Fruit Based Wine and Cider

No.	Name of the Units	Item of manufacture
1	Green Valley Industries Pvt. Ltd. I/A Shogi, District. Shimla	Cider
2	Minocha Industries, Shogi, District. Shimla	Cider
3	Hygia Fruit and Vegetable Processor Pvt. Ltd., Ratti, District. Mandi	Fruit wine and cider
4	Himachal Fruit Wines, Village Budu, The. Gohar, District. Mandi	Fruit wine and cider

Source: Department of Horticulture, Himachal Pradesh. "Present Status of Fruits and Vegetables Processing Industries and Available Post Harvest Infrastructure in Himachal Pradesh"

Table G-5.11 Permitted Companies to Manufacture Fruit Based Wine and Cider

No.	Name of the promoter	Proposal location	Items of manufacture
1	Golden Agro Wineries Limited, Mohalla Mehnu, Old Bus Stand, Bhatinda Punjab	Dochi in District. Solan	Fruit based Brandy, Wine and potato based Vodka
2	Green Hills Co-operative Society Ltd. Mohal District. Kullu	Mohal, District. Kullu	Fruit based Cider and Wine
3	Aarddvirk Beverages Pvt. Ltd. Henlay Cinma Complex, Near Friends colony, New Delhi.	Barotiwala in District. Solan	Ready to eat drink Milk Alcoholic Fruit based Beverages.
4	Valley Wine, Village Hat, P.O. Bajaura District. Kullu.	Bajaura in District. Kullu	Fruit based Cider and Wine
5	Bhammi Industries, 174, IA Baddi District.Solan	Baddi in District. Solan	Fruit based Cider and Wine
6	Cheryal Kumar Temptation, Mech-Loadganj, Dharamshala	Mech-Loadganj Dharamshala	Fruit based Cider and Wine
7	Himachal Indage Ltd., C/O HPMC Nigam Vihar, Shimla-2.	Pragtinagar Tehsil Kotkhai	Fruit Juice, Wine and Brandy.

Source: Department of Horticulture, Himachal Pradesh. "Present Status of Fruits and Vegetables Processing Industries and Available Post Harvest Infrastructure in Himachal Pradesh"

G-5.3 Small Scale Food Processing Industry

Compared with the fruit processing industry, vegetable processing is usually done by comparatively in small scale, such as women's groups or housewives in the villages. At present, many groups are processing and selling their own-branded fruit and vegetable processed food, such as pickles, jams, preserves, dry fruits etc.



Small scale women's agro-processing groups acting mainly in Kangra District

Usually they are trained by other parties and strengthened their manufacturing and marketing power. Followings are one part of example to contribute the enhancement of small women's groups and housewives.

(a) Indo-German Changar Eco-Development Project was executed by GTZ, Germany, during 1994 to 2006. Objective of the project is "Village groups manage their natural resources sustainably and on their own responsibility." Women's groups etc. trained and grown up by themselves continue their actions. Followings are the present situation of the acting groups.

(1) Samridhi Mahila Co-operative Society Ltd.

having their head office at V.P.O. Thakurdwara, Palampur, Kangra

- Established in 1995, and supported by *Indo-German Changar Eco-Development Project* during1997 to 1999. In 2000, they set up Co-operative organization, and started independent activity mainly processing and manufacturing of achar, chutney and jam etc.
- At present, total 25 groups are in action in 3 districts, and total member of the Co-operative is about 250 (all women members).
- Management condition (in fiscal year 2006/2007)
  -1. Final production processed: 15 tons/year
  -2. Sales volume: Rs 3,000,000
  -3. Gross profit: Rs 88,000
  -4. Income tax: Rs 12,000
  -5. Net profit: Rs 76,000
  - 50%: divide the profits among the each Co-operative member.
  - 50%: stock as the internal reserve.

(2) Vasundhara Van Utpad Producer's Co., Ltd.

having their head office at V.P.O. Bhawarna, Teh. Palampur, Kangra

- In 2000, established as the NGO named LVK (Lok Vigyan Kendra) by the support of *Indo-German Changar Eco-Development Project*, by 27 groups consists of 192 members. in 2004, set up Van Utpad Producer's Company.
- Main produces are dry amla and its powder etc., at present, 17 kinds of products are processed and sold.
- Total 13 groups are in action in Kangra district, and total member of the Co-operative is 83 (all women members).
- Management condition
  -1. Final production processed: 15 tons/year
  -2. Sales volume: Rs 306,000
  -3. Gross profit: Rs 44,000

(3) Anmol Baans Shilpkar Society

having their head office at Daroh, Palampur, Kangra

- Established in 2003 as the private organization. In 2005 set up the Society by 22members (mostly women) supported by *Indo-German Changar Eco-Development Project.* During the

project, technical instructors for bamboo craft were invited and trained members. Instructors were come from Tripura and Assam State, which is famous for highly skilled craftsmanship for bamboo crafts.

- About 30 types of the bamboo crafts are produced at members' villages, and transported to the head office. Produces are sold at exhibitions or fairs.
- Sales volume in 2007 is Rs 100,000.

(b) Himachal Pradesh Fruit Canning Unit under Horticulture Department, is operating 5 Community Fruit Processing and Training Centers. After getting the modern technology of fruit and vegetable processing, some women or women's groups have started the manufacturing and selling processed food in the neighbourhood markets.

G-5.4 Cold Storage

The importance of the cold storage industry is for enhancing the life of the fruits and vegetables for feeding the fresh market round the year. At production area, the Himachal Pradesh Horticultural Produce Marketing Corporation Ltd. (HPMC), a State Government undertaking, is operating 6 cold storages. Additionally, 4 cold Storages have also been established one at exit point at Parwanoo, Solan district and 3 in terminal markets at Delhi, Mumbai and Chennai. Details are mentioned on Table G-5.8 above. Typical cold storage facilities managed by private sectors which are recently set up are shown on Table G-5.12.

Table G-5.12 Typical Cold Storage Facilities Managed by Private Sectors

Name of the Company	Location	Capacity (tons)	Products/ activities	Employ-ment	Remarks
Adani Agrifresh Ltd.	Rohru, Kumarsain Sainj	25,000	Infrastructure for procurement , handling, storage, packing and transport of horticultural produce	185	This Company has purchased private land at Village Moha Ruwali, Tehsil Kumhairsain; Sainj, Tehsil Theog and Mehandali in Tehsil Rohru. The projects at these locations are already operational.
Dev Bhumi Cold Chain Pvt. Ltd,	Matiana, Teh. Theog	3,000	Cold storage, grading packaging line, apple juice processing plant	50	This Company has purchased private land at Village Matiana, Tehsil Theog, District. Shimla and has started land development work.

Source: Department of Horticulture, Himachal Pradesh. "Present Status of Fruits and Vegetables Processing Industries and Available Post Harvest Infrastructure in Himachal Pradesh"

G-6 Governmental Policies for Post-Harvest Processing

To accelerate the newly establishment of post-harvest processing facilities or extension of existing facilities, Central Government of India or State Government of Himachal Pradesh are carrying out many types of subsidiary policies. Typical policies are described below;

G-6.1 Scheme for Technology Upgradation/Establishment/Modernization of Food Processing Industries

(Ministry of Food Processing Industries, Government of India, and Directorate of Industry, Himachal Pradesh)

(a) Summary

The Ministry of Food Processing Industries, Government of India had been operating several plan schemes for the development of processed food sector in the country during the Ninth Plan, focusing on different segments of food processing industry, and following five schemes have been approved for implementation in the Tenth Plan.

-1. Scheme for Technology Upgradation/Establishment/Modernization of Food Processing Industries
-2. Scheme for Human Resource Development
-3. Scheme for Quality Assurance, Codex Standards and Research and Development
-4. Scheme for Strengthening of Nodal Agencies
-5. Scheme for Backward and Forward Integration and other Promotional Activities

Out of the above 5 schemes, first scheme (Scheme for Technology Upgradation/ Establishment/ Modernization of Food Processing Industries) targets to enhancement of the post-harvest processing facilities in the Country. This scheme covers following activities; as, setting up, expansion and modernization of food processing industries covering all segments, namely fruits and vegetables, milk products, meat, poultry, fishery, oil seeds and such other agri-horticultural sectors leading to value addition and shelf life enhancement.

(b) Objective

Increase the level of processing, reduce of wastage, facilitate value addition, enhance the income of farmers as well as increase exports thereby resulting in overall economic development.

(c) Eligibility and Pattern of Assistance

All implementing agencies engaged in setting up, expansion and modernization of food processing industries covering all segments would be eligible for financial assistance.

The assistance will be in the form of grant subject to 25% of the plant and machinery, and technical civil work subject to a maximum of Rs.5,000,000 in general areas and 33.33% up to Rs. 7,500,000 in difficult areas (Himachal is in difficult area).

(d) Note

Application for financial assistance duly completed should be submitted to the Ministry of Food Processing Industry through the concerned SNA (State Nodal Agency). In Himachal Pradesh, The Directorate of Industries, Government of Himachal Pradesh is nominated as SNA for this scheme.

Proposals for this scheme submitted to Ministry of Food Processing Industries are shown on Attachment G-3

G-6.2 Technology Mission for Integrated Development of Horticulture in Himachal Pradesh

(Horticulture Department, Himachal Pradesh, Centrally sponsored scheme)

(a) Summary

The development of North Eastern region examined by various commissions and committees recommended integrated development of horticulture in a mission mode to foster rapid growth of the region. Based on these recommendations, a Centrally Sponsored Scheme on "*Technology Mission for Integrated Development of Horticulture in North Eastern Region in including Sikkim*", was approved and launched from 2001-2002. Considering the potential of Horticulture for socio-economic development of Jammu and Kashmir, Himachal Pradesh and Uttaranchal, which are hilly States, Government of India decided to extend implementation of this Mission to these States from 2003 - 2004.

(b) Details

The Technology Mission has following 4 Mini Missions. Details of the 4 Mini Missions of the Scheme are mentioned below.

<u>Mini Mission -I: Technology Research and Development</u>

This mission aims to provide technological support by way of providing information on practices, nucleus planting material and skill up gradation for adoption of technology.

This Mission consists of following sub-projects;

I-1 Supply of Nucleus and Basic seed and planting material for horticulture crops:
I-2 Standardization of production and protection technologies:
I-3 Technology refinement and imparting training through on farm trials on farmer's fields and imparting training to extension functionaries:

Mini Mission -II: Enhancement of Production and Productivity

This mission aims at increasing production volume and productivity of the horticulture products in the region. The major activities of this mission are increasing production through area expansion under various horticultural crops having linkages with other missions.

This Mission consists of several kinds of sub-projects.

Mini Mission -III: Post-harvest management, marketing and export

This mission aims to create infrastructural facilities for post harvest management, marketing and export. For this purpose, existing schemes either with the existing outlays or with enhanced outlays will be implemented.

This Mission consists of following sub-projects;

III-1 Post Harvest Management
(1) Controlled Atmospheric (CA) Storage
(2) Cold Storage

III-2 Marketing

For efficient marketing, it is proposed to strengthen marketing infrastructure including; Improvement of services in wholesale markets, Development of rural primary markets, Development of Apni Mandis (kind of farmers' open markets), Promotion of Agmark (Quality standard of agricultural products) in domestic trade by strengthening the State grading laboratories and agricultural marketing information network.

In order to have forward and backward linkage in marketing, a pilot project of Alternate Marketing System is proposed under which marketing infrastructure will be developed in cooperative, private and joint sector with participation of wholesalers, retailers and farmers.

Following schemes and programs are proposed;

(1) Establishment of market infrastructure (Wholesale Markets)
(2) Market intervention
(3) Accommodation of funds
(4) Establishment of Agri-Export Zone (2 Agri-Export Zones will be established in each State)

Mini Mission -IV: Processing

This Mini Mission will be implemented by Ministry of Food Processing Industries (MFPI). Taken up programs are;

(1) Promotion of new units,
(2) Upgrading and modernization of existing units,
(3) Market promotion,
(4) Research and development (no fund required)
(5) Human resource development

G-6.3 Other Subsidy Schemes

Central Government and the Himachal Pradesh State have designated fruit, fruit and some food

processing industries as Thrust industries. The details of incentives being provided to these thrust industries are as under:-

(a) Incentives being provided by the Himachal Pradesh State to Thrust Sector Units:

-1. Exemption from the payment of VAT and other levies for a period of 10 years for new units and existing units on their substantial expansion setup and being set up in 8 tribal development blocks, 15 other backward blocks and all the backward Panchayats of the State (Tax free zone, category C area).

-2. Deferment from payment of VAT for a period of 5 years in category A blocks (industrially potential border areas of Solan and Sirmour District) and for 8 years in category B blocks (other intermediate areas).

-3. Exemption from State Electricity duty for period of 10 years in category B & C blocks.

-4. Exemption from State Excise duty for a period of 7 years for units manufacturing wine and cider in category B and C blocks.

-5. 5% subsidy on rate of interest for a period of 3 years subject to a ceiling of Rs.200,000 per annum.

(b) Incentives being provided by the Government of India to Thrust Sector Units:

-1. 100% outright excise duty exemption for a period of 10 years from the date of commencement of production.

-2. 100% income tax exemption for initial period of 5 years and thereafter 30% for companies and 25% for other than companies for a further period of 5 years from the date of commencement of production.

-3. 75% freight subsidy on the transportation of finished goods and raw materials from and to the nearest rail head on broad gauge for a period of 5 years from the date of commercial production from the Ministry of Commerce and Industries, Government of India.

-4. 33.33% investment subsidy on the investment in plant and machinery and technical civil works subject to a maximum ceiling of Rs.7,500,000 for food processing industries from the Ministry of Food Processing Industries, Government of India. Besides, the Ministry has been providing financial assistance under various other schemes like training, infrastructure development, backward and forward linkages, testing, bar-coding etc. for the promotion of Food Processing Sector under the Scheme for Technology Upgradation/Establishment /Modernization of Food Processing Industries. Details of the scheme are mentioned above.

-5. 50% investment subsidy on the investment in plant and machinery, and technical civil works subject to a maximum ceiling of Rs.40,000,000 for fruit processing industries from the Ministry of Food Processing Industries, Government of India under Mini Mission-IV of Horticulture Technology Mission. Details of the scheme are mentioned above.

G-7 Future Prospects of Post-Harvest Processing and Storage

In the field of small scale and grass-root level food processing activities in Himarchal Pradesh, training, strengthening and diffusion activities of food processing technique etc. are being sustainably executed at “Community Fruit Processing and Training Centers” operated by Himachal Pradesh Fruit Canning Unit (himcu) under Horticulture Department. By these trainings, many housewives and women’s groups have acquired the appropriate and useful techniques. And some of them have started the small scale processing and selling business by which they can get some profit.

Such regional development scheme for encouraging the food processing activities should be promoted and continued by Governmental sectors for a long time.

On the other hand, operation and management of large or medium scale of fruit and vegetable

processing plant and cold storage facilities in Himarchal Pradesh had commenced mostly by Governmental or semi-Governmental sectors, at the beginning. They are undoubtedly contributing not only for the development, diffusion and expansion of food industry, but also increasing of the farmers' income and opportunities of the employment.

However, recently, some quantity of big private farms have constructed the large scale modernized cold storages for apples in the State. They purchase fresh apples from the farmers directly, and store them in their own cold storages, and transport and sell them according to the market prices in the big consuming area. Most of their storage and marketing business seems to be going smoothly.

In recent years, private sectors have also started to access into the fruit and vegetable processing field, especially after many subsidy schemes have been enforced by the Government, many private companies plan to establish food processing plant or fruit wine breweries etc.

After establishment of the foundation of the processing industries by the Governmental sector and they have been well under the way, it is to be desired and appropriate that those industries are to be replaced to the private sectors. By using ample fund of the private sectors, the large and middle scale food processing industry will be grown up and developed certainly, and consequently, the farmers' income or employment opportunities of the processing factories will be increased.

G-8 Constraints and Countermeasures

After establishment of the foundation of the processing industries by the Governmental sector and they have been well under the way, it is to be desired and appropriate that those industries are to be replaced to the private sectors. By using ample fund of the private sectors, the large and middle scale food processing industry will be grown up and developed certainly, and consequently, the farmers' income or employment opportunities of the processing factories will be increased.

Table G-8.1 shows relationship among current situation, constraints, and countermeasures.

Table G-8.1 Constraints and Countermeasures for Post-Harvest Activities

Present Conditions	Constraints	Future Strategy & Measures
1. Major vegetables are perishable. So farmers are facing that part of vegetables are wasted and higher post-harvest and transportation loss, due to shortage of containers and farm roads	i. High vegetable demand in Delhi metropolitan & surrounding states, especially in the off-season ii. Increase of exotic vegetable demands because of increase of middle class people in Delhi metropolitan & urban area	1.1 Promotion of small scale cottage industry on agro-processing 1.2 Introduction of PPP for Promotion of small scale cottage industry on agro-processing
2. Price of unsorted and low graded vegetables could be lower.	iii. There is a regular demand in the markets of the surrounding areas. iv. Private retailers start to buy directly from farmers because of deregulation and provide quality guidance to farmers	2.1 Promotion of containers 2.2 Promotion of organizing farmers 2.3 Arrangement of space for activities on sorting, grading, packing, and storing
3. There are no standard on sorting, grading, and packing for vegetables		3.1 Establishment of quality standard 3.2 Promotion of quality standard, which were established

G-9 Post-Harvest Processing and Storage Promotion

G-9.1 Post-Harvest Processing and Storage Promotion for the Master Plan

After establishment of the foundation of the processing industries by the Governmental sector and they have been well under the way, it is to be desired and appropriate that those industries are to be replaced to the private sectors. By using ample fund of the private sectors, the large and middle scale food processing industry will be grown up and developed certainly, and consequently, the farmers' income or employment opportunities of the processing factories will be increased.

Post-harvest activities such as grading, sorting and packing etc., and agro-processing activities in Himachal Pradesh can be divided roughly into three categories according to their processing scale.

a. Large scale agro-processing on plant basis,
b. Small scale agro-processing on farm family or group basis, and
c. Post-harvest activities by farmers or farmer's groups

Category (a) : Large Scale Agro-processing

These are the large scale activities carried out by governmental, semi-governmental and large private companies. Recently, private enterprises invested in agro-processing and are expanding their businesses in the state as mentioned in Section G-5.1. The role of the state government in agro-processing sector has been gradually shifting from direct operation of the processing plants to the creation investor-friendly environment to encourage the private sectors in investing their capitals in agro-processing. The following points are recommended to accelerate investment by large scale private agro-processing and cold storage sectors;

1) Development of industrial estates for agro-processing by providing basic infrastructures such as road, electricity and water supply
2) Provision of preferential tax regime and special financing system with low interest; and
3) Improvement and maintenance of main truck roads to prevent or minimize losses during transportation from production area to processing plant

These measures seem to be effective in order to invite private processing sectors to the State,

Category (b) : Small Scale Agro-processing

Small scale agro-processing activities are usually carried out by women's groups producing simple products like pickles, chutney, jam and dried fruits from local produces. Subsequently, supplemental income is generated from product sales.

In order to promote small scale agro-processing business, the following points are to be considered;

1) Organization of small scale processing groups under coordination by the extension officers;
2) Dissemination of processing technology to the groups; and
3) Supply of simple equipment and instruments required for small scale agro-processing.

The process to support small scale agro-processing is given in Fig. G-9.1 and explained below;

1) Agricultural Extension Officer should organize farmers' or women's group who wants to commence the small scale agro-processing, and instruct them to issue the application letter to DOA (Department of Agriculture) through Block Officer and District Officer. On application letter, following matters should be mentioned;
   - Name and address of representative of the group and all members.

- Commitment to participate in the agro-processing group from all members with signature.
- Place and its area to be expected to use for the training camp and future activities of agro-processing
- Expected place for the training camp and future activities of agro-processing is individual house, community center of the village or same other suitable location.
- What kind of agro-processing, the group wants to do? and from where the materials will be provided? etc.

2) DOA evaluates the application letter. After approval of the application, the DOA will deploy appropriate trainers to group, while DOA sends simple instruments to the group.

3) By using supplied equipments and instruments, dispatched trainer executes training camp for the group members at community center in the village or member's house.

4) Each training camp will be held for some aggressive farmers' groups each block for one day.

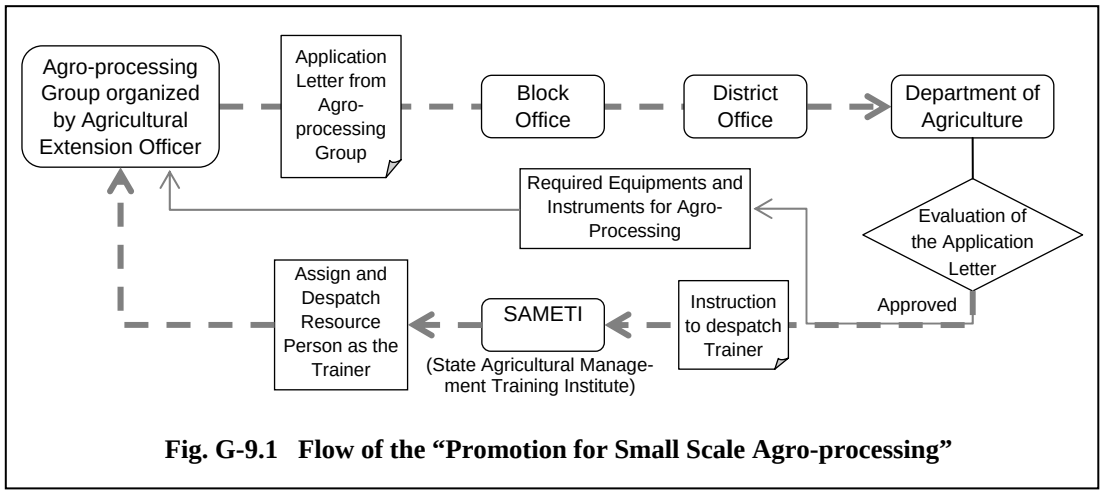

Fig. G-9.1 Flow of the "Promotion for Small Scale Agro-processing"

Category (c) : Post Harvest Activities

Post-harvest activities are usually carried out for grading, sorting and packing at the farm gate, collection center or market yard. At present, sorting and grading work are carried out according to the local practices without standardized specifications. The following points are taken into account for the promotion of post harvest processing in the state:

1) Preparation and dissemination of quality standards for agricultural and horticultural produces;

2) Promotion of post harvest activities to farmers especially in grading, sorting and packing.

3) Orientation of farmers and farmers' group on the use and operation of scales, rules and sugar content measuring instruments required for sorting and grading; and

4) Provision of financial support for the procurement of vehicles and other equipment with minimum interest and preferential tax for depreciation by the government instead of private commercial banks.

In order to improve post harvest and processing activities, Public Private Partnership (P.P.P) will be effective for their activation. Introduction and promotion of P.P.P are proposed.

This program focuses on farmer's small agro-processing and post-harvest activities. The target, outputs, executing organization and proposed activities of this component are listed below:

Table G-9.1 Outline of Post Harvest Processing Promotion

Item	Outline of Component for Farmer's Post-harvest & Small Scale Agro-processing
Target	1. Post-harvest activities will be improved for value addition of agricultural produces. 2. Small scale agro-processing will be promoted for value addition of agricultural produces.
Outputs	1. More farmers will practice post-harvest activities. 2. Farmers' group (especially women's groups) will be involved in small scale agro-processing activities.
Activities	1. Introduction and promotion of post-harvest activities such as grading, sorting and packing etc., in accordance with the quality standard through training activities. 2. Introduction or promotion of small scale agro-processing activities 3. Introduction and promotion of PPP for contract farming and direct purchase 4. Organizing or strengthening of farmers' groups (marketing group)
Related Components	Vegetable Cultivation, Integrated Farm Management
Execution Organization	Execution: Department of Agriculture / Himachal Pradesh State Agriculture Marketing Board / District & Block Agriculture Offices Supporting: Department of Horticulture / HPMC

The proposed master plan related to each activity is mentioned below.

Table G-9.2 Proposed Master Plan of Post Harvest Processing Promotion

Activity /Subjects	Target	Executed by	Type / Venue	Schedule
(1) Capacity development - Introduction or promotion of grading, sorting and packing etc.	- Extension Officers	DOA with MB	Workshop at DOA	First 2 years
(2) Workshop on market promotion	- APMC staff - CAs - Traders - Farmers	MB/ APMC with District Office	Awareness camp at each APMC	4 years
(3) Introduction and promotion of PPP for contract farming and direct purchase	- Farmers - Retailers / other stakeholders	Marketing Board	Awareness camp at each APMC	3 years
(4) Introduction or promotion of small scale agro-processing activities.	- Farmers' groups	DOA with District and APMC	Awareness camp at each district	4 years
(5) Organizing or strengthening of farmers' groups - executing with program for vegetable promotion	- Farmers	District Office with APMC		Depending on the schedule of project implementation

G-9.2 Post-Harvest Processing and Storage Promotion for the Action Plan

The A/P related to each activity of post harvest promotion plan, including its requirements is mentioned below.

Table G-9.3 Proposed Action Plan of Post Harvest Processing Promotion

Activity	Subjects	Target	Executed by	Remarks
(1) Capacity development	- Introduction or promotion of post-harvest activities such as grading, sorting and packing etc.	- Staff of Marketing Board - Staff of DOA - Staff of District office	DOA with MB by external experts	(1) This activity is included in capacity development for strengthening of department of agriculture (Attachment E-1)
(2) Workshop on market promotion	- Dissemination of quality vegetables - Dissemination of quality standard - Dissemination of proposed post-harvest activities - Dissemination of market information system - To collect brand name or trade mark from the public - Registration of brand name or trademark	- APMC staff - CA - Traders - Farmers	MB / APMC - District staff - MB staff	(1) executed with workshop for market system improvement (2) Progress of preparation of quality standard should be reported.
(3) Introduction and promotion of PPP for contract farming and direct purchase	- Dissemination of policy of state and district for PPP - Arrangement of opportunity for introduction between stakeholders and farmers	- Farmers - Retailers / other stakeholders	Marketing Board	(1) Each APMC shall arrange introduction meeting between farmers and retailers / other stakeholders once a year for three years. (2) see Attachment G-4 regarding implementation cost
(4) Introduction or promotion of small scale agro-processing activities.	- To organize small scale agro-processing groups in cooperation with the Agricultural Extension Officers - To disseminate agro-processing technology to the groups - Supply of 65 sets of simple equipments and instruments required for agro- processing to 65 groups mainly in zone 1 to 3.	- Farmers' groups	DOA with District and APMC	(1) executed by third party (2) 2times of this activities shall be carried out per block. (2 times per 1 group in 1 block) (3) see Attachment G-4 regarding implementation cost
(5) Organizing or strengthening of farmers' groups	- To organize farmers' groups for implementing effective activities on extension, marketing and post-harvesting	- Farmers' groups	District Office with APMC	(1) executing with program for vegetable promotion

G-9.3 Provisional Schedule for Program Implementation

Implementation schedule was prepared as shown in Fig. G-9.2 of Implementation Schedule, considering category-wise characteristics.

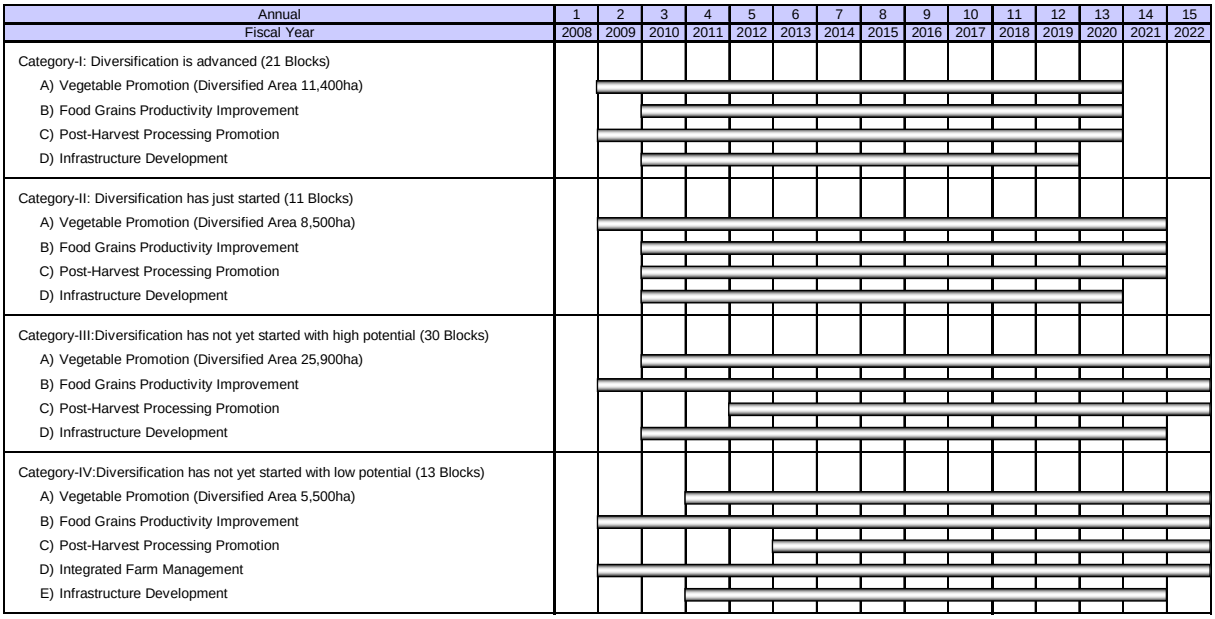

Fig. G-9.2 Implementation Schedule

G-9.4 Preliminary Cost Estimate

(1) Preliminary Cost Estimate for Each Program by Category

As shown in Table G-9.3, dissemination program on introduction and promotion of PPP for contract farming and direct farming could be one of the major training activities for farmers, which will be controlled by Marketing Board and APMC. Meanwhile promotion activity on small scale agro-industry is also arranged twice a block. Those cost estimates are shown in Attachment G-4 and summarized as follows:

Table G-9.4 Cost Estimate for Post Harvest Processing Promotion

(Unit: Rs.)

	1st Year	2nd Year	3rd Year	Total
Introduction and promotion of PPP	140,000	140,000	140,000	420,000
Promotion of small scale agro-industry	12,000 Rs./time, Two times per block			

Remarks) refer Attachments G-4 for details

(2) Cost Disbursement

Cost disbursement is estimated, applying the following conditions:

(i) This training program continues for three years.

(ii) This program will be managed by APMC under supervision of Marketing Board.

(iv) It is assumed that this program will be proceeded from 1st year.

Table G-9.5 Cost Disbursement by Program

(Unit: Rs. million)

Programs	2009	2010	2011	2012	Total
Introduction and Promotion of PPP	0.14	0.14	0.14	-	0.42
Promotion of small scale agro-industry	0.576	0.576	0.576	0.072	1.8

Attachment G-1 Details of Vegetables and Fruits Processing Plants of Each District

(Note: I/A in Address means Industrial Area)

No.	Name of the Plant	Address	Year of establishment	Products Trade mark	Capacity (tons/year)
District Bilaspur					
1	Himachal Pradesh Fruit Canning Unit	I/A, Nihal, Bilaspur	1980	himcu	100
2	Shashi Gramodyog Institution	I/A, Nihal, Bilaspur	1979		20
District Chamba					
3	Himachal Pickling	I/A, Sultanpur, Chamba	1999		50
4	Himachal Pradesh Fruit Canning Unit	Rajpura, Chamba	1968	himcu	100
5	Sago Food Industries	Sultanpur, Chamba	1996	Sago	57
6	Shakti Prasad Pickle Udyog	Village Sarol, Chamba	1996		20
7	Pooja Pickle	Chamba			10
8	Valey Food Products	I/A, Sultanpur, Chamba	1989		120
9	The Chamba District Fruit Growers Industrial Cooperative Society Ltd.	Sultanpur, Chamba			300
10	Arti Food Industry	Chamba			50
District Hamirpur					
11	Himachal Mahila Grih Udyog	Village Tibi, Kuthera, Hamirpur	1996		96
12	R. S. Food Product	Village Bhud, Kuthera, Hamirpur	1996		80
13	Himpro Food Pvt. Ltd.	Village Nakhner Souran, Kuthera, Hamirpur			100
District Kangra					
14	Himachal Pradesh Fruit Canning Unit	Hatwas, Nagrota Bagwan, Kangra	1977	himcu	200
15	Fruit & Flower Society of Himachal	Sungal, Tea Estate, Palampur, Kangra	1996	springs	100
16	Ganesh Fruits & Vegetable Products	I/A, Sansapur Terrace, Kangra	1998		50
17	The Kangra Pickle Unit	Village Atwas, Kangra	1997		8
18	Samridhi Mahila Cooperative Society Ltd.	Thakurdwara, Morinda, Palampur, Kangra	2001		25
19	Seneh Food	Dagli, Dharamsala, Kangra	2001		10
20	Tarsem Airary	Surajkund Road, Shila Bhawan, Kangra	1992		10
21	Vitamin Food	Village Ghanwi, Panhara, Nurpur, Kangra	1993		25
22	Pure Foods	Mallan, Kangra			21
23	Honey Processing Unit	Kandrori, Kangra			120
District Kinnaur					
24	Himachal Pradesh Fruit Canning Unit	Reckong Peo, Kinnaur	1982	himcu	100
District Kullu					
25	Himachal Pradesh Fruit Canning Unit	Shamshi, Kullu	1981	himcu	200
26	Himachal Gramodyog Kendra	Village Mohal, Kullu	1979		
27	Hill Thrill Juice Factory	Kullu, Kullu	1994		2.5
28	Himachal Honey House	Village Mohal, Kullu	1995	Asli	2
29	Lahoul Potato Society Fruit Processing Unit	Village Raison, Kullu	1999		5
30	Snow Fruit Processing Society	Village Snag, Manali, Kullu	1985		50

District Mandi					
31	Hygia Food & Vegetable Processor Pvt. Ltd.	I/A, Ratti, Mandi	1997		34
32	Himachal Agro Processor Pvt. Ltd.	I/A, Bhambla, Mandi	2000		30
33	Pushpa Pickle	I/A, Bhambla, Mandi			20
34	Himachal Fruit Wine Beverages Pvt. Ltd.	Badhu, Mandi			100
35	Surya-Gramoudyog Fruit Processing	Jarol, Sundernagar, Mandi			
36	Society for Technology & Development	Village Taldhar, Nagwain, Mandi	1994		50
37	Himachal Juice Udyog Association	Balli Chowk, Mandi	1994		40
38	Fruit Processing Plant, hpmc	Jarol, Mandi	1974	hpmc	2,500
District Shimla					
39	Himachal Pradesh Fruit Canning Unit	Naubahar, Shimla	1958	himcu	200
40	Minocha Industries	Shoghi		Minchys	100
41	Fruit Processing & Training Center (A Unit of HPC)			Hill Top	25
42	Shivalik Foods & Beverage	Mashobra, Shimla		Shivaliks	25
43	Tripti Food Products	Shimla		Tripti	20
44	New White Gate Fruit Products	Naubahar, Shimla	1996	White Gate	150
45	Green Valley Cider Pvt. Ltd.	Shoghi, Shimla			
District Sirmour					
46	Himachal Pradesh Fruit Canning Unit (now functioning under HPMC)	Bagthan, Sirmour	1969	himcu	100
47	Himachal Pradesh Fruit Canning Unit	Rajgarh, Sirmour	1968	himcu	100
48	Himachal Pradesh Fruit Canning Unit	Dhaulakuan, Sirmour	1964	himcu	200
49	Himachal Food Products	Paonta Sahib, Sirmour	1989		1,240
50	Mahan Dairies Ltd. (Fruit & Vegetable Div.)	Village Kunja, Poanta Sahib, Sirmour	1992		1,200
51	Nobel Agro Food Pvt.	Suketi Road, Kala Amb, Sirmour	1997		1,800
52	Bhuria Jams	Village Bhuria, Rajgarh, Sirmour	1999	Bhuria	15
53	Rajgarh Canneries	Village Bhuria, Rajgarh, Sirmour	1999		30
54	Himalaya International Ltd.	Village Shaubhhera, Paonta Sahib, Sirmour	1996		8,600
55	Rajgarh Cooperative Canneries Ltd.	Village Hanoli, Haban Road, Rajgarh, Sirmour	1996	Shauga	25
56	Richpro Foods	Village Santokgarh, Paonta Sahib, Sirmour	2001		25
57	Himachal Health Care Food Processing Society	Paneli, Rajgarh			1,500
58	Green Valley Industries	Kala Amb, Sirmour			2,000
District Solan					
59	Chambaghat Mushroom Growers Gramodyog Association	Village Basal, Mamlig, Teh. Kandaghat, Solan	1990		30
60	Thakur Fruit & Vegetable Processing Unit	Chambaghat, Solan	1994		20
61	Quality Food Product	Shed No.11, Industrial Estate, Dharampur, Solan	1997		250
62	Syen Food Products	Block No.11-B-1, Sector-6, Parwanoo, Solan	1997		1,487
63	Ruchi Agro Food Processing Industry	Plot No.21, I/A, Baddi, Solan	1998		125
64	Renu Foods	Plot No.95, I/A, Baddi, Solan	1998		80
65	J.K. Industry	Plot No.28, I/A, Baddi, Solan	1998		70
67	Himland Agro Foods Ltd.	Plot No.193, I/A, Baddi, Solan	1998		1,490
68	Himalayan Vege Fruit Ltd.	Koti, Solan	1995		10,000
69	Fruit Processing Plant, hpmc	Parwanoo, Solan		hpmc	25,500
70	Fruit Processing Plant, hpmc	Jabli, Solan		hpmc	1,000
71	Revens Fruit Products	Plot No.19, Sector-II, Parwanoo			100
72	Soland Food Products				2
73	Laxmi Canners Power House				5
74	Hops Processing Unit	Baddi, Solan			250

District Una					
75	Shivambu Intrenational	Mahesh Nagar, Oel, Una	1994	BDM	15,000
76	Trivani Food Products	Mohalla, Gursar, Una	1995		2,160
77	Himgiri Food Products	Una	1993		2,160
78	Channe Foods	Semeer Khurd, Una	2001		50
79	Kashmiri Food Products	Una	1995		1,550
81	Koshal Enterprises	I/A, Mihatpur, Una			2,160
82	Ambota Foods	Ambota, Amb, Una			600

Source: Department of Horticulture, Himachal Pradesh. "Present Status of Fruits and Vegetables Processing Industries and Available Post Harvest Infrastructure in Himachal Pradesh"

Attachment G-2 New Food Processing Plants being Setup in the State

No.	Name of the Plant / Project	Location of the plant	Items to be manufactured	Annual Capacity (tons)	Planed	
					Invest-ment (Rs. mill.)	Employ-ment
A. Fruits and Vegetables Processing						
1	M/s Nu-Tech (India) Agro Food Pvt. Ltd.	I/A, Kala Amb Sirmaur District	Frozen fruits and vegetables. Canned dehydrated fruits and vegetables	2,200	40	64
2	M/s PHF Food Ltd.	932 GT Road Jalandhar Kala Amb Sirmaur District	Fruit and vegetable processing	300		
3	M/s Himachal Indage Ltd. c/o HPMC Nigam Vihar, Shimla-2	Pragti nagar, Shimla District	Fruits based wine, brandy and juices		250	102
4	M/s Manali Food Products (Unit-3)	Plot No.1-2 I. A, Shamshi, Kullu District	Dehydrate Fruits and vegetables	36,600	23.5	45
5	M/s Ambrogia Food Products (Export Division) SCO68-70, Sukh Chambers Sector I7-A, Chandigarh	Baddi Solan District	Ready to eat Canned food.		27.9	100
B. Medical Herbs and Aromatic Herbs Processing						
6	Mayur India Ltd. Mayur Tower, 12 Yamuna Marg, Civil Lines, Ner Delhi	Baddi Solan District	Ayurvadic/herbal products		120	90
C. Food Items						
7	M/s Dunn Foods Pvt. Ltd. 8-A/Model Town, Patiala	Baddi Solan District	Biscuits of various kind		40.3	92
8	M/s Cadbury India Ltd. 19, Bhwlabhai Desai Road, Mumbai	Baddi Solan District	Food Products (Coco based food, Malt based food and wafers)	7,000	150	90
9	M/s Crimica Agro Food Ltd. Bxxx II-324, G.T.Road (W) Jalandhar Bye Pass, Ludhiana	Tahliwala, Una District	Biscuit	24,000	77.3	105
10	M/s Legacy Foods Pvt. Ltd. C-48, Kailash Apartments, Kailash Colony, New Delhi	Baddi Solan District	Malted Food		30	350
11	M/s Bagrrys India Ltd.	Plot No.154 HPSIDC I/A, Baddi, Solan District	Breakfast Food Muesli, Corn Flakes, Ready to eat breakfast cereals		426.5	17

Source: Department of Industry, Himachal Pradesh "Processing Industry in Himachal Pradesh, 2003)

Attachment G-3 Proposal List for Ministry of Food Processing Industries under "Scheme for Technology Upgradation/Establishment /Modernization of Food Processing Industries"

(as on 26 Dec., 2007 : List of Himachal Pradesh State only)

Application	Applicant	Received	Sector	Status
355	Green Valley Foods Ltd	8/14/2000	Fruit And Vegetable	Approved By Pac/File
394	Green Valley Frozen Foods Ltd.	9/3/2001	Fruit And Vegetable	Release Full
446	Aromatrix Flora Pvt. Ltd.	6/4/2001	Fruit And Vegetable	Release Full
821	A.B Foods	12/31/2001	Fruit And Vegetable	Approved By Pac/File
965	Hygia Fruit Veg Processors	11/3/2002	Fruit And Vegetable	Release Full
998	Manikaran Roller Flour Mills (P) Ltd	3/28/2002	Flour Milling	Release Full
1152	Hpaic Shimla	8/16/1998	Fruit And Vegetable	Release Full
1160	Inka Food Pvt. Ltd.	7/6/1997	Fruit And Vegetable	Release Full
1171	Mahaan Dairies Ltd.	5/4/1998	Fruit And Vegetable	Release Full
1268	Himachal Agro Expo Ltd.	7/2/1998	Fruit And Vegetable	Release Part
1307	Himachal Pradesh Centre For Entrepreneurship	9/2/1999	Study And Ic	Approved By Pac/File
1402	Cpri	7/10/1999	Study And Ic	Approved By Pac/File
1458	Hpced	4/4/2000	Study And Ic	Approved By Pac/File
1496	Aromatrix Flora P. Ltd.	2/5/1999	Fruit And Vegetable	Release Full
1776	Directorate Of Industries	2/21/2000	Fruit And Vegetable	Approved By Pac/File
1825	World Environment Foundation	3/19/2001	Study And Ic	Approved By Pac/File
1903	Central Potato Research Institute, Shimla	1/4/2001	R And D	Approved By Pac/File
2027	Maharani Mushroom Farms (India)	7/1/2002	Fruit And Vegetable	Release Part
2903	Directorate Of Industries	4/4/2003	Hrd	Approved By Pac/File
3091	Sungal Agri Export Corporation	5/1/2003	Fruit And Vegetable	Release Full
3099	B.B.N. Foods	5/2/2003	Fruit And Vegetable	Approved By Pac/File
3142	Shivambu International Unit	5/8/2003	Fruit And Vegetable	Approved By Pac/File
3344	Himachal Consultancy	5/29/2003	Hrd	Approved By Pac/File
3535	Klarion Pet-N-Polyments	7/15/2003	Fruit And Vegetable	Release Full
3985	M/S Rkm Food Products	12/8/2003	Fruit And Vegetable	Release Part
4062	Kbm Food Products	12/30/2003	Fruit And Vegetable	Approved By Pac/File
4204	Inka Foods Pvt. Ltd	2/19/2004	Fruit And Vegetable	Release Part
4290	Cremica Agro Foods Ltd	3/22/2004	Bakery Products	Release Part
4406	Dunn Foods (P) Ltd	4/26/2004	Bakery Products	Approved By Pac/File
4658	World Environment Foundation	3/20/2004	Study And Ic	Approved By Pac/File
4788	Shashi Gramoudhyog	6/21/2004	Fruit And Vegetable	Approved By Pac/File
4818	Himalya International Ltd.	7/5/2004	Fruit And Vegetable	Pending With Officer
4976	Kullu Valley Mineral Water Co.	5/19/2003	Consumer Industries	Approved By Pac/File
5004	Phd Chamber Of Commerce And Insutry	8/25/2004	Study And Ic	Pending With Officer
5022	Green Valley Cider Pvt. Ltd.	9/3/2004	Fruit And Vegetable	Pending With Officer
5128	Mango Dairies Pvt. Ltd.	10/21/2004	Milk And Dairy Product	Release Full
5132	Jai Chamunda Food Processing Association	11/1/2004	Fruit And Vegetable	Pending With Officer
5249	Himachal Consultancy Organisation Ltd.	12/22/2004	Hrd	Approved By Pac/File
5292	Natraj (India) Agri Processor Pvt. Ltd.	1/12/2005	Fruit And Vegetable	Release Full
5408	Shakti Impex	3/21/2005	Fruit And Vegetable	Release Full
5409	Institute Of Applied Systems & Rural Development (Iasrd)	3/17/2005	Fruit And Vegetable	Pending With Officer
5413	Shivalik Milk Plant	3/22/2005	Milk And Dairy Product	Release Part
5553	M/S K.P.U. Food Products	6/3/2005	Fruit And Vegetable	Release Part
5571	Himachal Plywood Private Limited	6/10/2005	Fruit And Vegetable	Release Full
5667	M/S Klarion Pet-N-Polymers,	5/7/2005	R And D	Release Full

5824	M/S Ambota Gramudyog Vikas Sanstha	9/22/2005	Fruit And Vegetable	Release Full
5844	M/S V.B. Agro Foods Pvt. Ltd.	12/14/2005	Fruit And Vegetable	Pending With Officer
5846	Himachal Consultancy Organization Ltd.	9/30/2005	Hrd	Approved By Pac/File
5856	M/S Tarsem Foods	10/5/2005	Fruit And Vegetable	Release Part
5915	Institute For Development Studies	11/14/2005	Hrd	Pending With Officer
6001	M/S Murliwala Agrotech	12/29/2005	Consumer Industries	Release Part
6058	M/S Marwah Bakers & Confectioners	2/3/2006	Consumer Industries	Pending With Officer
6083	M/S Legacy Foods Pvt. Ltd.	1/24/2006	Consumer Industries	Complete
6176	M/S R.K.M. Foods	3/22/2006	Consumer Industries	Pending With Officer
6179	M/S H.K. Industries	3/27/2006	Fruit And Vegetable	Complete
6253	M/S Anand Foods	4/24/2006	Milk And Dairy Product	Approved By Pac/File
6261	M/S Star Bakewell Industries	3/29/2006	Consumer Industries	Complete
6276	M/S Oswal Industries	4/24/2006	Bakery Products	Pending With Officer
6306	M/S Devyani Food Industries Pvt Ltd	3/31/2006	Milk And Dairy Product	Pending With Officer
6435	M/S Kangra Herbs Pvt. Ltd.	6/23/2006	Fruit And Vegetable	Pending With Officer
6482	M/S Devyani Food Industries Pvt. Ltd.	8/8/2006	Milk And Dairy Product	Approved By Pac/File
6488	M/S Bbn Foods High Tech Processing Pvt.Ltd.	8/7/2006	Consumer Industries	Pending With Officer
6603	Small Industries Services Institute	10/3/2006	Fruit And Vegetable	Release Full
6677	Disha	11/28/2006	Fruit And Vegetable	Pending With Officer
6704	Dr. Yashwant Singh Parmar Univ. Of Hort. & Forestry	4/6/2005	Hrd	Release Part
6782	M/S Hamirpur Supplement Foods	1/15/2007	Fruit And Vegetable	Pending With Officer
6902	M/S Megaa Bakers (P) Ltd,	3/12/2007	Bakery Products	Pending With Officer
7032	M/S Solan Food Products Pvt.Ltd.	4/11/2007	Fruit And Vegetable	Pending With Officer
7034	M/S Bagrrys India Limited	3/30/2007	Consumer Industries	Pending With Officer
7171	Himachal Consultancy Organization Ltd	6/8/2007	Hrd	Pending With Officer
7327	Institute Of Himalayan Bioresource Technology	8/23/2007	R And D	Pending With Officer
7397	M/S Hind Sewa Sangathan	10/1/2007	Hrd	Pending With Officer
7427	M/S Devbhumi Cold Chain Pvt. Ltd.	9/18/2007	Fruit And Vegetable	Pending With Officer

Source: Ministry of Food Processing Industry, Central Government of India, "Scheme for Technology Upgradation/ Establishment/ Modernization of Food Processing Industry" (from Home Page : http://mofpi.nic.in/technologies/index.htm)

Attachment G-4 Cost Breakdown for Promotion of Post-Harvest Processing

(1) Introduction and Promotion of PPP

Items	Unit Cost (Rs.)	Q'ty	Amount (Rs.)	Remarks
One-day workshop				
a. Preparatory work	100	1 staff x 3 days	300	
b. Meeting cost	50	60 persons x 1 days	3,000	for farmers and investors
c. Transportation	100	30 persons x 2 days	6,000	for farmers
d. Materials	LS		5,000	
Total			14,300	
		per one APMC	(14,000)	
		for 10 APMCs	140,000	for 1 year

(2) Introduction or promotion of small scale agro-processing activities

Items	Unit Cost (Rs.)	Q'ty	Amount (Rs.)	Remarks
One-day workshop				
a. Trainer	3000	1 trainer x 3 days	9,000	
b. Meeting cost	100	30 farmers x 1 time	3,000	
c. Transportation	100	30 persons x 1 day	3,000	
d. Materials	LS		6,000	small gadget for each group
Total			12,000	
			(12,000)	

ANNEX-H

Infrastructure

THE STUDY ON DIVERSIFIED AGRICULTURE FOR ENHANCED FARM INCOME IN THE STATE OF HIMACHAL PRADESH

FINAL REPORT

ANNEX-H
INFRASTRUCTURE

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ANNEX-H INFRASTRUCTURE

H-1 Present Conditions of Infrastructure

H-1.1 Natural Conditions

(1) Geography and River System

Himachal Pradesh (the State) lies between 30°22'40'' and 33°12'20''north latitude and 75°45'55'' and 79°04'20'' east longitude. As it extends over a wholly mountainous region in the lap of Himalayas, its altitude ranges from 350 m to 6,975 m above mean sea level. Higher Himalayan reaches more than 4,000 m above mean sea level comprising of Pir Panjal, Dhuladhar, Zanskar and Great Himalayan ranges as illustrated in Fig. H-1.1. The geographical area of the State is 55,673 km² in total. The Himachal Pradesh State borders on the Jammu and Kashmir State in the north to northwest, Tibet in the east, the Uttarakhand State in the southeast, the Haryana State in south and the Punjab State in the southwest to west.

It has certain water resources from five major river systems mostly originating in glaciers. These river basins cover around 90% of the geographical area as shown in Fig. H-1.2. Of these, the Chenab, the Beas and the Ravi originate from and flow through the State, covering 27,057 km² in total. The Satluj with its origin in Tibet goes across the State and forms the largest catchment area of 17,092 km² in the State. The Yamuna flows along the south-eastern border of the State and its catchment area is 5,901 km² within the State. The surface water resources of these river systems are perennial, originating from glaciers, and their flows are further augmented by run-off from the downstream catchments. Size of most glaciers are small with lengths of 2 ~ 25 km and accumulation zone of 2 ~ 4 km². Due to the adverse effect of global warming phenomenon, a constant recession phenomenon is recently hastening in these glaciers. There exist a number of natural lakes in the State, and the major ones are Manimahesh, Khajiar, Chandratal, Surajtal, Rawalsar, Prashel and Kamrunag lakes

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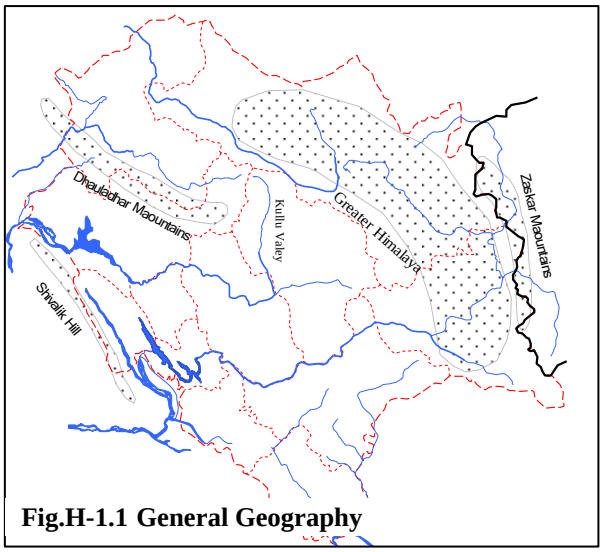


Fig.H-1.1 General Geography

Source : JICA Study Team

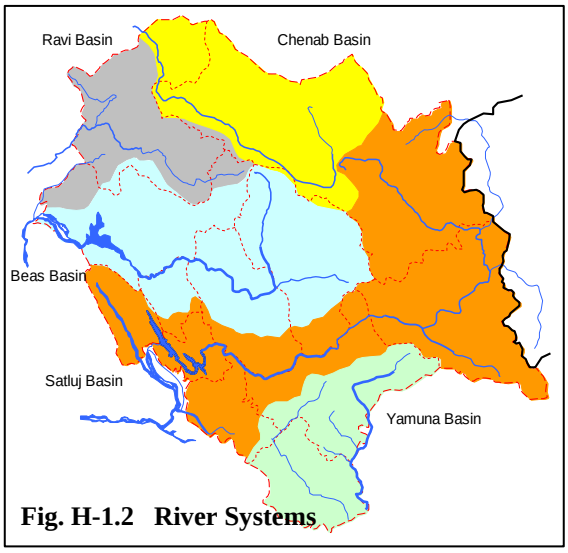


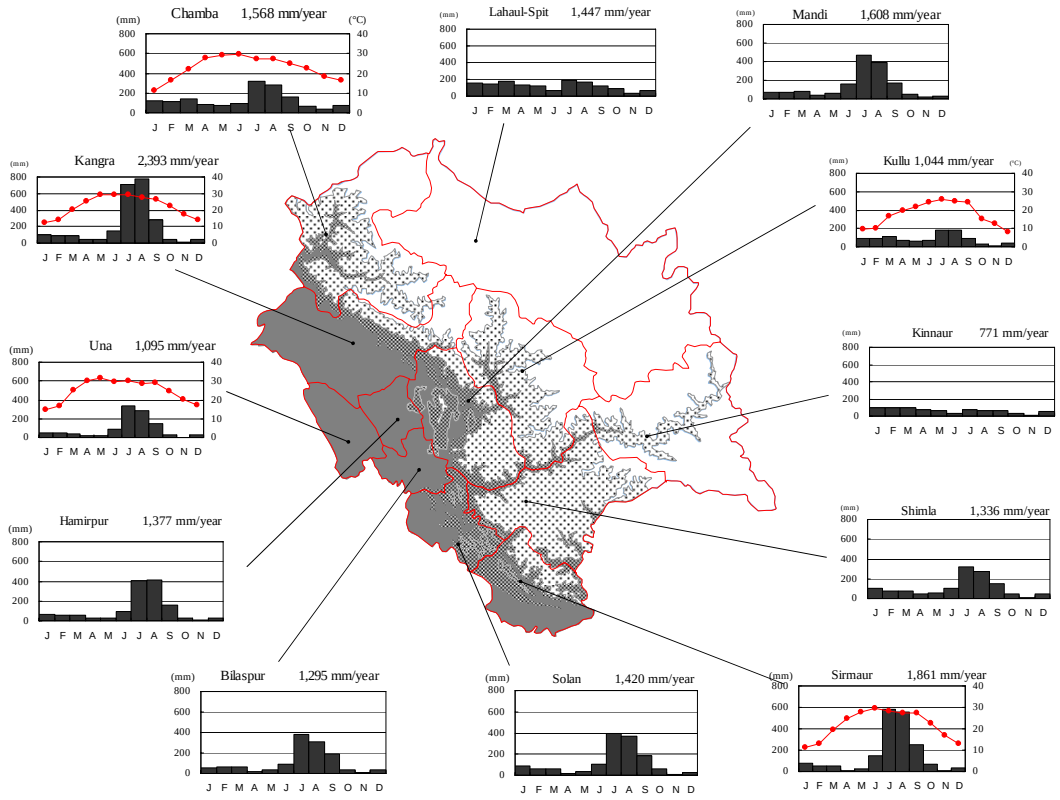
Fig. H-1.2 River Systems

Source : JICA Study Team

(2) Climate

Due to wide range of the altitude, the climate of the State varies from sub-humid tropical (EL.350 ~ 1,000 m) in the southern low tracts, warm and temperate (EL.1,001 ~ 1,500 m), cool and temperate (EL.1,501 ~ 2,500 m), and cold alpine and glacial (EL.2,501 ~ 6,975 m) in the northern and eastern mountain ranges. In the State, three seasons are found throughout the year such as cold season (October to February), hot season (March to June) and rainy season (July to September).

In the State, daily rainfall data are collected from 55 meteorological stations and temperature data from 27 stations. The average annual rainfall of 55 stations ranges from 332 to 2,606 mm. Besides less rainfall during summer, the cold alpine and glacial areas have very heavy precipitation in the form of snow during winter. It snows during winter down to an elevation of about 1,500 m. At elevations of about 3000 m, the average annual snowfall is about 3 m, while above 4,500 m there is almost perpetual snow for four months from December to March. The range of maximum and minimum temperature is between 20.4°C and 0.5°C at the highest location among 27 stations, and 14.4°C and 28.6°C at the lowest site. Average monthly rainfall and monthly mean temperature in representative stations is summarized in Fig. H-1.3.



Source : JICA Study Team

Fig. H-1.3 Rainfall and Temperature Patterns in Representative Stations in Himachal Pradesh

(3) Agro-ecological Zone

The State is categorized by agro-ecological conditions into 4 major zones and 9 sub-zones based on altitude and annual rainfall. The agro-ecological zoning criteria, agro-ecological zone distribution map and their specific features are mentioned in Annex - B.

(4) Geology and Soils

The State is the most complicated geological regions in Himalaya. From the geological point of view, the State falls into four major zones. These are outer- or sub-Himalayan zone consisting mainly of tertiary formations, lowest Himalayan range mainly composed of granite and other crystalline rocks, high Himalayan zone represented by granite rocks lacking fossils, and Tibetan or Tethys Himalayan zone comprising the wide basin covering the Spiti valley.

The soils of the State vary from deep and rich alluvial soil of valleys to thin and bear soil or snow-covered soil of high mountains. These are broadly classified into nine groups based on development process, and physical and chemical features. These are: a) alluvial soils; b) brown hill soils; c) non-calcic brown soils; d) brown forest soils; e) grey wooded or brown podzolic soils; f) grey brown podzolis soils; g) planosolic soils; h) humus and iron podzols; and i) alpine humus mountain skeletal soils.

H.1.2 Public Infrastructures

(1) Road Network and Logistics Systems

The total length of roads in the State was 29,011 km as of March 2006, comprising National Highways of 1,235 km, Boarder Roads of 691 km, State Highways of 2,164 km, and other arterial and rural roads of 24,921 km. Of these, the motorable section shared 25,968 km or 89.5%, including double lane section of 2,369 km, the section provided with cross drainage of 15,657 km and metalled and tarred section of 14,974 km. According to the data of the Public Works Department (PWD), 10,999 villages were connected with roads out of 17,495 inhabited census villages as of 2001 until March 2006. Table H-1.1 shows district-wise road distribution in the state as of March 2006.

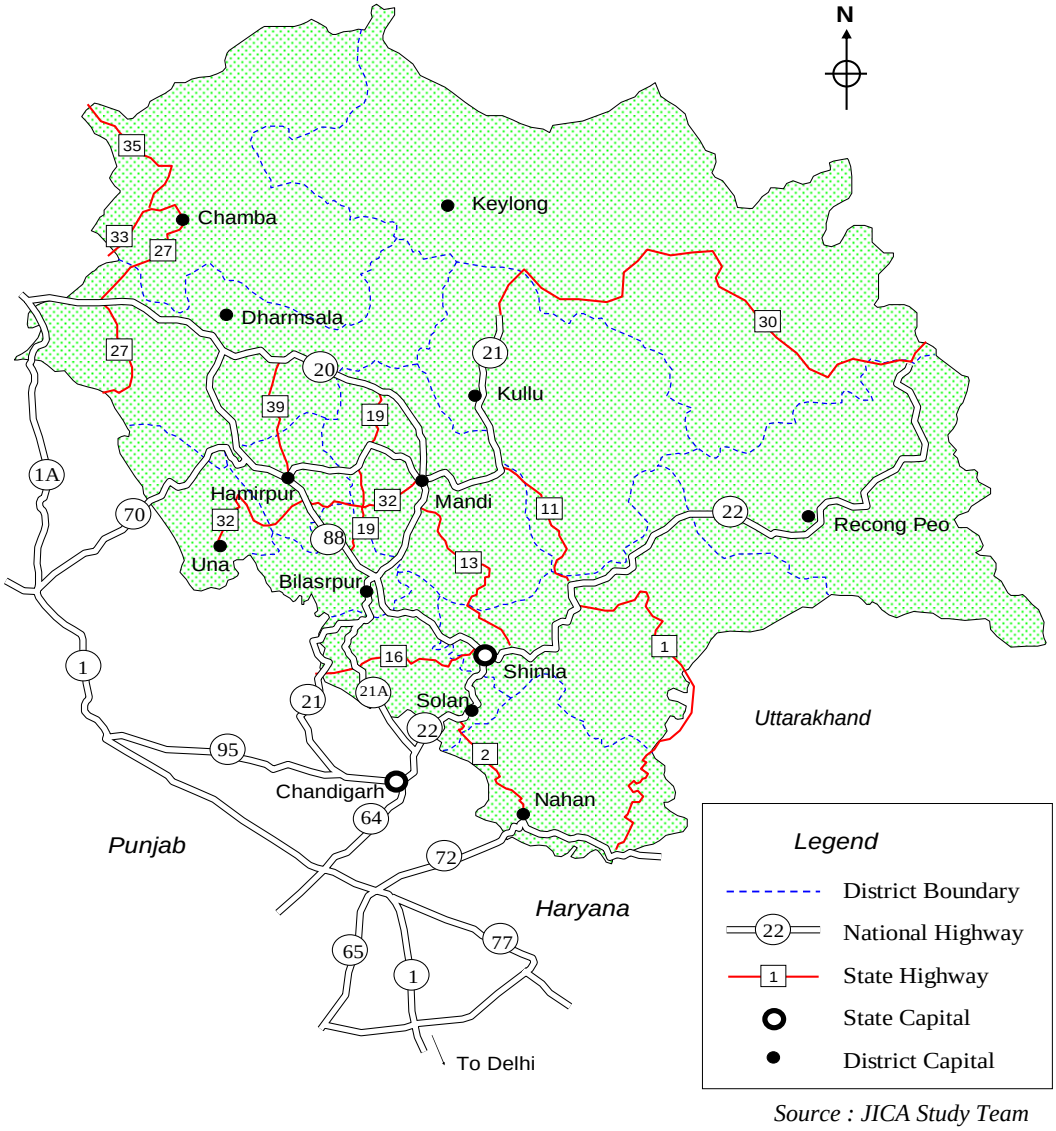
Table H-1.1 Road Conditions by District

District	Length of Roads (km)					Metalled & Tarred Section (km)	Connectivity		
	Total	Motorable single lane	Motorable double lane	Jeepable	Track		Inhabited Villages	Connected Villages	%
Bilaspur	1,352	1,184	125	0	43	890	1,021	539	52.8
Chamba	2,694	1,540	89	280	785	1,008	1,342	748	55.7
Hamirpur	1,579	1,527	52	0	0	1,189	1,722	1,143	66.4
Kangra	4,806	4,296	468	2	40	3,349	3,616	2,320	64.2
Kinnaur	944	467	177	28	272	413	149	107	71.8
Kullu	1,333	1,033	128	2	170	658	944	549	58.2
Lahaul-Spiti	1,110	812	260	3	35	450	282	135	47.9
Mandi	4,608	3,652	191	60	705	1,902	2,852	1,640	57.5
Shimla	4,171	3,676	334	10	151	1,756	2,435	1,313	53.9
Sirmaur	2,513	2,043	216	2	252	1,041	1,001	528	52.7
Solan	2,422	2,046	173	3	200	1,098	2,152	1,416	65.8
Una	1,479	1,323	156	0	0	1,220	754	561	74.4
Total of State	29,011	23,599	2,369	390	2,653	14,974	18,270	10,999	60.2

Source: Department of Public Works, Himachal Pradesh State Government

The main route from the northern states to Delhi, which is the capital and one of largest vegetable consuming markets in the country, is the National Highway No.1 (NH1). From Himachal Pradesh, six access routes to NH1 as shown in Table H-1.2 are usable for transporting agricultural products by trucks. Within Himachal Pradesh, there are several branch routes connecting to these six access routes including NH88 connecting Shimla with Mataur via Bilaspur, Hamirpur and Kangra with the total length of 115 km as well as 12 State Highway routes consisting of SH19 connecting with NH88 in Bilaspur, SH27, SH33 and SH 35 connecting with NH20 from Chamba, SH32 and SH39 connecting with NH70 and NH88 in Hamirpur, SH27 and SH39 connecting with NH20 in Kangra, SH11

connecting to NH21 from Kullu, SH 30 connecting to NH21 from Lahaul-Spiti, SH13, SH19 and SH32 connecting with NH21 and NH70 in Mandi, SH1 and SH13 connecting with NH22 in Shimla, SH1 and SH2 connecting with NH72 in Sirmaur, SH16 connecting with NH21A in Solan, and SH 32 connecting with NH88 from Una, as shown in Fig.H-1.4.



Source : JICA Study Team

Fig. H-1.4 Road Map

Table H-1.2 Main Access Routes from Himachal Pradesh to Delhi

National Highway					Distance (km)	
No.	Starting point	District on Route	Joining Point with NH1	Length in HP (km)	From HP to J/P	From J/P to Delhi
20	Mandi	Mandi, Kangra	Pathankot	210	10	480
70	Mandi	Mandi, Hamirpur, Una	Jalandhar	120	50	368
21	Manali	Kullu, Mandi, Bilaspur,	Ambala	232	91	201
21A	Swarghat	Solan	Ambala	49	66	201
22	India/Chaina border	Kinnaur, Shimla, Solan	Ambala	398	61	201
72	HP/UT border	Sirmaur	Ambala	50	51	201

Source: Ministry of Shipping, Road Transport and Highways, Government of India

In Himachal Pradesh, 41,644 cars in total 2005/06 are registered as multi-axial/articulated vehicles/trucks/lorries and 2,340 cars registered as light motor vehicles for goods.

The Department of Transport under the State Government through the State Transport and Regional Transport Authorities directed to fix freight rates of goods carriages in Himachal Pradesh in February 2005. According to this official notification, the maximum freight rates of non-bulky goods including grains, potatoes, vegetables and other agricultural products are fixed as shown in Table H-1.3.

Table H-1.3 Maximum Freight Rates of Non-bulky Goods within Himachal Pradesh

Unit: Paise/quintal/km

Road Type	up to 300 km	up to 200 km	up to 100 km
Metalled roads in plains	29.57	27.98	26.90
Un-metalled roads in plains	34.50	32.65	31.30
Metalled roads in hills excluding Lahaul-Spiti District	36.96	34.98	33.50
Un-metalled roads in hills excluding Lahaul-Spiti District	39.42	37.31	35.70
All roads in Lahaul-Spiti District	44.35	43.14	41.20

Source: Department of Transport, Himachal Pradesh State Government *Note : (Paise/quintal//km = Rs./10ton/km)*

(2) Railway and Civil Aviation

Three lines of the Northern India Railway are operating in the State. Of these, 96-km long Kalka to Shimla line and 164-km long Pathankot to Jogindenagar line are made up of 760-mm narrow gauge and operate only passenger trains. Meanwhile, Sirhind to Una line with 1676-mm broad gauge branches at Sirhind on Jammu Tawi to New Delhi line via Ambala. The distance from Una to New Delhi is 300 km, and a direct passenger train service for this section is available daily. A freight train is operated as an unscheduled train on demand basis.

There exist three airports in Himachal Pradesh. These are Shimla Airport located 12 km from Shimla with a 3,800-feet runway, Gaggal Airport situated 5 km from Kangra having a 3,900-feet runway and Kullu Manali Airport sited 9 km from Kullu.

(3) Domestic Water Supply

All the census villages in the State have been provided with drinking water facilities since March 1994. However, it was found during the survey conducted by the Central Government that there are still many remaining small units, where residents do not have access to safe drinking water supply.

According to the latest survey officially conducted on April 1, 2005, from the total of 45,367 habitations, 39,337 or 86.7 % were fully provided, 6,030 or 13.3 % partially provided and zero not-covered habitation. In 2005/06 safe drinking water supply facilities were provided to 858 partially-covered habitations.

(4) Power Generation and Rural Electrification

A hydroelectric potential of 20,386 MW has been already identified in the five river basins of the State. However, only 6067 MW or 29.8% out of the available potential have been utilized by various agencies so far. Out of these, a total of 330 MW or 5.4 % were controlled by the State, 3,830 MW or 63.1 % by the central sector, 1,500 MW or 24.7 % by joint sectors, 386 MW or 6.4 % by private sector and 21 MW by Himachal Pradesh Energy Development Agency (HIMURJA). The remaining 14,319 MW hydroelectric potential includes 7,602 MW under execution/stand allotted, 1,767 MW under project advertised, 4,200 MW as potential balanced, and 750 MW as present project under HIMURJA.

The State government achieved 100% of its rural electrification target of 16,807 inhabited census

villages by 1998/99. As per census 2001, number of villages is 17,495, of which 17,155 or 98% have been supplied with electricity at the end of November 2006.

H-1.3 Irrigation

(1) Present Situation of Irrigation Development

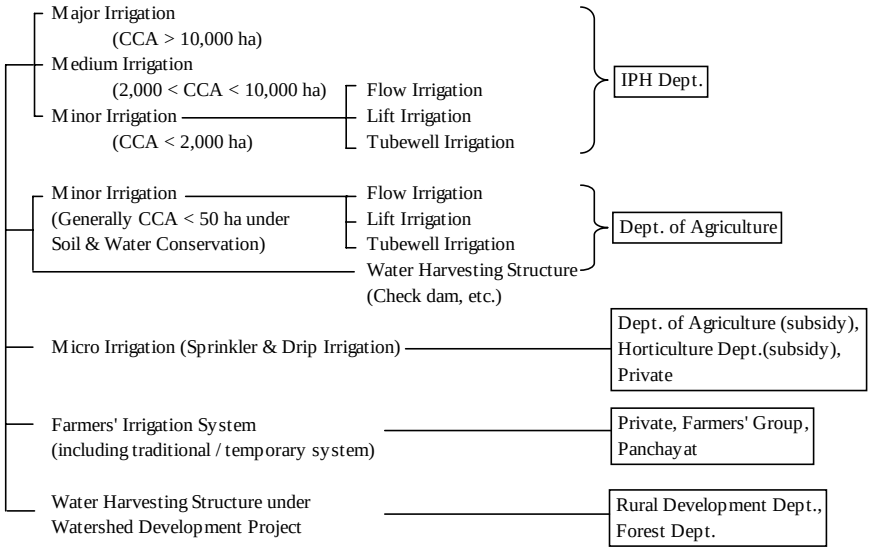
The cultivable area in the State has annual rainfall of 1,000 to 2,500mm, however it falls in rainy season and widely fluctuating year by year, hence the irrigation is necessary for the increase and stable agricultural productivity. The State is restrained in initiating large scale irrigation development due to its precipitous geography, and hence the irrigation system available for development is limited to 207,000 ha. Moreover, the actual irrigable area is further limited to 107,000 ha, which are 36% and 18% of net area sown of 583,000 ha as shown in Table H-1.4.

Table H-1.4 Summary of Irrigation Areas

	(x 1,000 ha)	Percentage in Total Area	Percentage in Net Sown Area	Percentage in Created CCA
Total Geographical Area	5,567[/1]	(100.0%)		
Net Area Sown	583[/1]	(10.5%)	(100.0%)	
C.C.A* Created upto 31.3.2006	207[/1]	(3.7%)	(35.5%)	(100.0%)
C.C.A Utilized (actually irrigated)	105[/2]	(1.8%)	(18.0%)	(50.7%)

*Note : * C.C.C : Culturable Command Area, Net sown area: cultivated land*
Source: 1; Annual Plan 2007-08, 2; Land Record 2003

Various types of the irrigation facilities have been constructed by farmers' themselves, farmers group, panchayat and by the Government. Irrigation schemes are classified into major, medium, minor & micro irrigation, farmer's irrigation and water harvesting structures which definitions are shown in Fig. H-1.5. Irrigation and Public Health Department (IPH) of the State deals with major - minor irrigation projects, DOA deals with minor and micro irrigation projects, which command area is generally less than 50 ha, Rural Development Dept (RDD). & Forest Dept. deal with water harvesting structures as shown in the same.



Source : JICA Study Team

Fig. H-1.5 Type of Irrigation Scheme in Himachal Pradesh

According to the Annual Plan 2007/08, 114,000 ha is developed by IPH Dept, and 93,000 ha is under RDD and DOA which includes farmers' own traditional systems as summarized in Table H-1.5. The irrigation development is given higher priority in five year plans and annual plans. Irrigable are has been increased almost double during the period from 1980s to date as shown in Table H-1.6 and Fig. H-1.6. In the last four years, 2,638 ha were developed from 2002/03 to 2005/06 according to Annual Plan 2007/08.

Table H-1.5 Irrigation Area by Type as of March 2006

(Unit: ha)

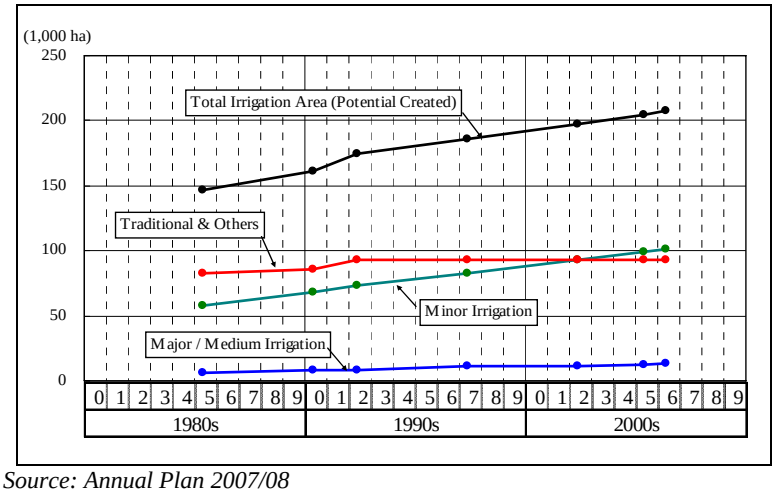
	IPH	RDD & DOA	Total Area	Share (%)
Major Irrigation	1,555	0	1,555	0.9 %
Medium Irrigation	11,381	0	11,381	5.5 %
Minor Irrigation	101,320	92,796	194,116	93.8 %
Total	116,256	92,796	207,052	100 %

Source : Annual Plan 2007/08

Table H-1.6 Summary of Irrigation Type and Development Progress

6th-9th Five Year Development Plan 1980/81-2001/02	Plan Period: By the end of 6th Plan 1980-85	By the end of 7th Plan 1985-90	By the end of Annual Plan 1991-92	By the end of 8th Plan 1992-97	By the end of 9th Plan 1997-2002
Major & Medium Irrigation	6,386	8,136	8,386	10,936	11,836
Minor Irrigation	57,344	67,915	73,811	82,595	92,607
Traditional and others	82,478	85,573	92,761	92,796	92,796
Total	146,208	161,624	174,958	186,327	197,239
10th Five Year Plan Development Plan 2002/03-2005/06	Year-wise achievements: 2002/03	2003/04	2004/05	2005/06	by the end of 2005/06
Major & Medium Irrigation	200	300	300	300	12,936
Minor Irrigation	2,088	2,161	2,126	2,338	101,320
Traditional and others	N.A.	N.A	N.A.	N.A.	93,196
Total	2,288	2,461	2,426	2,638	207,452

Source: Annual Plan 2007-08



Source: Annual Plan 2007/08

Fig. H-1.6 Progress of Irrigation Development

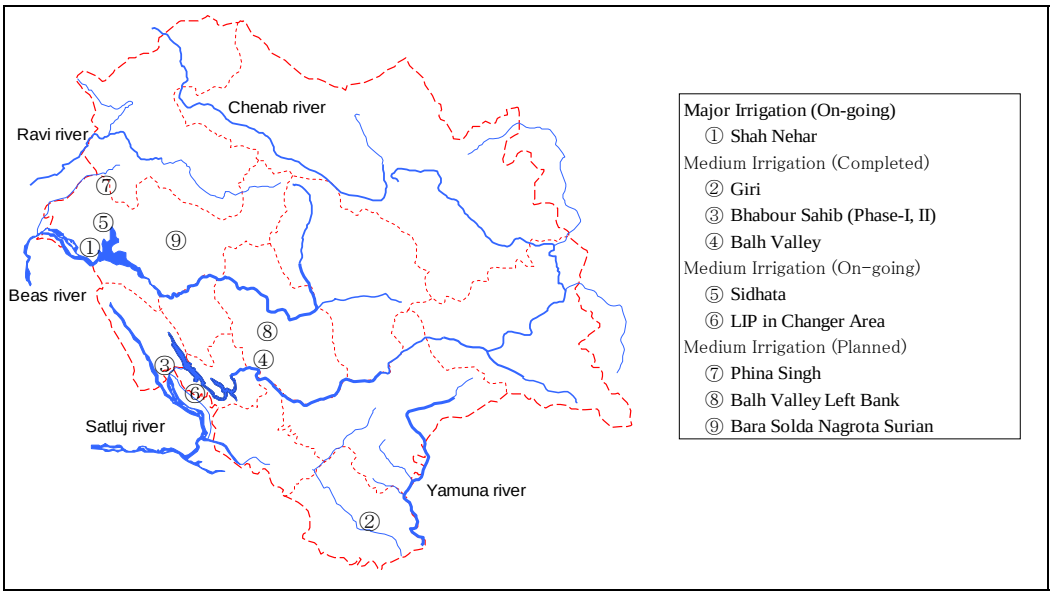
(2) Irrigation Systems

Irrigation systems in the State consist of major irrigation project, medium irrigation projects, minor irrigation schemes classified in terms of the size of Culturable Command Area (CCA). Major irrigation project has a CCA of more than 10,000 ha and medium irrigation projects cover a CCA of more than 2,000 but less than 10,000 ha. Minor irrigation schemes cover a CCA of less than 2,000 ha. Minor irrigation schemes in the State are further divided into i) Gravity Flow Irrigation so-called "Flow Irrigation", ii) Pump Irrigation so-called "Lift Irrigation", and iii) Tube Well Irrigation including dug well.

1) Major and Medium Irrigation Project

More than 50,000 ha of cultivated land can be brought under irrigation through major and medium irrigation projects constructed under IPH Dept, while the remaining area can be provided with irrigation through minor and other irrigation projects/schemes. Major irrigation project is only one in Himachal Pradesh, namely Shah Nahar project on the Beas river basin in Kangra district, of which construction works have been started in 1997 and in progress at present. This project aims at irrigating 15,287 ha of CCA benefiting 93 villages.

Four (4) medium irrigation projects have been completed, which are Giri, Bhabour Sahib (Phase I & II), and Balh Valley projects. Two medium projects, namely Sidhata and LIP in Changer Area from Anandpur Hydel Channel are in progress. The completed, on-going, and planned major and medium projects are summarized in Table H-1.7. These on-going projects are scheduled to be completed in five to seven years, and it is estimated that about 32,000 ha of land shall be irrigated by these projects by the end of next Eleventh five year plan period till 2012. Eighteen other medium irrigation projects are under feasibility study and these projects are expected to be taken up soon. Fig. H-1.7 shows the location of completed and on-going major and medium projects.



Source : IPH Dept

Fig. H-1.7 Location Map of Major and Medium Irrigation Projects

Table H-1.7 Summary of Major and Medium Irrigation Projects

Name of Project	River Basin	District	CCA (ha)		Expected Completion Time
			Designed	Completed	
Major Irrigation (On-going)					
Shah Nehar	Beas	Kangra	15,287	3,555	March 2010
Medium Irrigation (Completed)					
Giri	Yamuna	Sirmaur	5,263	5,263	-
Bhabour Sahib (Phase I)	Satluj	Una	923	923	-
Bhabour Sahib (Phase II)	Satluj	Una	2,640	2,640	-
Balh Valley	Beas	Mandi	2,410	2,410	-
Medium Irrigation (On-going)					
Sidhata	Baes	Kangra	3,150		March, 2009
LIP in Changer Area	Satluj	Bilaspur	2,000		March, 2010
Medium Irrigation (Planned)					
Phina Singh	Rabi	Chamba/ Kangra	4,650	0	
Balh Valley Left Bank	Beas	Mandi	2,780	0	March, 2011
Bara Solda Nagrota Surian	Beas	Kangra	2,000	0	

Source : Annual Plan 2006-07 & IPH Dept.

2) Minor Irrigation Schemes by Irrigation and Public Health Department

Minor irrigation scheme is classified that CCA is less than 2,000 ha, which are being developed by both IHP Department and DOA. There is no clear boundary of the responsibilities by two departments in terms of size of CCA, however it is generally understood that relatively small scale schemes i.e. less than 50 ha in most cases are taken by the DOA, and others are by IPH department.

According to the IPH department, there are about 1,900 completed irrigation schemes in Himachal Pradesh at the end of March 2006, out of which Flow Irrigation Schemes (FISs) are 933, Lift Irrigation Schemes (LISs) are 510 and Tubewell schemes are 481. These minor irrigation schemes are constructed, operated and maintained by IPH Department.

3) Soil & Water Conservation Schemes by Department of Agriculture

Department of Agriculture is implementing Soil & Water Conservation Schemes which often include development / improvement of minor irrigation schemes consisting of FIS, LIS and Tubewell schemes. Most of these schemes are covering CCA less than 50 ha. The details are described in Section H-1.4.

4) Other Irrigation

The other irrigation system includes small schemes developed by Rural Development Department (RDD), existing traditional systems, and other water harvesting system under some watershed development project under the Forest Department and RDD. Traditional irrigation practices include development of small channels (kuhl), pond, terrace bunding. Some of the kuhls provide water during rainy season or little after because the forest cover can not keep water for long. Terrace bunding for water harvest with continuous flow from one terrace field to another is practiced where the terraces are contiguous and are particularly on flat land. On slopy lands, ordinary bunding can retain rainwater for short time.

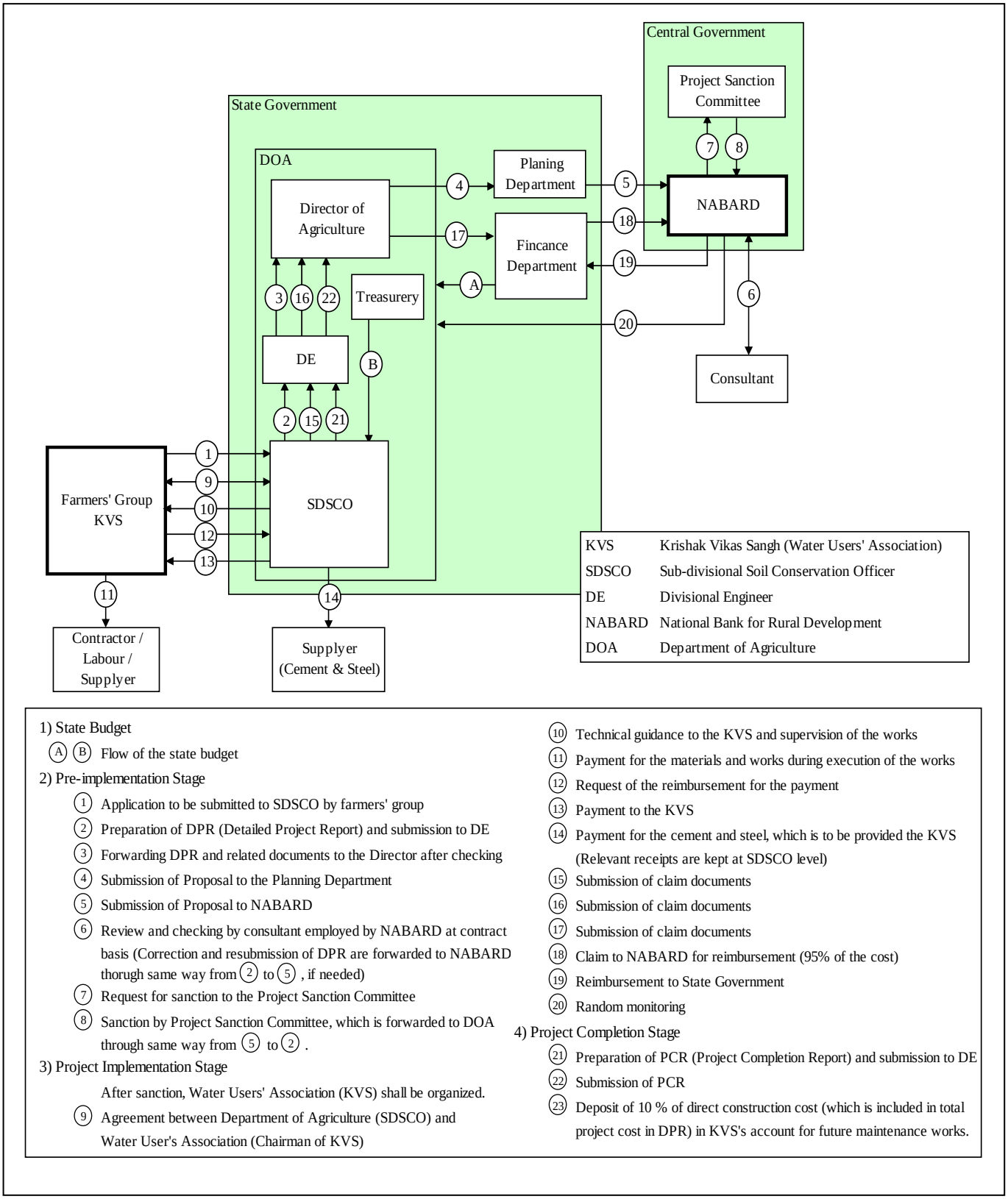
(3) On-going Irrigation Development Program

1) Irrigation Development under Rural Infrastructure Development Fund

The DOA and IPH Department are both participating under centrally supported RIDF program financed by NABARD (National Agricultural Bank for Rural Development) for their irrigation development. Rural Infrastructure Development Fund (RIDF) is a loan program with the condition that 95% shared by NABARD in shape of loan and remaining 5% shared by State share since 1995-1996. The budgetary flow and the process of project implementation under RIDF are illustrated in Fig H-1.8. Most projects under IPH Department and DOA are executed under RIDF.

2) Command Area Development Program

As shown in Table H-1.4, gap between potential created (Pc) and utilised (Pu) is high. In order to bridge such gap, Command Area Development activities (CAD) are also extended not only to medium irrigation projects but also to minor irrigation schemes. Command Area Development Program (CADP) was initiated in the year 1974-75 under centrally sponsored program with the objective of fast utilization of created irrigation potential and optimum agriculture production from irrigable land. Initially three medium irrigation projects were included, which has since been completed. Ten (10) more projects stands completed under CAD Programme and seven (7) projects are in progress in Himachal Pradesh. Up to March 2006, 21, field channels for 739 ha and warabandi (Rotational irrigation and its facilities) for 20,844 ha have been completed.



1) State Budget

(A) (B) Flow of the state budget

2) Pre-implementation Stage

(1) Application to be submitted to SDSCO by farmers' group
(2) Preparation of DPR (Detailed Project Report) and submission to DE
(3) Forwarding DPR and related documents to the Director after checking
(4) Submission of Proposal to the Planning Department
(5) Submission of Proposal to NABARD
(6) Review and checking by consultant employed by NABARD at contract basis (Correction and resubmission of DPR are forwarded to NABARD thorugh same way from (2) to (5) , if needed)
(7) Request for sanction to the Project Sanction Committee
(8) Sanction by Project Sanction Committee, which is forwarded to DOA through same way from (5) to (2) .

3) Project Implementation Stage

After sanction, Water Users' Association (KVS) shall be organized.

(9) Agreement between Department of Agriculture (SDSCO) and Water User's Association (Chairman of KVS)
(10) Technical guidance to the KVS and supervision of the works
(11) Payment for the materials and works during execution of the works
(12) Request of the reimbursement for the payment
(13) Payment to the KVS
(14) Payment for the cement and steel, which is to be provided the KVS (Relevant receipts are kept at SDSCO level)
(15) Submission of claim documents
(16) Submission of claim documents
(17) Submission of claim documents
(18) Claim to NABARD for reimbursement (95% of the cost)
(19) Reimbursement to State Government
(20) Random monitoring

4) Project Completion Stage

(21) Preparation of PCR (Project Completion Report) and submission to DE
(22) Submission of PCR
(23) Deposit of 10 % of direct construction cost (which is included in total project cost in DPR) in KVS's account for future maintenance works.

Source: JICA Study Team on the basis of Hearing Survey

Fig. H-1.8 Budgetary Flow and Process of Project Implementation under RIDF

3) Accelerated Irrigation Benefit Program

Persistent efforts have been made to get approval of the Central Government for minor irrigation projects under Accelerated Irrigation Benefit Program (AIBP) for fund arrangements, as 75% of the expenditure is borne by the Central Government. As the result, 95 minor irrigation schemes spread in the districts of Solan, Una, Kangra, Mandi, Sirmour have been got approved. Under this program one Major Irrigation Project Shahnehar and two other medium irrigation projects Sidhata and Anandpur Hydel channel have also been got approved under AIBP. So far the Central Government has sanctioned Rs.67.1 million for minor irrigation schemes, Rs.51.5 million for medium irrigation projects and Rs.502.6 million for Major Irrigation Project Shahnehar under central loan assistance. New proposals of 102 minor irrigation schemes amounting to Rs.502.5 million have been further requested to the Central Government for approval to cover 12,480 ha of CCA under this program.

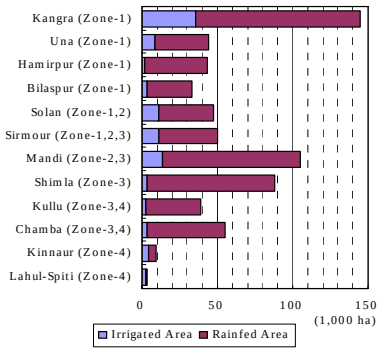
(4) District-wise Irrigation Area

District-wise irrigation area is estimated in Table H-1.8 and summarized in Fig. H-1.9 with rainfed area. Percentage of irrigated area to total cultivable area is shown in Fig. H-1.10.

Table H-1.8 District-wise Irrigation Area

Name of District	(1) Geograph. Area (km^2)	(2) Cultivable Area (ha)	(3) =(2) / (1) (%)	(4) Net Area Sown (ha)	(5) =(4) / (1) (%)	(6) Potential Irrigable Area Pc, (ha)	(7) Actual Irrigated Area Pu, (ha)	(8) =(7) / (4) (%)
Bilaspur	1,167	39,132	34%	29,909	26%	7,444	2,984	10%
Chamba	6,528	50,591	8%	41,777	6%	9,136	3,252	8%
Hamirpur	1,118	53,262	48%	35,105	31%	6,560	1,533	4%
Kangra	5,739	162,765	28%	116,661	20%	63,822	35,922	31%
Kinnaur	6,401	13,089	2%	7,268	1%	7,306	4,336	60%
Kullu	5,503	42,916	8%	36,707	7%	7,243	2,547	7%
Lahaul - Spiti	13,835	4,126	0%	3,326	0%	5,640	2,206	66%
Mandi	3,950	101,045	26%	86,371	22%	30,451	13,952	16%
Shimla	5,131	101,712	20%	67,301	13%	11,235	3,403	5%
Sirmour	2,825	100,364	36%	39,795	14%	27,069	10,782	27%
Solan	1,936	58,208	30%	39,264	20%	15,423	11,237	29%
Una	1,540	73,000	47%	41,091	27%	15,423	8,503	21%
Total	55,673	800,210	14%	544,575	10%	206,752	100,657	18%

Source : Annual Plan 2006- 07



Note : Rainfed area = (Net area sown) - (Irrigated area)

Fig.H-1.9 District-wise Irrigated Area and Rainfed Area to Geographical Area

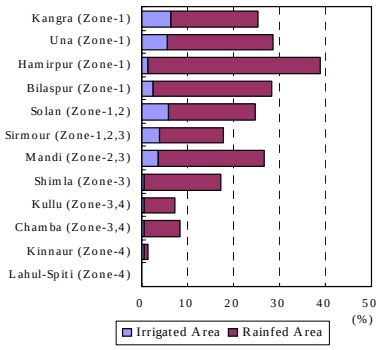


Fig.H-1.10 District-wise Percentage of Irrigated Area and Rainfed Area to Geographical Area

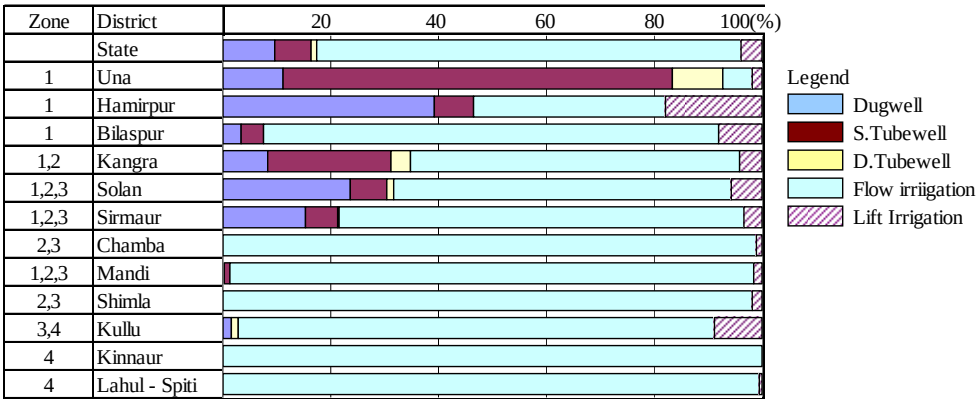
(5) Classification of Minor Irrigation

According to the Minor Irrigation Census in 2000/01, minor irrigation schemes in each district, including IPH projects, soil and water conservation under Dept. of Agriculture, traditional and private schemes are classified into five types such as flow irrigation, lift irrigation, deep tube well, shallow tube well, and dug well as shown in Table H-1.9 and Fig. H-1.11.

Table H-1.9 District-wise Minor Irrigation Scheme by Type

Name of District	No.of Villages	Total Number of Schemes						Total Area * (ha)
		Dugwell	Villages	Deep	S.flow	S.Lift	Total	
Bilaspur	1,083	35	45	0	889	86	1,055	2,984
Chamba	1,598	0	0	0	617	7	624	3,252
Hamirpur	1,684	224	43	0	204	102	573	1,533
Kangra	3,906	256	697	110	1,873	125	3,061	32,367
Kinnaur	686	0	0	0	235	0	235	4,336
Kullu	173	2	0	2	119	12	135	2,547
Lahul - Spiti	521	0	0	0	574	3	577	2,206
Mandi	3,367	10	49	0	4,037	63	4,159	11,542
Shimla	3,040	0	0	0	1,351	25	1,376	3,403
Sirmaur	984	400	150	12	1,943	88	2,593	5,519
Solan	2,551	742	217	37	1,976	178	3,150	11,237
Una	866	227	1,448	190	111	35	2,011	4,940
Total	19,593	1,669	1,201	161	13,818	689	17,538	85,866

Source : Minor Irrigation Census, 2000/01
*Remark : * ; Estimated (District total (actual irrigated)- Completed major & medium irrigation)*

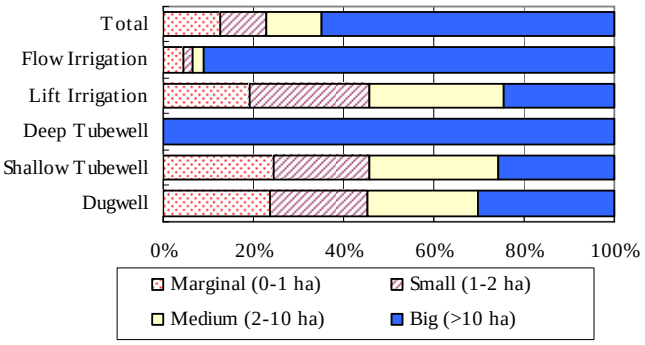


Source: Minor Irrigation Census, 2000-01

Fig. H-1.11 Type of Minor Irrigation Scheme in each District

In lower area in Agro-eco Zone-1, there are many tube well schemes with higher potential of groundwater. Especially in the case of Una district more than 90% are groundwater irrigation schemes and 80% of which are shallow tubewell. In the higher region in Agro-eco Zone-2, 3 and 4, there are either few or nil. In Agro-eco Zone-4, Kinnaur and Lahaul & Spiti, almost all schemes are flow irrigation schemes.

Figures H-1.12 to H-1.15 show classification of minor irrigation schemes in the state by holding size, ownership, financial source, and distribution system.



Source: Minor Irrigation Census, 2000-01

Fig.H-1.12 Classification of Minor Irrigation Scheme by Holding Size

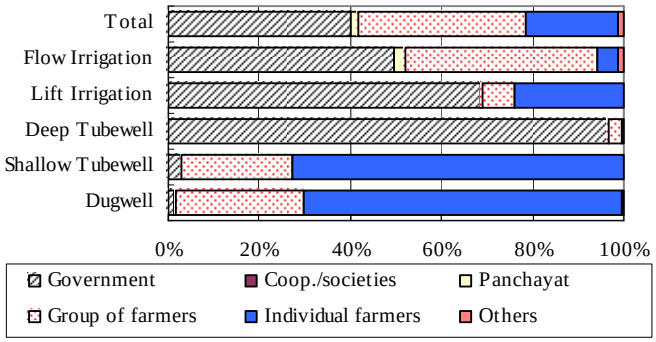
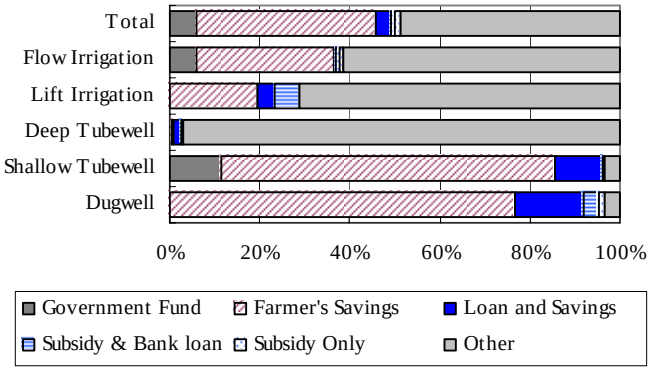


Fig. H-1.13 Classification of Minor Irrigation Scheme by Ownership



Source: Minor Irrigation Census, 2000-01

Fig. H-1.14 Classification of Minor Irrigation Scheme by Financial Source

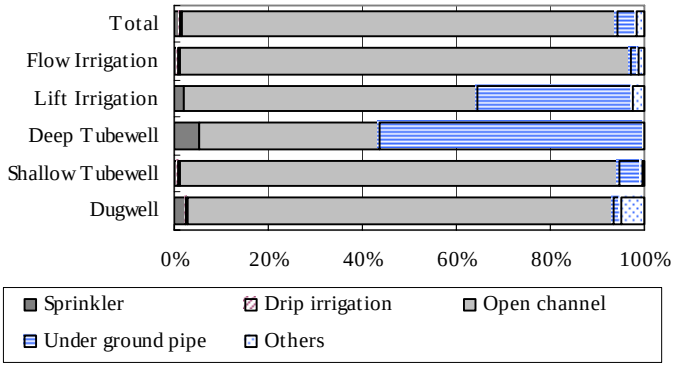


Fig. H-1.15 Classification of Minor Irrigation Scheme by Distribution System

As shown in the above figures, minor irrigation schemes in the state are summarized below.

Table H-1.10 Summary of Classification of Minor Irrigation

Type	Flow	Lift	Deep Tubewell	Shallow tubewell	Dugwell
Size	Mostly > 10ha	Depend on size	> 10 ha	Depend on size	Depend on size
Ownership	Government 50% Farmers' group 40 %	Government 70% Farmers' group 25 %	Government 95%	Farmers' group 75% Framer 20 %	Farmers' group 70% Framer 28 %
Financial source	Government 5% Farmer's saving 20%	Government 5% Farmer's saving 15%	Mostly other source	Farmer's saving 90%	Farmer's saving 80%
Distribution system	Mostly open channel	Open channel 30% Pipe 35%	Open channel 40% Pipe 55%	Open channel 95%	Open channel 95%

Source : JICA Study Team

H.1.4 Soil and Water Conservation under Department of Agriculture

(1) Activities of Soil and Water conservation Division

DOA is implementing soil and water conservation schemes under state sector and Central sponsored programs, which fall under the jurisdiction of Soil and Water Conservation (SWC). The main activities of the SWC are;

- To create irrigation facilities through beneficiaries participatory approach, mainly consisting of minor irrigation schemes so as to obtain maximum returns from their land

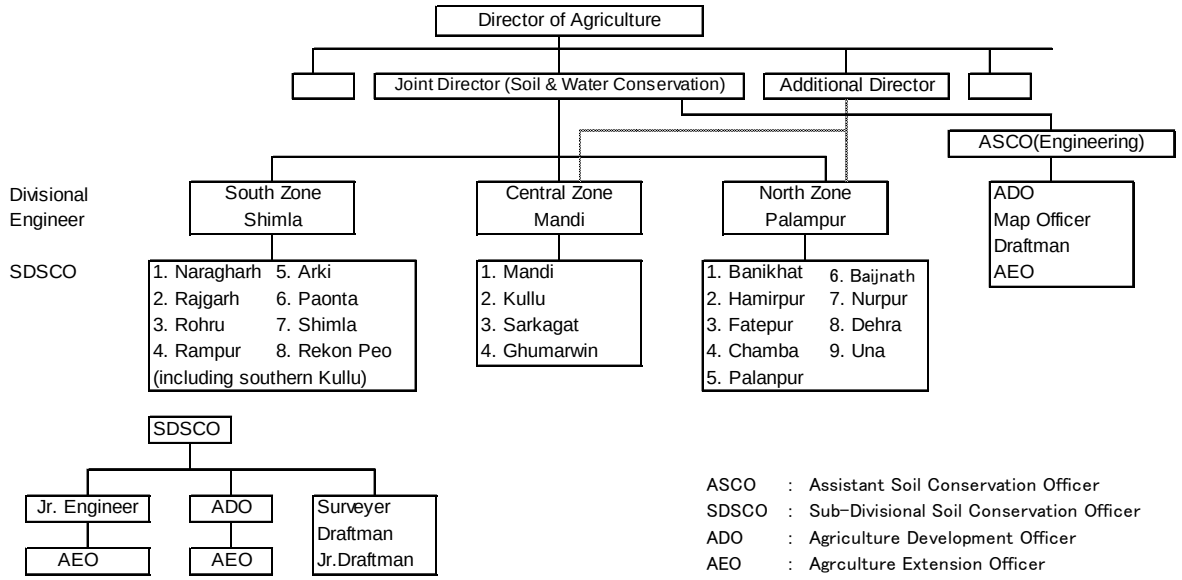
- To educate the farmers regarding economic use of irrigation water, and

To educate the farmers about soil and water conservation technologies

The schemes under state sector managed by the SWC division are (i) Soil Conservation Works in Shivalik Hills (Construction of check dams, wire crate, retaining wall and head walls) and (ii) Massive Assistance to small & marginal farmers for increasing agriculture production (Execution of minor irrigation schemes for small groups of small and marginal farmer).

Under the Central financial support, DOA is participating in RIDF program financed by National Bank for Rural Development (95% share by NABARD & 5% State share) the Rural Infrastructure Development Fund (RIDF) for creation of irrigation potential through minor irrigation, such as tube well, flow and lift irrigation schemes. Beside this, SWC division executed the community based Water Harvesting and Natural Resource Management Project in Hamirpur District. These schemes are being executed through Water Users Associations who will also maintain them after their completion.

The SWC division is divided into 3 zones, under which Sub-divisional Soil Conservation Officers (SDSCOs) are organized. The present organization structure of SWC is illustrated as below.



Source : Department of Agriculture

Fig.H-1.16 Present Organization of SWC

(2) On-going Program

DOA is implementing Soil & Water Conservation Schemes which often include development / improvement of minor irrigation schemes consisting of FIS, LIS and Tubewell schemes. Most of these schemes are covering CCA less than 50 ha. These schemes are to be developed by farmers themselves with farmers' participatory approach during planning, construction and operation & maintenance under the financial and technical support by the DOA. Table H-1.11 shows summary of soil & water conservation schemes constructed under the centrally supported Rural Infrastructure Development Fund (RIDF) program in each Tranche.

Table H-1.11 Summary of Soil & Water Conservation Schemes under RIDF

Tranche	Year	Nos. of Scheme	CCA (ha)	Estimated Cost (Million Rs.)	Expenditure (Million Rs.)
I	1995 - 96	15	612.00	36.000	31.290
II	1996 - 97	12	470.00	32.206	31.233
III	1997 - 98	-	-	-	-
IV	1998 - 99	-	-	-	-
V	1999 - 00	157	3,588.49	148.252	147.514
VI	2000 - 01	140	3,031.06	113.772	109.195
VII (MIS)	2001 - 02	125	2,380.52	78.411	77.922
VII (WSD)	2001 - 02	90	6,128.21	71.113	67.896
VIII	2002 - 03	-	-	-	-
IX	2003 - 04	28	390.62	14,785	14.476
X	2004 - 05	60	1,025.31	40.746	40.663
XI	2005 - 06	68	1,182.51	57.790	57.790
XII	2006 - 07	61	980.87	63.367	under execution
	Total	756	11,280.86 *1	656.442	577.979

*Remark; *1: Excluding MIS (Micro irrigation system) and WSD (Watershed development)*
Source: Department of Agriculture

Minor irrigation under DOA is classified into three types, namely flow irrigation (FIS), lift irrigation (LIS), and tube well, in which majority is flow irrigation (92 %) as shown in Table H-1.12.

Table H-1.12 Type of Minor Irrigation under DOA

Type	Nos.		Area (ha)	
FIS	485	(95%)	9,288	(92%)
LIS	2	(0%)	51	(1%)
Tube well	21	(5%)	791	(7%)
Total	508	(100%)	10,130	(100%)

Source: DOA

Generally for FIS, the works are rehabilitation or upgrading of existing traditional system made of local materials such as soil and timber into permanent facilities made of stone masonry or cement concrete structures including canal lining. The schemes are implemented by the following process;

a. Application to DOA is sent from farmers' group by farmers' initiative through division office;

b. Evaluation of the Application first, and planning, survey and design are made by the department's sub-division office;

c. Review by divisional office and approval by the Department;

d. Agreement on responsibility between the farmers' group and the Department is made and estimated cost is paid to farmers' group;

e. Farmers' group arranges labor and materials, except cement and steel which are provided by the Department, and execute the works; and

f. The scheme is operated and maintained by farmers themselves without DOA's support.

(3) Water Harvesting and Natural Resource Management Project

Beside minor irrigation, DOA also executed 90 community based Water Harvesting and Natural Resource Management Projects within the category of the soil & water conservation program, which aims not only irrigation but integrated watershed management project, and cover all the catchment as beneficially area. This type of project has been started in Hamirpur district, therefore it is called as "Hamirpur model". These projects are also being carried out by farmers' participatory approach under the financial arrangement by DOA creating check dam for control of soil erosion, while water lifting facilities at check dam and distribution channel in the fields are to be provided by farmers themselves

under the government subsidy (25 % of the cost and Rs.8,000 at the maximum). Upto 2006, these projects covers CCA of 6,128 ha in Hamirpur district. Summary of Water Harvesting and Natural Resource Management Project is shown in Table H-1.13. However, in these schemes only 38 ha have been utilized due to the difficulty of farmers' financial arrangement to provide lifting facilities after construction of check dam.

Table H-1.13 Water Harvesting and Natural Resource Management Project in Hamirpur

Block	Nos. of Projects	(FIS)	Total Beneficially Area (ha)	Total Expenditure (Rp. million)	Potential Utilized (ha)
Hamirpur	14	(1)	789.40	11.002	3.60
Bhoranj	13	(2)	280.00	9.217	5.90
Bijhari	11		1,339.27	10.757	7.20
Sujanpur	13		394.06	9.568	10.10
Nadaun	28	(1)	1,703.29	20.755	8.00
Bamsan	11		346.00	6.597	3.45
	90	(4)	4,852.02	67.896	38.25

Source : Department of Agriculture

(4) Life Saving Irrigation

The irrigation in this Master Plan has two types, one is “Full irrigation” or “Assured Irrigation” and the other is called as “Life Saving Irrigation” or “Protective irrigation”. The former is to assure full water supply to the crops as required with certain dependability (80%), and the latter is to supply water at least to minimum level in order to save the crop at critical time and to keep minimum level of the yield, which is supplementary to rain water in Kharif season.

(5) Micro Irrigation

Sprinkler and drip irrigation system are called as micro irrigation, which are being established by farmer's themselves privately or utilizing subsidy from the government. DOA has a program for supporting farmers on installation of sprinkler sets. Sprinkler sets installed under this program is summarized in Table H-1.14. In addition, the DOA has started new project in Chhota Bhanga, Kangra District under Tranche 12 of the Rural Infrastructure Development Fund (RIDF-XII) from 2006 to install sprinkler sets by 100% government share, which is being carried out in special difficult area for agriculture. At moment 28 projects are on-going and will be expanded to the other districts.

Table H-1.14 Summary of Sprinkler installed with Subsidy from DOA

Year	No. of sprinkler sets installed	Subsidy amount released (Rs.1,000)	Area covered (ha)
2000/01	272	3,406	272.17
2001/02	287	3,976	296.69
2002/03	314	4,025	305.25
2003/04	149	1,236	132.95
2004/05	247	3,150	227.50
2005/06	398	5,050	364.15
2006/07	767	9,347	695.70

Source: Department of Agriculture

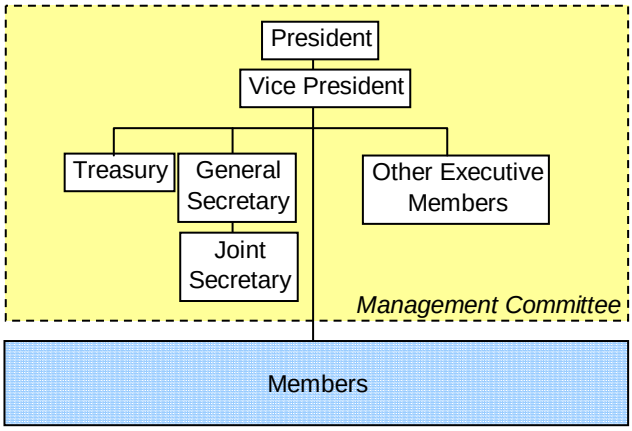
For fruits and other horticulture planting area, Department of Horticulture also has a program to support farmers under both state government own budget and centrally assisted program of Horticulture Technology Mission (HTM).

(6) Farmers' Participation and Water Management

As the National Water Policy prescribes the participation of farmers in water management of the irrigation systems, water users' association (called KVS; Krishak Vikas Sangh) is being organized and registered in accordance with the government guideline. The activities of KVS in the soil and water conservation schemes under the DOA include operation and maintenance of the irrigation system. Schemes under IPH Department are operated and maintained by the department, imposing minimal charge to the farmers. Generally in most KVS, regular meetings are held either once a month or once in six months, wherein the water supply schedule are planned.

For minor irrigation, schemes are developed on the application filed by farmers' group. Therefore the group activities commence before construction works. Especially for the DOA schemes, farmers' participation is vital not only after taking over the system but also during planning, survey, design and construction. Construction works are carried out by KVS subject to condition that materials such as cement, reinforcement, and pipes shall be provided by the department, while local materials such as sand and gravel, and common labor shall be managed by KVS. From the total cost, 10% is deducted from the gross running bill and the same is released in the account of KVS for the O&M after the completion

The payment and its reimbursement flow are shown in Fig.H-1.8 and the organization of KVS is illustrated in Fig. H-1.17.



Source: Department of Agriculture

Fig. H-1.17 Organization of KVS

H-1.5 Farm Road

In the rural areas, the farm roads consist of various types of minor roads, or access farm roads in the State as follows:

A) Katcha (temporary) earthen roads with an average width of 2-3m, poor drainage facilities, mostly un-surfaced (no pavement),

B) Mule track with an average width of 1.8 m, partly paved by stone or concrete, no drainage facilities, and

C) Footpaths with an average width of 1 m or less partly paved by stone or concrete, no drainage facilities.

These roads are constructed mainly for the single Panchayat by District Block Office, APMC and DOA, and maintained mainly by the Block Office and Panchayat as afore-mentioned. However, most of these roads are not well functioned in the rainy season mainly due to muddy earth sections from the end of June to the beginning of September when harvest of off-season vegetable and temperate fruit are at its peak.

The rural roads in the State are developed by several agencies as follows:

a. Public Works Department (PWD) for development of Village Roads which connect 17,449 habitations (2001 census) and 3225 Panchayats in the State by all-weather roads in accordance with rural road guidelines and core network.

b. Other agencies as follows:

- District Block Offices develop Rural Roads (so called Block or Panchayat Roads)

mostly within a Panchayat territory mainly by Katcha roads (temporary earthen jeepable roads), footpaths and ropeways.

- Agriculture Produce Marketing Committees (APMC) under Marketing Board (MB) financially assists Block Offices and Panchayat to develop Market Link Roads mainly by Katcha roads and partly by paved roads, mule paths and ropeways.
- DOA also assists KVS to develop Katcha road and canal inspection foot paths.

Further details of roads in the rural area can be presented below:

(1) PWD Village Roads

Source of Fund: The source is mainly sponsored by Pradhan Mantri Gram Sadak Yojana (PMGSY); Prime Minister's Village Road Programme) assisted by Bharat Nirman Yojana (Indian Rural Development Scheme, time bound by 2009), World Bank and the State.

Road Category: Category is under all weather passable roads (for 42-seater busses). Habitations within a distance of 500 m (1.5 km in case of hills) from the all-weather road or the habitation is considered as connected. The carriageway width of the village roads is 3.75m, however, 3.0m is dominantly applied in hilly area. Standard pavement is pre-mix bituminous carpet (asphalt).

Annual Progress: In fiscal year of 2006-07, 3767 km of the new roads and improvements were completed, which is equivalent to1334 km per annum in average since 2000 (improvement is 12.5% of the new construction). Vision 2025 issued by Ministry of Rural Development (MORD) stipulates complete connection of habitation with a population of more than 250 by 2021/22, however, the State sets it to 2012, and that connection for all 17,449 habitations shall be completed by 2020.

Organization: 1303 Junior Engineers (JEs) are employed in PWD to design, construct and maintain the national and the state highways, major district roads and village roads. It is estimated that one JE is responsible for 5km of construction of new village roads and 15km of maintenance of the existing village roads in average.

Implementation: For village roads, Panchayat is responsible for land acquisition, determination of approximate alignment and application. Survey is done by PWD. The construction contract is concluded between 106 executive engineers and contractors.

Maintenance: PWD is responsible for the sub-division office and mechanical section.

(2) Rural Roads by Block Office (Panchayat road)

Source of Fund: The source is Rural Development Department (RDD) under 70/30 Program (30% shared by Panchayat), District Deputy Commissioner Fund, MLA Fund (member of legislative assembly), Panchayat Fund, etc.

Road Category: Category is mostly katcha (temporary earth) roads, concrete footpaths, and ropeways. The carriageway width is 3.0m.

Annual Progress: Estimated at about 353 km/year based on the data obtained from RDD for 12 Blocks, and from Block Development Office (BDO) for 12 Blocks.

Organization: 4 assistant engineers and 147 junior engineers appointed by Panchayat in the State supervise all technical services for rural development.

Implementation: Panchayat is responsible for land acquisition, determination of approximate alignment and application. Survey is done by PWD in most cases. The construction contract is concluded between BDO and the contractor. Minor encroachment to the forest reserve is carried out by outsourcing to the forest department through deposit system.

Maintenance: Panchayat is responsible under the financial assistance from 70/30 Program, Deputy Commissioner Fund, MLA Fund, Panchayat, etc.

(3) Market Link Roads by APMC under supervision of APMB

Source of Fund: A part of market charge (1 %) is allocated.

Road Category: Category is mostly katcha (temporary earth) roads and partly paved road, concrete mule paths and ropeways. The carriageway width is 3.0 m

Annual Progress: Approximately 30 km/year which was obtained from the statistics summarized in two fiscal years (2004-2006).

Organization: One executive engineer, 4 assistant engineers and 9 junior engineers who belong to Marketing Board in the State supervise all engineering services including architecture and civil engineering.

Implementation: Panchayat is responsible for land acquisition, determination of approximate alignment and application. Survey is done by a Jr. Engineers. The construction work is carried out by Panchayat and contractors that they employed. Difficult works are sometime carried out by outsourcing to PWD through deposit system.

Maintenance: Panchayat is responsible under the financial assistance from 70/30 Program, Deputy Commissioner, MLA, Panchayat, etc

(4) Farm Roads under DOA

Source of Fund: 100% through NABARD

Road category: Category is katcha (temporary earth) and canal inspection footpath

Annual Progress: Occasionally constructed when KVS requested.

Organization: 3 divisional engineers, 21 sub-divisional engineers, assistant engineers and 50 junior engineers (83 sanctioned), 10 surveyors (48 sanctioned) and 9 draughtsmen (27 sanctioned) who all belong to DOA in the State supervise all engineering services for soil and water conservation, irrigation, water harvesting and farm road when required.

Implementation: KVS is responsible for land acquisition, determination of approximate alignment and application. Survey is done by Jr. Engineers. The construction work is carried out by KVS and contractors that they employed.

Maintenance: KVS is also responsible for its maintenance.

(5) Access Farm Road Development and Rehabilitation

The results of survey of 23 links of the proposed access farm roads in sample sites reveal that the average maximum manual transportation distance of agricultural produce is estimated at 1.2 km (minimum 0.6 km to maximum 3 km). Some of these benefited areas along the proposed links have been converted from previous food grain cultivation to vegetable and temperate fruit recently. In these areas, the yield has been increased from 2.5 tons/ha of food grains to 25 tons/ha of vegetable & temperate fruit in average. This fact reveals that the manual transportation increases from 50 trips to 500 trips, if one person transports 50 kg/trip. The development of the access farm road is, thus, prerequisite as one of tools to promote and support crop diversification from food grains to vegetable and temperate fruit.

Under such circumstances, the proposed beneficiary farmers, agricultural block offices and DOA conceives a plan to promote development of access farm roads in the recently completed District Agriculture Plan (DAP prepared by Palampur University in August 2008). The total length of the access farm roads proposed in DAP is estimated at 4,816 km except some districts which could not submitted properly as shown below:

Table H-1.15 Length of Access Farm Road for Five Years Proposed in DAP

No.	District	Proposed Access Farm Road Length (km)	Estimated Fund Requirement (Rs. Lak)
1	Bilaspur	280	1,000
2	Chamba	117	3,200
3	Hamirpur	LS	935
4	Kangra	1,633	3,660
5	Kinnaur	No data	7,720
6	Kullu	93	22,713
7	Lahaul-Spiti	597	9,754
8	Mandi	2,061	11,611
9	Shimla	0	2,520
10	Sirmaur	LS	1,500
11	Solan	35	460
12	Una	No data	No data
	Total	4,816	65,073

Source: DOA and Palampur University, August, 2008 (LS: lump sum)

(6) Construction Committee for Farm Roads

Farm road construction is implemented through need base application by the Panchayats. In some cases, Village Construction Committees are organized to prepare application and in other cases, the block development offices or Panchayat office are in charge. For APMC's market link roads are mostly arranged by the committees under the supports by PWD.

H-2 Constraints and Countermeasures

H.2.1 Irrigation

The constraints, development potential, needs and their counter measures in irrigation are summarized as shown below.

Table H-2.1 Constraints and their Countermeasures in Irrigation

Present Conditions / Constraints	Potential / Opportunity	Future Strategy & Measures
Irrigation 1. Restriction of medium and large scale developments because of topographic conditions in most cases 2. Limit of type of water intake facility and distribution facility because of steep topography in most cases 3. Necessity of water-saving cultivation because of limited water source in dry season	a. Potential of 110,000 ha by new development and 110,000 ha by rehabilitation b. In the hilly regions where water source is available, small-scale irrigation development is feasible. c. Community-based small scale irrigation is generally maintained well.	1) Promotion of small-scale irrigation system, minor irrigation 2) Life saving irrigation with tank irrigation and micro catchments rainwater harvesting facilities, etc. 3) Pump irrigation and pipeline system 4) Increase irrigation efficiency by repair /renewal of existing systems and O&M improvement 5) Water saving irrigation facilities such as drip irrigation

H.2.2 Farm Road

The constraints, development potential, needs and their counter measures in access farm road are summarized as shown below.

Table H-2.2 Constraints and their Countermeasures in Farm Roads

Present Conditions / Constraints	Potential / Opportunity	Future Strategy & Measures
Access Farm Road 1. Limited farm access in the hilly and undulated terrain.	a. High needs for access farm roads connecting to PWD village roads	1) Development and improvement of motorable access farm roads & foot paths

H-3 Master Plan Study

H-3.1 Proposed Infrastructure Development Plan

(1) Irrigation

Based on the requirement as countermeasure to the present constraints of irrigation component for the crop diversification, which are confirmed through the series of the workshops, the basic strategy for irrigation development are proposed in this master plan as summarized below.

1) Development of minor irrigation systems - The area for diversified agriculture lies in the hilly and mountainous region, but in these zones the existing irrigation system has not fully covered the area and the major and medium irrigation development are not suitable due to the physiographic features. On the other hand, perennial rivers and small streams are available in the area with a certain run-off discharge from snow-fed streams or springs. It is, therefore, necessary for diversification to develop new minor irrigation systems composed of flow, lift and groundwater irrigation and water harvesting facilities.

2) Improvement of existing irrigation system - Since the gap between the area with irrigation facilities and actually irrigated area is prominent showing actual irrigation ratio at 51%, the existing irrigation area has to be improved. These include replacement of the traditional temporary system with new permanent system, and repair, rehabilitation, up-grading and extension of the existing minor irrigation schemes.

3) Development of small-scale irrigation facilities - The irrigation development aims not only at the government project area, but also at the communal and individual systems of farmers. This includes communal and private tanks, pump, and tubewell, and micro-irrigation (sprinkler & drip irrigation) under the government supporting program.

4) Efficient water management - Low ratio of actually irrigated area and low irrigation efficiency are due to insufficient operation and poor maintenance works by the farmers' group. Training and demonstration programs on water management for the individual farmers should be organized to improve and maximize irrigation efficiency.

5) Responsibilities of DOA and farmers' group - In this M/P, responsibilities of DOA and farmers' group are as below;

DOA	- Training and assistance to the farmers' group for organizing WUA - Survey, investigation and design of minor irrigation system - Guidance and supervision of construction or improvement of irrigation system - Training to the WUA for O&M
Farmers' group	- Construction of irrigation system including subletting works to the contractor - Development of on-farm irrigation facilities - Operation and maintenance

6) Coordination and linkage with other department - As the irrigation development is also being-on by the other department, such as IPH department, RDD, etc., it is necessary to coordinate with them to implement irrigation development smoothly for crop diversification.

This development program is proposed to be implemented though bottom-up way with need-based planning under farmers' participatory approach.

(a) Full Irrigation

- Flow irrigation

In hilly area, there are small rivers called Nallah flowing with sufficient gravity heads which are being tapped for irrigation. Snow-fed water sources are available in Kinnaur, Kullu, Lahaul & Spiti and other snow rich areas. The flow irrigation caries water by gravity from water sources to the field through canal system with construction of intake facilities and weir (called as check dam) in most cases. The primary canals are proposed to be lined and/or pipeline according to the site conditions.

- Lift irrigation

Lift irrigation systems are developed (with construction of check dam in some cases) to carry water by means of pumps from the water source to the delivery chamber, which distributes the water to the fields by suitable distribution system, such as lined canal in most cases and/or pipeline.

- Groundwater irrigation (tube well)

The valleys in Kangra, Mandi, Sirmaur, Solan and Una districts have potential aquifer, where groundwater can be exploited for small scale irrigation and micro-irrigation. The discharge of the wells generally varies from 10 to 40 lit/s, which can be utilized by construction of tube well schemes (mostly shallow tube well).

(b) Life saving irrigation (Communal base)

- In the State, there are many springs and small streams which are one of the major sources of small scale irrigation, where water can be brought from these sources to the small tanks through pipes or tubes and can be used for irrigation. Water harvesting check dam is required in some cases. The tank irrigation utilizing such local water source is suitable for the area where water sources are not available for full irrigation.

- Micro catchment rain water harvesting

Micro catchment rain water harvesting is one of the measures to solve water shortage due to less precipitation in hilly area where the other suitable water source is not available. These water harvesting is developed by means of farm pond with earth embankment or concrete storage tank. Collector channels are required to gather and convey the rain water in the catchment into the storage. The irrigation water is to be delivered to the field through pipe or tube, instead of earth canal to minimize the conveyance loss.

Flow Irrigation

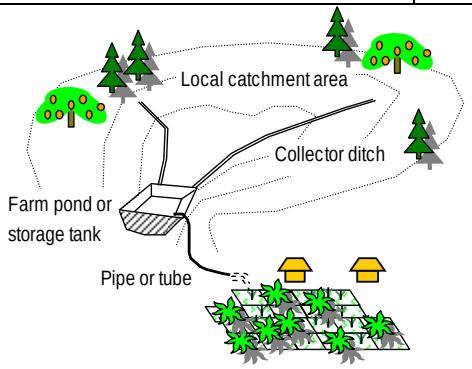
Irrigation Canal of Flow Irrigation

Water Harvesting Check Dam

Groundwater Irrigation (Tube well)

Tank Irrigation

Micro Catchment Rain Water Harvesting Tank



Sketch of Micro Catchment Rain Water Harvesting

Micro Catchment Rain Water Harvesting (Trial and research in Palampur university)

- In addition to the above, demonstration of micro irrigation (drip and sprinkler irrigation) is proposed at the selected advanced area to expedite the existing government subsidy program. The demonstration will be carried out under the proposed program component in corporation with the vegetable promotion program including demonstration of poly house mentioned in Annex B.

(2) Access Farm Road

Farm roads to be developed in the M/P is defined as “access farm road” for crop diversification, and are not covered by PWD.

1) Construction of connecting roads from farm land / villages to main roads -Development of the farm access roads is vital to the crop diversification, because transportation quantities of produce will increse by about ten times in weight from food grain to vegetables. In the series of workshops it is also confirmed that the poor condition of the farm access roads is one of the major constraints in smooth crop diverisification, and hence the farmers strongly request to develop the farm roads in their farm.

2) Improvement, repair and rehabilitation of existing roads – Existing access farm roads are generally narrow with no pavement. Due to this condition, only human, bicycle, motorcycle and bajaj are passable. The roads are often damaged by land slides. Therefore, the M/P covers improvement and up-grading of existing farm roads by paving, widening and provision of additional structures. Repair and rehabilitation of damaged existing farm roads are proposed. Construction or improvement of existing footpath and mule track are also taken into consideration.

3) Construction of ropeways - In such areas where new road construction is not technically and economically feasibility, ropeway with prime mover will be utilized for transportation of agricultural inputs and products.

4) Construction of on farm road – Crop diversification will be also conducted in remote farmland beyond the proposed farm access. In such area, it is recommended that rural community will provide further access or on-farm path connecting the proposed access farm roads in order to mitigate burden of manual transport of diversified crops as illustrated in Fig.H-3.1.

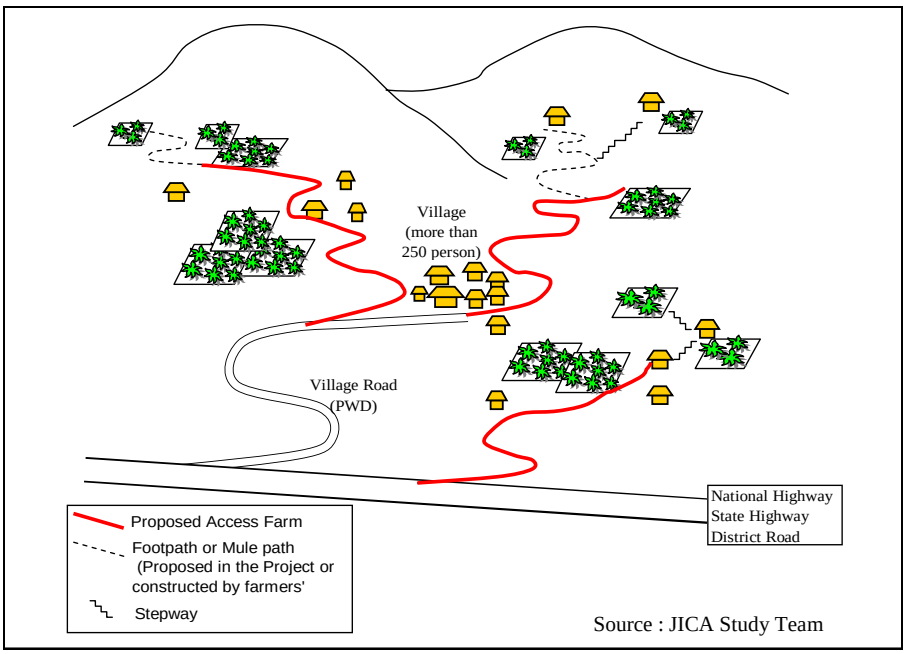


Fig. H-3.1 Sketch of Typical Farm Access Roads in Hilly Area

5) Responsibilities of DOA and farmers' group - In this M/P, responsibilities of DOA and farmers' group are as below;

DOA	- Training and assistance to the farmers for organization of farmers' group for implementation of the access farm road development - Survey, investigation and design of irrigation system - New construction and improvement works of access farm roads not covered by PWD. - Training to the farmers' group for maintenance works
Farmers' group	- New construction and improvement of relatively small and flat roads including subletting the works to the contractor - Development of further access on-farm roads such as footpath, and/or steps in the remote area. - Maintenance works as needed

6) Coordination and linkage with the road section of APMC - As the farm road construction is also going-on under the program of APMC (market link road), it is necessary for DOA to coordinate with the road section of APMC to improve the condition of the farm roads in the target areas.

H-3.2 Program Component of Infrastructure Development

Under such situations mentioned in the previous sections, program component for infrastructure development has been prepared. The target, output, executing organization and proposed activities of the components both for infrastructure development / improvement and infrastructure development support are listed below.

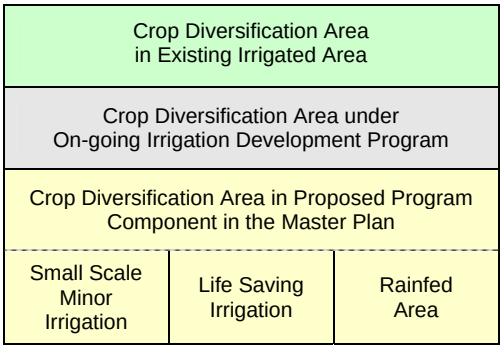
Table H-3.1 Outline of Infrastructure Development/Improvement

Item	Outline of Component
Target	Crop diversification will be promoted and accelerated.
Outputs	1. Irrigation area will be expanded. 2. Transportation capacity for agricultural produces will be increased.
Activities	Major activity 1. Construction of new minor irrigation systems 2. Rehabilitation and improvement of existing minor irrigation and traditional irrigation systems 3. Construction of supplementary irrigation 4. Construction of micro irrigation for demonstration 5. Construction of new farm roads which will not be covered by PWD. 6. Improvement of existing farm roads 7. Construction and improvement of existing footpath and mule track 8. Construction of ropeway
Related Components	Vegetable Cultivation, Exotic Vegetable Cultivation, Food Grain Crop Productivity Improvement, Infrastructure Development Support
Execution Organization	Execution：Divisional and Sub-divisional Soil Conservation Offices of Department of Agriculture Supporting：District & Block Agriculture Offices

H-3.3 Target of Irrigation Development

Target crop diversification area (total incremental vegetable production area in Kharif and Rabi seasons) mentioned in Annex-F is further categorized into the followings, according to the availability of irrigation facilities.

1) Crop diversification area in existing irrigable area
2) Crop diversification area in further development of irrigation system
   * Area in new irrigation system under on-going program of IPH and DOA
   * Area in new irrigation system under the proposed program
3) Crop diversification area in life saving irrigation area (supplementary in Kharif season)
4) Crop diversification area in rainfed area



Source: JICA Study Team

Figure H-3.2 Demarcation of Crop Diversification Area in Irrigation Area

In this master plan study, the target irrigation development area is estimated by the following assumption and procedure.

(1) In existing irrigable area, especially in the Category -III (mostly in the AEZ-1), crop diversification has not been well progressed. Therefore, firstly, crop diversification from food grains in Kharif season to vegetable is considered without new construction of irrigation system.

(2) In new irrigable area in irrigation systems which will be constructed by IPH and DOA under the on-going RIDF (Rural Infrastructure Development Fund) program, crop diversification will be expected with extension services by DOA.

(3) The balance area is to be developed under the proposed program.

(4) For estimating required irrigation development area, proposed crop intensity is assumed taking into food security for small and marginal farmers into consideration.

(5) The irrigation area under the proposed program is divided into 3 types of irrigation system, namely, i) small scale minor irrigation, ii) life saving irrigation and iii) rainfed area, with reference to the results of the pre-feasibility study in the sample area.

Irrigation development area for the Mater Plan period for 15 years is estimated at 20,900 ha, consisting of 16,000 ha for minor irrigation and 4,900 ha for life saving irrigation. The category-wise proposed crop diversification area and proposed irrigation development area are summarized as below:

Table H-3.2 Proposed Crop Diversification Area

Unit ; ha

Category	Proposed Crop Diversification Area; Incremental Vegetable Cropped Area in Kharif & Rabi					
	In Existing Irrigated Area	On-going Program (DOA+IPH)	Proposed Program			Total
			Minor Irrigation	Life Saving Irrigation	Rainfed Area	
I	1,100	3,800	1,300	2,400	2,800	11,400
II	700	2,700	1,000	1,900	2,200	8,500
III	10,200	11,200	4,100	200	200	25,900
IV	2,300	1,800	600	400	400	5,500
Total	**14,300**	**19,500**	**7,000**	**4,900**	**5,600**	**51,300**

Source: JICA Study Team

Table H-3.3 Proposed Irrigation Development Area

Unit ; ha

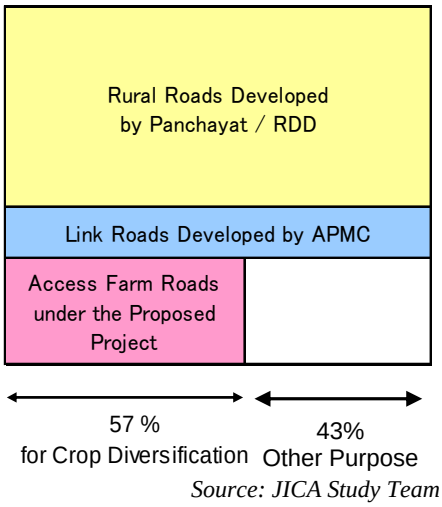
Category	Proposed Irrigation Development Area					
	In Existing Irrigated Area	On-going Program (DOA+IPH)	Under Proposed Program			Total
			Minor Irrigation	Life Saving Irrigation	Rainfed Area	
I	-	9,300	3,000	2,400	-	14,700
II	-	6,900	2,300	1,900	-	11,100
III	-	24,400	9,300	200	-	33,900
IV	-	4,400	1,400	400	-	6,200
Total	**-**	**45,000**	**16,000**	**4,900**	**-**	**65,900**

Source: JICA Study Team

H-3.4 Target of Access Farm Road Development

Access farm roads to be implemented by DOA under the proposed program for the Master Plan period of 15 years are estimated with the following conditions.

- Total length of farm roads required in the entire State are estimated on the basis of results of the sample study at the pre-feasibility level. In the sample area, necessary farm roads were listed up by the farmers group in the process of participatory resource mapping, based on the topographic survey and preliminary design.
- From the results of pre-feasibility study, required length per cultivated area is calculated for two types of topographical conditions, namely low plain area and hilly steep area.
- Construction of rural road will be continued under the on-going program by the Panchayats and APMC with the



Source: JICA Study Team

Fig. H-3.3 Demarcation of Farm Road Development

certain progress as same as that in the previous years, however does not limit to the farm access road in the crop diversification area. Rural road of 5,250 km to be developed by Panchayat / RDD is estimated on the basis of past 3-years achievement, and the link road of 450 km to be developed by APMC is also estimated on the basis of past 2-years achievement.

- DOA will execute the construction of balance roads, contributing to the diversification, which will not be covered by the Panchayat and APMC, as illustrated in Figure H-3.3.
- During the workshops in this study, 57% out of 75 blocks noted that one of the major constraints is insufficient farm road networks for the crop diversification. The access farm roads which contribute to promotion of vegetable and fruits are therefore assumed to be 57% of the entire cultivated area, while other rural roads locates in the food grain area and/or contribute to the social purpose.

Based on the above conditions, access farm roads to be developed by DOA are estimated at 1,330 km for the Master Plan (15 years) as summarized below: For footpath and mule path, required length for entire Stets in estimated at 150 km based on the sample design in the sample study at pre-feasibility level.

Table H-3.4 Required Length of Farm Road

Farm Road	Entire Rural Area	For Crop diversification (57%)
Required Farm Road	8,040 km	4,580 km
- Rural road developed by Panchayat / RDD	5,250 km	2,990 km
- Link road developed by APMC	450 km	260 km
- Balance	2,340 km	1,330 km
Required Access Farm Road for Crop Diversification Area under the Proposed Program in 15 years	-	1,330 km

Source : JICA Study Team

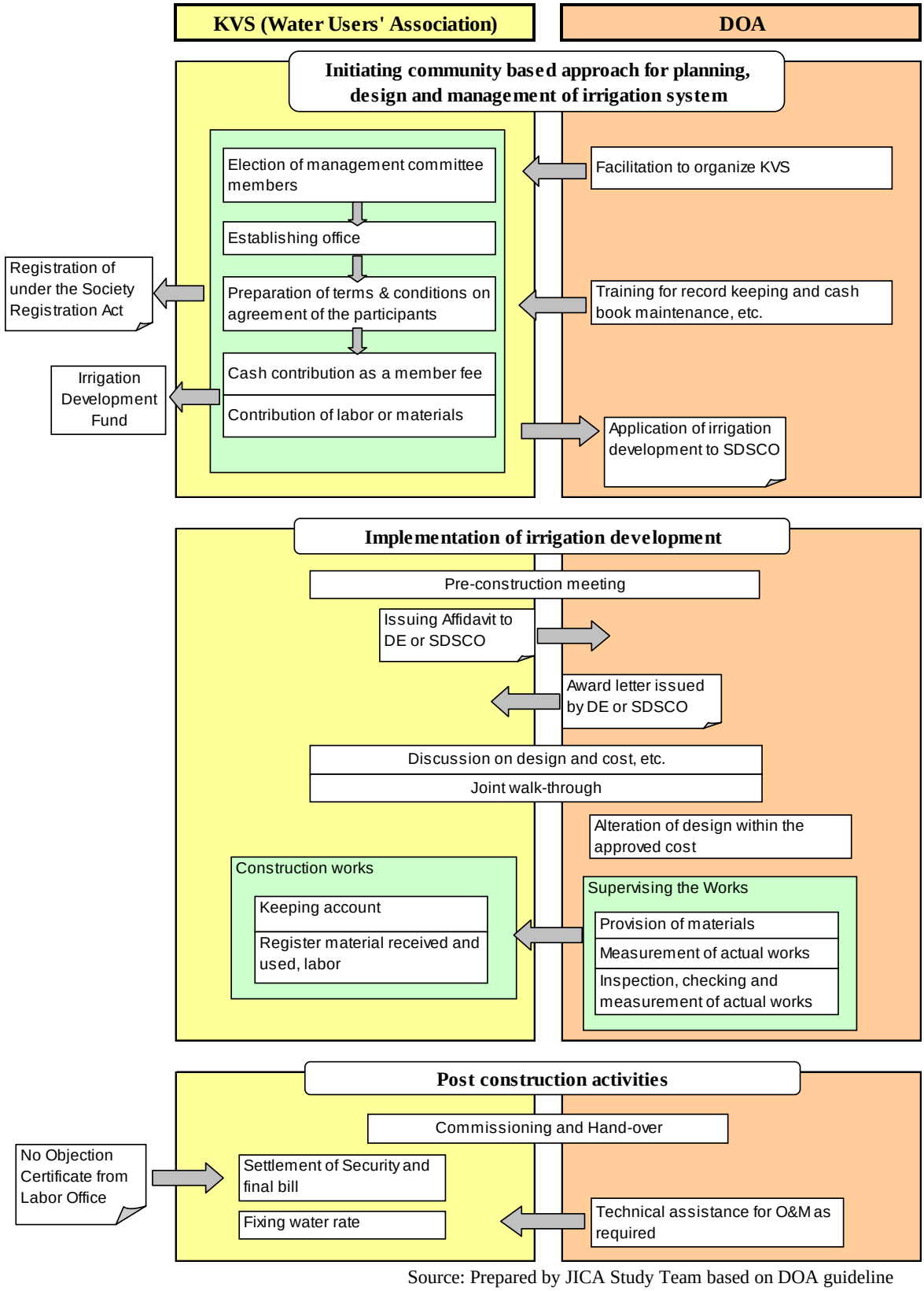
H-3.5 Proposed Infrastructure Development Support Plan

(1) Irrigation

The gap between the area with irrigation facilities and actual irrigated area is high, and hence increasing the irrigation efficiency through proper water management is required, which should be realized by strengthening of Water Users Associations (KVS) under training to be provided by the government. Besides, their management capability should also be improved together with provision of irrigation facilities. In addition, farmers' own irrigation facilities, either private or communal, such as irrigation tanks, micro-irrigation facilities (sprinkler and drip irrigation) are improved by themselves through the promotion of existing subsidy system of the government.

The infrastructure development under the proposed program will be implemented with community needs base by the farmers' participatory approach, which is not only after handing over of the facilities to the farmers' group but also before implementation of the works.

The proposed infrastructure development support includes; 1) Orientation and support on organization of farmers' group, 2) Capacity development of project management before, during and after the construction works, 3) guidance and training on proper operation and maintenance works. The proposed activities are referred to the existing guideline for irrigation works under the Rural Infrastructure Development Fund (RIDF), as summarized below.



Source: Prepared by JICA Study Team based on DOA guideline

Fig. H-3.4 Procedure of the Works to be done by KVS and Correlation with DOA

(2) Access Farm Roads

In infrastructure development support for farm access road, the minor maintenance works are proposed to be carried out by the maintenance committee of Panchayat.

DOA will conduct training for capacity development of Panchayat in tendering and contracting for the improvement work of the existing farm roads and in construction supervision and maintenance capacity.

(3) Program Component of Infrastructure Development Support

The target, output, executing organization and proposed activities of the components both for infrastructure development / improvement and infrastructure development support are listed below.

Table H-3.5 Outline of Infrastructure Development Support

Item	Outline of Component
Target	Agriculture infrastructure development and O&M for crop diversification will be expedited and improved through farmers' participatory approach.
Outputs	1. Irrigation efficiency will be improved through proper O&M and water management. 2. Farm road will be well maintained by farmers' group
Activities	Major activity 1. Organization and strengthening of WUA for improvement of water management 2. Organization and strengthening of O&M activities for road and other infrastructures concerned by farmers' groups 3. Strengthening of supporting system for farmers' irrigation system by demonstrating micro irrigation (sprinkler and drip irrigation, etc.) Supporting activities 3. Monitoring and Evaluation
Related Components	Vegetable cultivation, Exotic vegetable cultivation, food grain crop productivity improvement, Infrastructure development / improvement
Execution Organization	Execution：Divisional and Sub-divisional soil Conservation Offices of Department of Agriculture Supporting：District & Block Agriculture Offices

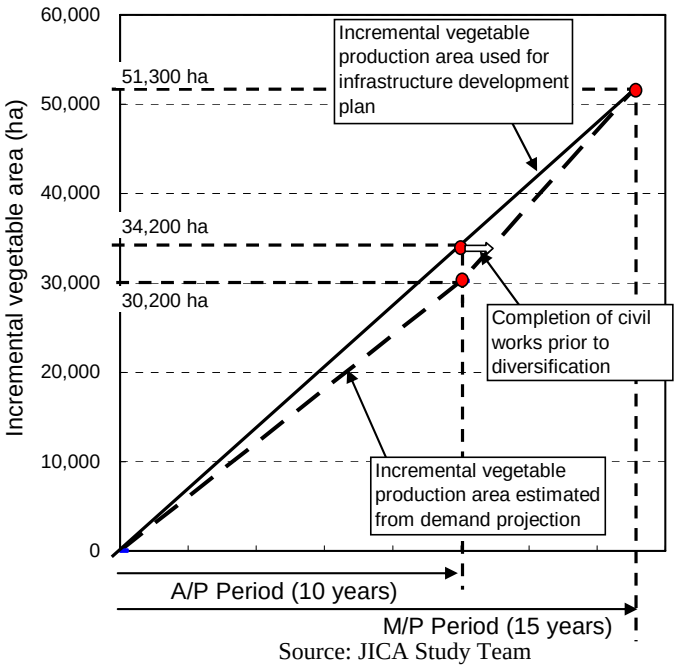
H-4 Action Plan for Infrastructure Development

H-4.1 Target under Action Plan

(1) Irrigation Development Area

The target infrastructure development in the 10-year period of A/P was simply estimated by applying the ratio of the duration from the total requirements in the master plan period of 15 years while the estimate of incremental vegetable area for 10 years is estimated from demand projection as mentioned in the previous section. The civil works development should have the same progress rate in both first 10 years and remaining 5 years as shown in Fig.H-4.1.

Target irrigation development of Action Plan up to 2017/18 is estimated from the requirement in the Master Plan, of which the category-wise development area is summarized below.



Source: JICA Study Team

Fig. H-4.1 Correlation between Crop Diversification Target and Irrigation Development

Table H-4.1 Infrastructure Development Plan

Infrastructure	M/P Period (15 years)	A/P Period (10 years)
Irrigation	20,900 ha	14,000 ha
(Full Irrigation)	(16,000ha)	(10,700 ha)
(Life Saving Irrigation)	(4,900 ha)	(3,300 ha)

Source : JICA Study Team

Table H-4.2 Target Irrigation Development Area of Action Plan

Irrigation Area	Diversification to Vegetable Area	Target Farmland for Irrigation	Remarks
Existing Irrigation Area	9,500	-	
Irrigation Area to be developed by On-going Programs	13,000	-	
Minor Irrigation Area	4,700	10,700	
Supplementary Irrigation Area	3,300	3,300	
Rainfed Area	3,700	-	
Total	34,200	14,000	
Irrigation Needs in Workshop		18,000	Short List
		33,200	Long List

Note; Short list: relatively realistic needs, Long list: needs with less information

Table H-4.3 Proposed Irrigation Development Area in Action Plan

Unit ; ha

Category	Proposed Irrigation Development Area					
	In Existing Irrigated Area	On-going Program (DOA+IPH)	Under Proposed Program			Total
			Minor Irrigation	Life Saving Irrigation	In Rainfed Area	
1	-	6,200	2,100	1,600	-	9,800
2	-	4,600	1,500	1,300	-	7,400
3	-	16,300	6,200	100	-	22,600
4	-	2,900	900	300	-	4,100
Total	-	**30,000**	**10,700**	**3,300**	-	**43,900**

Source : JICA Study Team

The above area is further categorized into new construction and improvement of existing system including three irrigation types, namely flow irrigation, lift irrigation and life saving irrigation based on the ratio obtained from the short list in the workshop as shown below.

Table H-4.4 Target of Irrigation Development by Types

	Minor Irrigation	Life Saving Irrigation
New Construction		
FIS	3,012 ha	
LIS	2,405 ha	
GW	1,950 ha	
RWH, Tank		2,976 ha
Sub-total	7,367 ha	2,976 ha
Improvement / Rehabilitation		
FIS	3,172 ha	
LIS	68 ha	
GW	93 ha	
RWH, Tank		324 ha
Sub-total	3,333 ha	324 ha
Total	**10,700 ha**	**3,300 ha**

Source : JICA Study Team

The quantity of the installation of the micro irrigation in the demonstration areas is estimated with the condition that fifteen (15) locations in each block under the category 1 and 2 (15 nos. x 32 blocks = 480 nos.).

(2) Access Farm Road Development

Target access farm road development in Action Plan up to 2017/18 is also estimated applying the ratio of the duration from the total requirement in the master plan period for 15 years, as summarized below.

Table H-4.5 Target Access Farm Road Development for Crop Diversification

Farm Road	Required Length of General Farm Road	Crop Diversi-fication related F. Road (57%)	Remarks
Farm Road Construction by RDD	1,520	2,010	
Farm Road Construction by APMC	130	170	
Access Farm Road Construction by Department of Agriculture	-	890	
Total		3,070	
Access Farm Road Needs in Workshop		1,900	Short List
		4,600	Long List

Note; Short list: relatively realistic needs, Long list: needs with less information, RDD: Rural Development Department, APMC: Agricultural Produce Market Committee of Market Board

Table H-4.6 Target Access Farm Road Development for Master Plan and Action Plan Period

Infrastructure	M/P Period (15 years)	A/P Period (10 years)
Access Farm Road	1,330 km	890 km
Improvement	610 km	410 km
New	720 km	480 km
Footpath/ Mule Path	230 km	150 km

Source : JICA Study Team

District-wise proposed quantities of the access farm road, mule path and footpath are estimated applying same method, as summarized below.

Table H-4.7 District-wise Proposed Quantities of Access Farm Road, Mule Path and Footpath

Name of District	Access Farm Road			Mule Path & Footpath		
	Improv. (km)	New (km)	**Total (km)**	Mule Path (km)	Footpath (km)	**Total (km)**
Bilaspur	18	14	**33**	6	2	**8**
Chamba	32	46	**77**	8	3	**11**
Hamirpur	25	20	**44**	8	3	**11**
Kangra	81	70	**151**	26	8	**34**
Kinnaur	6	8	**15**	1	1	**2**
Kullu	29	43	**73**	7	2	**9**
Lahaul-Spiti	5	8	**15**	1	1	**2**
Mandi	70	95	**165**	17	6	**23**
Shimla	63	91	**154**	15	5	**20**
Sirmour	28	32	**61**	8	3	**11**
Solan	28	33	**61**	8	3	**11**
Una	24	19	**42**	8	3	**11**
State Total	410	480	**890**	113	38	**150**

Source : JICA Study Team

H-4.2 Infrastructure Development Plan

(1) Infrastructure Development/Improvement Plan

The action plan related to each activity and its requirements are mentioned below.

Table H-4.8 Proposed Action Plan of Infrastructure Development/Improvement

Activity	Proposed Plan	Requirement and Schedule
Construction of new minor irrigation systems	• Development of Flow irrigation, including construction of check dam • Development of Lift irrigation, including construction of check dam • Development of Groundwater irrigation	• 7,370 ha for 10 years
Rehabilitation and improvement of existing minor irrigation and traditional irrigation systems	• Rehabilitation and improvement of existing intake facilities and canals, mainly to upgrade from Katcha (earth works) to Pacca.(concrete works)	• 3,330 ha for 10 years
Construction of water harvesting facilities for life saving irrigation	• Development of Rain water harvesting with collector channel and farm pond / tank • Development of Tank irrigation utilizing water source of small stream and spring	• 3,300 ha for 10 years
Provision of micro irrigation for demonstration	• Provision of drip and sprinkler irrigation in advanced areas in the category I and II for demonstration	• 15 locations in 32 blocks for 3 years period
Construction of new farm roads which will not be covered by PWD.	• Construction of new access farm road, including formation cut, construction of retaining wall, drainage structure, bridges and pavement	• 480 km for 10 years
Repair and rehabilitation of damaged existing farm roads	• Widening of existing farm road • Pavement of existing farm road including water bound macadam, pre-mix bituminous carpet or asphalt and cement concrete • Improvement of the existing muddy road	• 410 km for 10 years
Improvement of existing footpath and mule track	• Upgrading to motorable road • Pavement of existing footpath with cement concrete	• Program continues for a 10 years period

(2) Infrastructure Development Support Plan

The action plan related to each activity and its requirements are mentioned below.

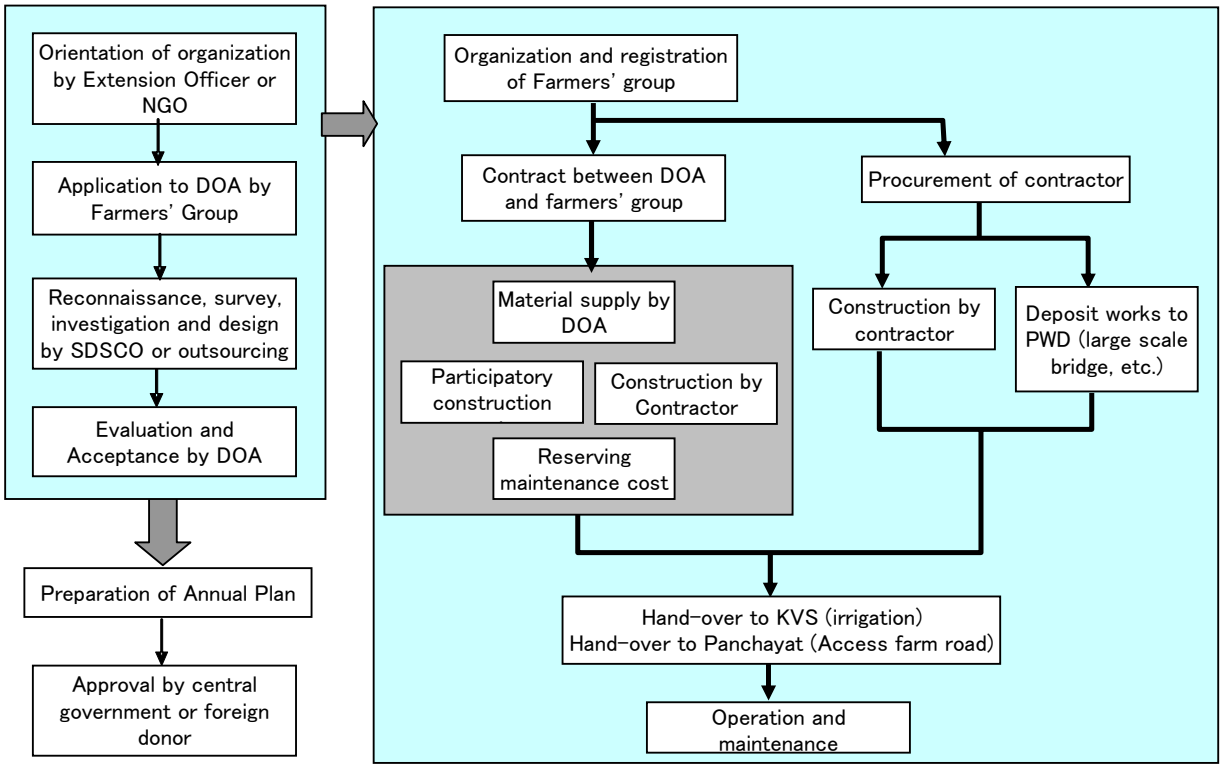
Table H-4.9 Proposed Action Plan of Infrastructure Development Support

Activity	Proposed Plan	Requirement and Schedule
Strengthening of WUA for improvement of water management	• Capacity building trainings on technical and management aspects of O&M	• Employment of local consultants for each block for 10 years period • Trainers for capacity building • Arrangement of training materials
Strengthening of O&M activities for road and other infrastructures managed by farmers' groups	• Capacity building trainings on technical and management aspects of O&M	• Employment of local consultants for each block for 10 years period • Trainers for capacity building • Arrangement of training materials
Strengthening of supporting system for farmers' irrigation system including micro irrigation (sprinkler and drip irrigation, etc)	• Demonstration and training for new micro irrigation	• Program continue for a 10 years period

H-5 Implementation Plan

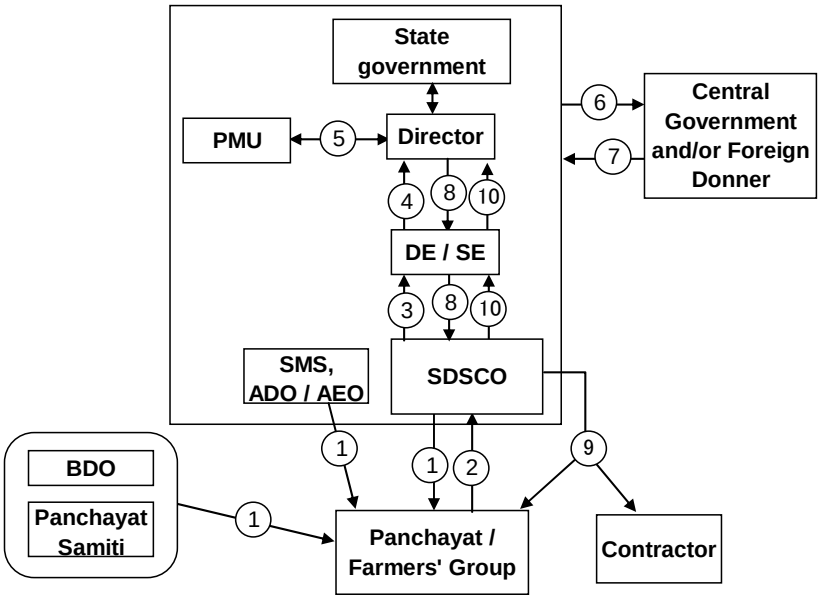
H-5.1 Procedure of Implementation

Development target of increased irrigation area by 2022/23 is discussed in the previous section considering the progress of the macro-frame of required diversified area under irrigation and on-going development progress as well. This development program should be implemented though bottom-up way with need-based planning under farmers' participatory approach. In case of access farm road construction, farmers' participatory construction works shall apply as much as possible. However, due to the scale of the works and difficulty requiring heavy construction equipment, some works will be sublet to the contractor, especially for new construction in hilly area. Typical workflow of infrastructure development is shown as below.



Source: JICA Study Team

Fig. H-5.1 Typical Workflow of Infrastructure Development



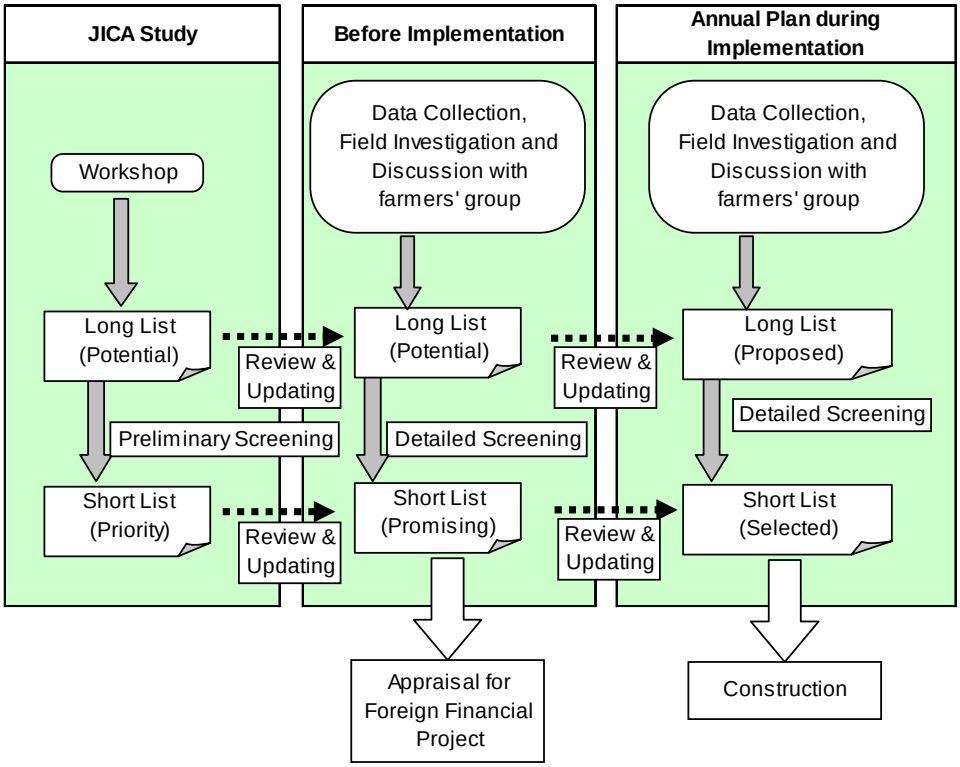
① Orientation and consultation for preparation of Application Form
② Preparation and submission of Application Form
③ Preliminary reconnaissance survey, design and cost estimate and submission of DPR to DE
④ Submission of DPR to Director through SE for appropval
⑤ Review, approval of DPR and preparation of Annual Plan
⑥ Submission of Annual Plan to the foreign donner for concurrence
⑦ Concurence of Annual Plan
⑧ Approval for commencement of implementation to SDSCO through SE & DE
⑨ Tendering process to Contractor and signing of Contract
⑩ Submission of Evaluation Report to Director through DE and SE

Source: JICA Study Team

Fig. H-5.2 Typical Process of Infrastructure Development Works

H-5.2 Selection and Screening of the Candidates of Project

In this master plan, various workshops were conducted to formulate the crop diversification master plan, as well as preparation of the list of candidate project, which are compiled in the long list and short list. The long list has the projects with incomplete information especially area oriented data. The long list was preliminary screened into the short list which has relatively realistic needs. This short list should be reviewed and updated from time to time prior to commencement of the implementation of the proposed program and also in the course of implementation during the action plan period.



Source: JICA Study Team

Fig. H-5.3 Proposed Flow of Screening of Candidate Sub-projects

Before implementation, selection and screening criteria should be prepared taking the following points into consideration.

(1) Irrigation

- The proposed irrigation project shall contribute to the on-going or planned crop diversification, mainly from food grain to vegetable.
- The system should be minor irrigation or life saving water harvesting facilities (in principle, irrigable area is less than 50 ha).
- Improvement of existing system is given higher priority because of easiness of the works and expected earlier project benefits.
- The maturity of project preparation is also important. Projects with more data and information have a higher priority than that with less data and information. Especially, potential of the available water sources shall be confirmed, which has a higher priority than that with less information about water sources.
- Projects with more beneficiaries have a higher priority than that with fewer beneficiaries.
- Projects supported by farmers with stronger willingness have a higher priority than that without farmers' willingness. Farmers' group (KVS) shall be organized and be active.
- The projects for which sanctions were given or application were submitted to any government program should be dropped from the candidate projects.

(2) Access farm roads

- The access farm roads which contribute for promotion of off-season vegetable and temperate fruit. Already promoted area is given 1st priority. Major purpose shall be off-season vegetable though it can be utilized for other purpose which can be constructed by other

agencies.

- Improvement of the existing muddy road during harvest due to poor drainage and un-surfacing.
- New road which is free from land conflict for construction of road and disposal area for the excavated material (agreement for development of spoil bank to be converted to terrace crop field by the committee: construction cost will be paid.).
- Availability of access farm road maintenance committee.
- Agreement for minor maintenance by the maintenance committee.
- Area of off season vegetable and/or temperate fruits along the proposed road shall be more than 5ha/km.
- Proposed new road shall avoid encroach into restricted area as forest.
- Present manual transport distance less than 500m will not be included.
- Expensive and not feasible new road because of many zigzags and long bridge shall be discarded, and alternatives such as footpath, step or ropeway shall be considered.
- If the number of prospective candidate is too many, only one development site shall be selected for one Panchayat
- For smooth capacity development on design, construction and project management, following standard ranking is considered.

  (1) First year : To start improvement of existing farm road by subletting to the contractor

  (2) Second year : To start improvement of existing farm road by farmers' participatory works and to start construction of new roads by subletting to the contractor

  (3) Third year : To start construction of new roads by farmers' participatory (relatively small scale works)

H-5.3 Implementation Organization

(1) Strengthening of Soil and Water Conservation Division

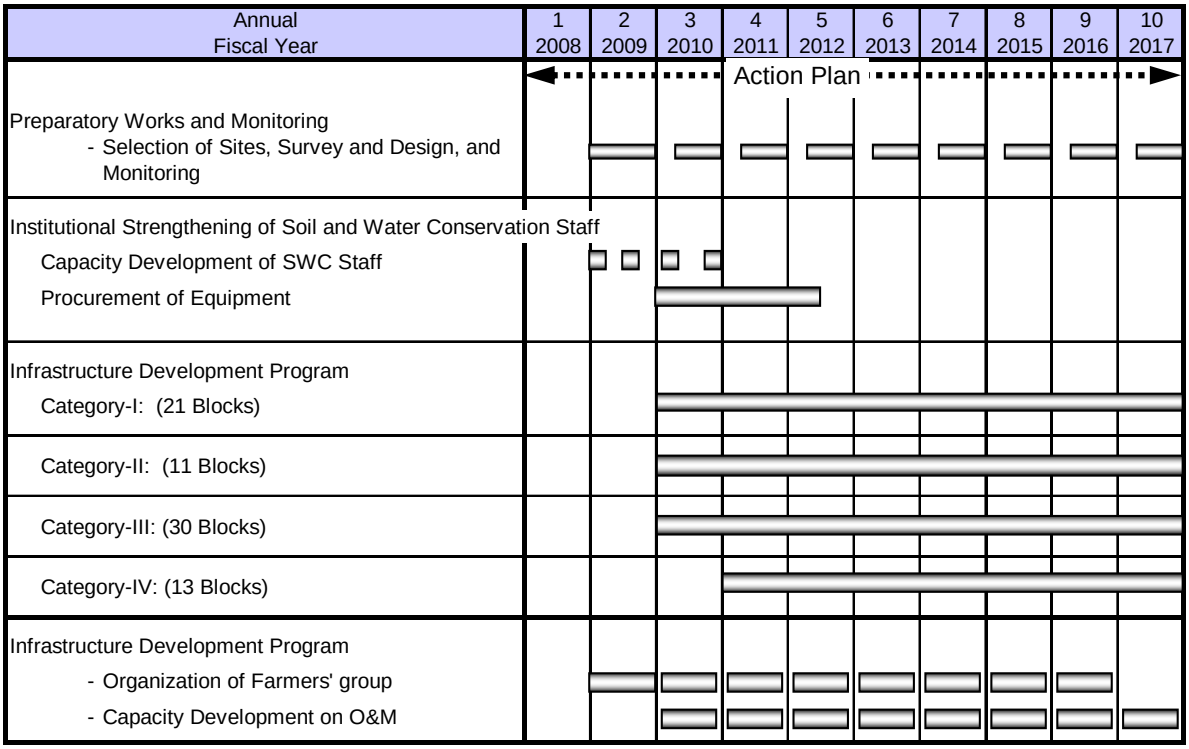
As discussed in the previous section, quantity of irrigation development works to be executed by the DOA will increase to attain the required progress of crop diversification. As for farm road, DOA will expand road construction activities to the proposed access farm road. For these engineering activities should be under the responsibilities of the Soil and Water Conservation (SWC) Wing of DOA, and hence the capacity of the SWC shall be strengthened including enhancement of Sub-divisional Soil Conservation offices and their staff through training and increase of staff number. For management of all the activities including engineering and administration, one Superintending Engineer is proposed to be appointed in the proposed organization. The proposed organization of SWC is described in Annex - E.

(2) Outsourcing

Because of the suitable size of the government, it is proposed that some works should be sublet to local outsource such as local consultants and NGOs. For topographic survey, investigation including geological and soil survey, design and preparation of detailed project report (DPR) can be done by outsourcing of the local consultants, and organization of farmers' groups can also be sublet to the consultants or suitable NGOs under supervision of SDSCO.

H-5.4 Implementation Time Schedule

Infrastructure development program shall be well harmonized with other programs such as vegetable promotion and food grain productivity improvement program, etc. considering category wise crop diversification strategy. Based on the overall crop diversification strategic time frame, implementation schedule of infrastructure development and support program are shown in Fig. H-5.4.



Source: JICA Study Team

Fig. H-5.4 Implementation Time Schedule of Infrastructure Development and Support

H-5.5 Preliminary Cost Estimate

(1) Basic Conditions for Cost Estimate for Infrastructure

Cost has been estimated based on the past experiences in DOA, results of sample study at pre-feasibility level and workshop's result. The estimate is on preliminary basis on the following conditions.

i) The construction works for minor and life saving irrigation will be executed on community contract basis with DOA's support in survey, design and construction. On the other hand, the construction works for access farm roads will be executed on contract basis, in principle.

ii) For irrigation, preliminary design was made at pre-feasibility study level in sample areas, including topographic survey based on the resource map prepared by the farmers' group of the Panchayats. However, these sample design did not cover all types of construction works of irrigation system. Also, as sample designs of lift irrigation in hilly area have resulted high construction cost and operation cost because of high pumping head more than 100 m, most of the plans are not economically feasible. In addition, high pump output capacity will be beyond the capacity of farmers' operation and maintenance, and hence some costs estimated in sample design is not representing average cost for entire state. In such case, average costs by different types which were obtained from the short list estimate was made by each SDSCO are applied.

Average cost per hectare and cost estimate are summarized in Table H-5.1. District-wise cost estimate is summarized in Attachment H-1.

Table H-5.1 Cost of Irrigation System

	Minor Irrigation (ha)	Life Saving Irrigation (ha)	Cost per ha (Lac/ha)	Amount (Rs.million)
New Construction				
FIS	3,012.0		1.0	301
LIS	2,405.6		2.0	481
GW	1,949.6		2.0	390
RWH, Tank		2,976	0.7	208
Rehabilitation				
FIS	3,171.7		0.5	159
LIS	67.9		1.5	10
GW	93.2		1.0	9
RWH, Tank		324	0.3	10
Total	**10,700**	**3,300**		**1,568**

Cost of demonstration of micro-irrigation is estimated using unit cost obtained from the average of on-going program under SDSCO, which is 0.46 Lac/nos. The total cost is estimated as below.

Nos. per Block	Blocks	Unit cost / nos.	Total Cost
15	32 (in category 1 & 2)	0.46 Lac/nos.	Rs. 22 million

iii) For access farm road, preliminary design was made at pre-feasibility study level in sample areas, including topographic route survey based on the resource map prepared by the farmers' group of the Panchayats. These results are summarized in Attachment H-2 and compiled as an average costs per km for the four types of roads; namely (1) Improvement & upgrading of existing roads in plain area, (2) Improvement & upgrading of existing roads in hilly area, (3) New construction in plain area, and (4) New construction in hilly area. These average costs are applied to the other area in 75 blocks and arranged in 12 districts. For footpath and mule path also, design and cost estimate in sample area both of plain area and hilly area were used for preliminary estimate for all the blocks applied.

The district-wise required length and cost estimate are summarized in Tables H-5.2 and H-5.3.

Table H-5.2 District-wise Required Length and Cost of Access Farm Road

Name of District	Improvement		New construction		Total	
	(km)	(Rs.'000)	(km)	(Rs.'000)	(km)	(Rs.'000)
Bilaspur	18	14,010	14	21,487	33	35,497
Chamba	32	37,010	46	164,631	77	201,641
Hamirpur	25	19,263	20	29,543	44	48,806
Kangra	81	65,465	70	130,537	151	196,002
Kinnaur	6	6,938	8	30,862	15	37,799
Kullu	30	34,513	43	153,526	73	188,039
Lahaul-Spiti	6	6,872	8	30,568	15	37,440
Mandi	70	78,487	95	332,819	165	411,306
Shimla	63	73,456	91	326,759	154	400,215
Sirmour	28	27,882	33	96,678	61	124,561
Solan	28	28,219	33	100,456	61	128,674
Una	24	18,442	19	28,283	42	46,725
State Total	410	410,557	480	1,446,149	890	1,856,705

Source : JICA Study Team

Table H-5.3 District-wise Required Length and Cost of Mule Path and Footpath

Name of District	Mule Path		Footpath		Total	
	(km)	(Rs.'000)	(km)	(Rs.'000)	(km)	(Rs.'000)
Bilaspur	6.0	5,527	1.9	1,009	7.9	6,535
Chamba	7.7	7,145	2.5	1,304	10.2	8,449
Hamirpur	8.2	7,599	2.7	1,387	10.9	8,986
Kangra	25.7	23,742	8.4	4,333	34.0	28,076
Kinnaur	1.4	1,339	0.5	244	1.9	1,584
Kullu	7.2	6,663	2.3	1,216	9.6	7,879
Lahaul-Spiti	1.4	1,327	0.5	242	1.9	1,569
Mandi	16.9	15,633	5.5	2,853	22.4	18,486
Shimla	15.3	14,181	5.0	2,588	20.3	16,770
Sirmour	7.9	7,273	2.6	1,327	10.4	8,601
Solan	7.8	7,180	2.5	1,311	10.3	8,491
Una	7.9	7,275	2.6	1,328	10.4	8,603
State Total	113.4	104,884	37.0	19,142	150.3	124,029

Source : JICA Study Team

The construction cost of ropeway with relatively short span is estimated based on the preliminary design in sample area.

iv) The cost of SID (survey, investigation and design) and construction supervision, which will be sublet to the local consultant as outsourcing is estimated based on the standard cost of SWC for preparation of DPR (Detailed Project Report of the on-going program under NABARD, adding the construction supervision works throughout the works, total of which is estimated at 5% of the construction cost.

v) The cost for Infrastructure Development Support is estimated based on the typical training activities in the proposed project areas both for irrigation and access farm road development as summarized in Attachment H-4.

(2) Preliminary Cost Estimate for Infrastructure

The preliminarily estimated cost is summarized as below.

Table H-5.4 Summary of Preliminarily Estimated Cost

Description	Quantity	Amount (Rs.Million)
1. Infrastructure Development/Improvement [*1]		
(1) New Construction of Minor Irrigation		
- Flow Irrigation	3,012 ha	301
- Lift Irrigation	2,406 ha	481
- Tubewell	1,950 ha	390
- Rain Water Harvesting / Tank Irrigation	2,976 ha	208
(Sub-total)	(10,343 ha)	**(1,380)**
(2) Improvement of Minor Irrigation		
- Flow Irrigation	3,172 ha	159
- Lift Irrigation	68 ha	10
- Tubewell	93 ha	9
- Rain Water Harvesting / Tank Irrigation	324 ha	10
(Sub-total)	(3,567 ha)	**(188)**
(3) Demonstration of micro-irrigation		**22**
(4) SID & Supervision (Outsourcing for Irrigation)	5 %	**80**
Sub-total for Irrigation		**1,670**
(5) New Construction of Access farm road		
- Access Farm Road	480 km	1,446
- Footpath & Mulepath	150 km	124
- Ropeway	6 nos.	7
(Sub-total)		**(1,577)**
(6) Improvement of Access farm road		
- Access Farm Road	410 km	**411**
(7) SID & Supervision (Outsourcing for Road)	5 %	**99**
Sub-total for Access Farm Road		**2,087**
Sub-total of 1) to 6)		**3,757**
2. Infrastructure Development Support		
(1) Capacity building for Irrigation		
- Organization of WUA		18
- O&M and WUA under the Project		27
- O&M and WUA in On-going project		62
Sub-total		**107**
(2) Capacity building for Access Farm Road		
- Organization for Road Construction		34
- Repair and Maintenance		34
Sub-total		**68**
Sub-total of (1) to (2)		**175**
Total of 1. to 2.		**3,932**

Attachment H-1 District-wise Cost Estimate for Irrigation Development

(1) New Construction of Minor Irrigation

Name of District	FIS		LIS		GW		Sub-total		Supplementary Irrigation		Total	
	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)
Bilaspur	51	51	6	12	168	336	225	399	533	373	758	772
Chamba	23	23	0	0	0	0	23	23	879	615	902	638
Hamirpur	21	21	279	558	70	140	370	719	0	0	370	719
Kangra	455	455	295	590	1,158	2,316	1,908	3,361	279	195	2,187	3,556
Kinnaur	770	770	0	0	0	0	770	770	14	10	784	780
Kullu	130	130	0	0	0	0	130	130	0	0	130	130
Lahaul & Spiti	0	0	0	0	0	0	0	0	0	0	0	0
Mandi	855	855	1,075	2,150	18	36	1,948	3,041	414	290	2,362	3,331
Shimla	92	92	0	0	0	0	92	92	7	5	99	97
Sirmour	551	551	172	344	0	0	723	895	448	314	1,171	1,209
Solan	47	47	317	634	50	100	414	781	49	34	463	815
Una	17	17	262	524	486	972	765	1,513	353	247	1,118	1,760
State Total	3,012	3,012	2,406	4,812	1,950	3,900	7,368	11,724	2,976	2,083	10,344	13,807

(2) Improvement of Minor Irrigation

Name of District	FIS		LIS		GW		Sub-total		Supplementary Irrigation		Total	
	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)	Area (ha)	Cost (Rs.Lac)
Bilaspur	38	19	3	5	93	93	134	117	0	0	134	117
Chamba	59	30	0	0	0	0	59	30	41	12	100	42
Hamirpur	13	7	10	15	0	0	23	22	0	0	23	22
Kangra	2,185	1,093	55	83	0	0	2,240	1,176	63	19	2,303	1,195
Kinnaur	87	44	0	0	0	0	87	44	0	0	87	44
Kullu	122	61	0	0	0	0	122	61	0	0	122	61
Lahaul & Spiti	94	47	0	0	0	0	94	47	0	0	94	47
Mandi	264	132	0	0	0	0	264	132	0	0	264	132
Shimla	11	6	0	0	0	0	11	6	0	0	11	6
Sirmour	261	131	0	0	0	0	261	131	41	12	302	143
Solan	37	19	0	0	0	0	37	19	178	53	215	72
Una	0	0	0	0	0	0	0	0	0	0	0	0
State Total	3,171	1,589	68	103	93	93	3,332	1,785	323	97	3,655	1,882

Attachment H-2 Results of Preliminary Design of Access Farm Road in the Sample Area

Model Area	Farm Road		Improve	Farm Road Length				Width (m)		Future					Access		Farm Land		Trafic	Road Density	
	Name	No.	or New	Survey	WBM	Asfalt	Concrete	Width	Manual transport		Measure				Access to Farm Road		Panchayat	Road	Pickup	Improve	New
				(m)	(m)	(m)	(m)	(m)	km	km	Widening	Drainage	Bridge	Pavement	BP	EP	(ha)	(ha)	per day	(m/ha)	(m/ha)
Lalri				**837**													**68**	**17**			
	Ralri	R1	Imp	837	27	825		2.4	1.1	0.3	Yes	3		WBM, PMC	PWD NH	PWD NH		17	17		
Malan				**1703**													**197**				
	Radha krishan M	R1	New	499	500	0		3.0	1.0	0.5	Yes	3		WBM	PWD VR	Crop Field		15	15		
	Chamunda road S	R2	New	644	645	0		2.5	0.9	0.2	Yes	3		WBM, PMC	PWD SH	R2		10	10		
	Pankar	R3	Imp	560	560	0		2.5	1.0	0.3	No	NN		WBM	PWD SH	PWD VR		10	10		
	Dhiman Basti ma	Rf1	Imp					**1.8**	1.0	0.5	No	NN		CC	PWD VR	Crop Field		15	15		
		Rf2																		**9.585**	
Plain Total				**2540**													**265**			5.272	4.313
Hallan-1, Kullu				**715**													**502**				
	Baltha	R1	New	397	400	0		3.0	1.0	0.5	No	NN		WBM	PWD VR	Crop Field		12	12		
		R2																			
	Kamarhti	R3	Imp					**1.8**	0.6	0.3	Yes	NN		CC	PWD VR	Village		3	3		
		R4																			
	Bhaarka	R5	Imp	318	320	0		2.5	0.6	0.4	Yes	1		WBM	PWD SH	Crop Field		5	5		
Nagwain, Mandi-Sadar				**8306**													**312**				
	NH-21 to society gl	R1	Imp	287	290	0		2.5	0.8	0.5	Yes	NN		WBM	PWD NH	Crop Field		12	12		
	NH-21 to talahar ro	R2	Imp	748	745	245		2.5	0.8	0.2	Yes	2		WBM	PWD NH	PWD VR		20	20		
	Panchayat ghar to	R3	Imp	968	970	470		2.5	0.8	0.2	Yes	1		WBM, PMC	Block Rd	Block Rd		**20**	20		
	Panchayat ghar to	R4	Imp	270	270	0		2.5	0.8	0.2	Yes	3		WBM	Block Rd	Crop Field		**16**	16		
	Shiv Mandir, nagw	R5	New	510	510	0		3.0	1.0	0.3	New	2		WBM	PWD VR	Crop Field		10	10		
	Palser	R5new	New	1550	1550	0		3.0	1.0	0.5	New	4	10mx2	WBM, PMC	PWD VR	Footpath		**15**	15		
	NH-21 to Raha villa	R6	Imp	945	945	445		2.4	1.0	0.3	Yes	3		WBM, PMC	PWD NH	Bridge		20	20		
	NH-21 to Raha villa	R7	Imp	515	515	0		2.4	1.0	0.3	Yes	2		WBM	PWD NH	Crop Field		10	10		
	Baloo road near Ch	R8	Imp	1360	1360	860		2.4	1.3	0.3	Yes	4		WBM, PMC	Block	Crop Field		20	20		
	Baloo road Palesha	R9	Imp	208	210	0	210	2.2	0.6	0.4	Yes	NN		WBM	PWD VR	Crop Field		12	12	Steep	
	Baloo road to Burki	R10	New	945	945	445		3.0	1.0	0.5	Yes	NN	10m	WBM, PMC	PWD VR	Crop Field		20	20		
		R11																			
Bagain, Theog, Shimla				**4812**													**245**				
		R1																			
	Hotel farmer's nest,	R2	New	2262	2260	0		3.0	1.0	0.3	New	6		WBM	PWD SH	Footpath		15	15		
	Dasana nalla, Ghun	R3	Imp	946	945	445		2.5	1.5	0.5	No	3		WBM,PMC	PWD VR	Crop Field		5	5		
	Ghoond road to vil	R4	Imp	770	775	275		3.0	1.5	0.5	Yes	3		WBM,PMC	PWD VR	Crop Field		10	10		
	Kahar, ghoond roa	R5	Imp	834	835	335		3.0	1.5	0.5	Yes	3		WBM,PMC	PWD VR	Crop Field		20	20		
Chamo, Dharampur, Solan				**6298**													**83**				
	Kurla to Oyal	R1	New	3900	3900	0		3.0	3.0	0.5	New	10	6m	WBM	Block Rd	Footpath		20	20		
	Hanuman mandir n	R2	New	2398	2398	0		3.0	2.5	0.5	New	6	10m	WBM	PWD VR	PWD VR		20	20		
Steep Total				**20131**													**1142**			**17.628**	

Attachment H-3 Preliminary Design of Access Farm Road in Sample Area

1) General

The preliminary design of access farm road in the sample area was carried out following the standard design which is adopted by PWD and APMC for rural road design. The standard and design criteria applied for the preliminary design in this study are summarized as below.

2) Improvement of the existing road

The alignment and carriageway width are planned in accordance with the existing alignment in principle. However, after the reconnaissance survey, DOA advice the road construction committee of the Panchayat for alternatives for widening and vertical and horizontal curve radius in accordance with the rural road manual. Pavement is determined through discussion among the road construction committee and DOA. Concrete pavement is generally selected for pavement of mule tracks and footpaths. The committee selects from 3 alternative pavement, i.e., WBM, concrete and asphalt. However, final decision is made by DOA considering road length, carriageway width and estimated maximum traffic, etc.

Improvement	Width (m)	Pavement
Access farm road	2.5-3.0	WBM, Asphalt or Concrete
Mule track	1.8	Concrete
Footpath	1.0	Concrete

3) Construction of new farm access road

The essential design parameters are determined in accordance with the provisions of the rural road manual (IRC: SP-20, 2002) as follows.

for steep terrain < El. 3,000m AMSL

Design Parameters	Rural Roads Manual (India)
Min. design speed	20 km/hr
Vertical gradient	
Ruling	6 % (1 in 16.7)
Limiting	7 % (1 in 14.3)
Exceptional	8 % (1 in 12.5)
Type of pavement	Earth to Tarring (after rainy season)
Road width	
Formation Width	6.0 m
Carriageway width	3.0 m
Shoulder	0.875
Side drain width	0.6
Design speed	20-40 km/hour
Radius of curvature	minimum 14 m
Normal practice at the site	(Minimum)
20mm	Surface Course
75mm	WBM G2 Base Course 45-63mm
100mm	Sub-Base G1 45-90mm
	Compacted Subgrade

Source: IRC: SP-20, 2002

The proposed pavement for new road is WBM in principle which consists of compacted subgrade, WBM G1 and WBM G2. The salient design parameters are determined as follows:

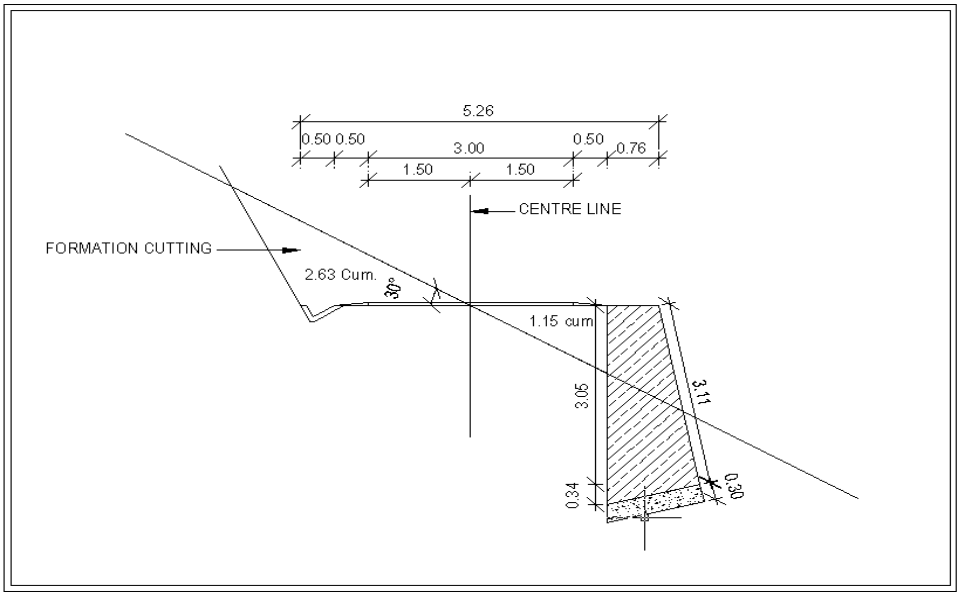
- Expected maximum manual transportation distance at this stage: 500 m from the nearest road heads to the production site, if the beneficiary farmers request.
- The carriageway width is 3 m and other parameters are all in accordance with Rural Road Manual (IRC: SP-20, 2002) for new farm access roads to allow collection of produce directly from the farm roads by pickup (1.5 ton loading capacity) or small truck (4-6 ton loading capacity) in the peak harvesting period in the rainy season.
- The carriageway width and other parameters are in accordance with the same as the existing conditions, if the farmers request improvement of the existing farm access roads as it is, due to difficulty in additional land for widening and/or vertical gradient.
- Pavement for the new road is WBM (water bound macadam) in accordance with the specification provided in the Manual considering necessary stability of newly excavated slope and road foundation.
- Pavement for the improvement of the existing road is WBM for the section of 500-600m from the dead end point of the existing farm access road, and rest of section may be planned by PMC (pre-mix bituminous carpet or asphalt), if the beneficiary requested and economically eligible (with a minimum benefited vegetable area of 5 ha per km of access farm road)

4) Application to Reserve Soil and Environment

In order to reserve soil and environment, the following two type of design are proposed and applied.

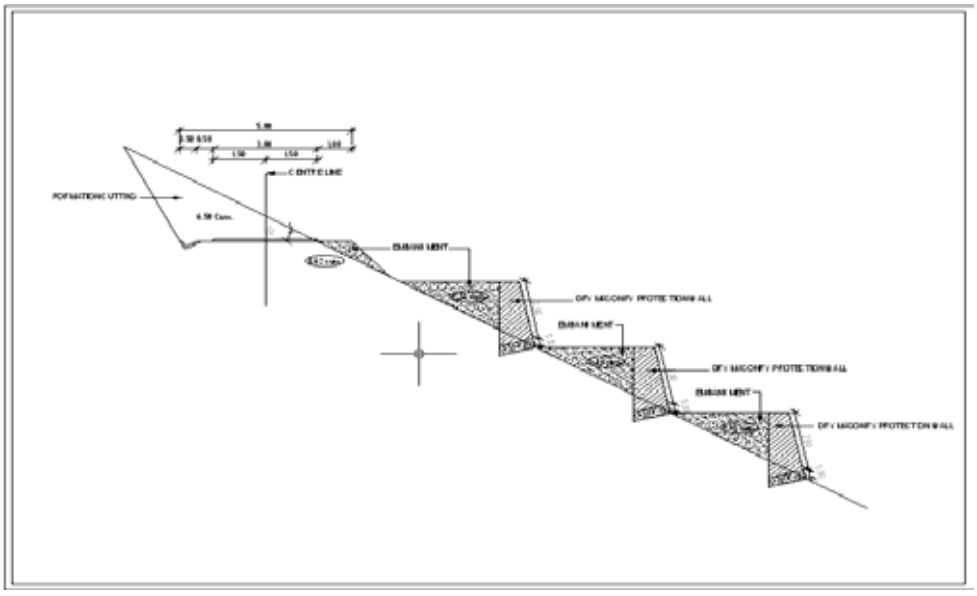
(1) Cut and Fill

In steep area in order to avoid sediment flowing into downstream reservoir, cut and fill volume shall be balanced by constructing retaining wall especially in steep slope in hilly area. In this design, construction of retaining wall will cause high construction cost, and hence generally it is not recommended except hair pin bend of zigzag roads.



(2) Spoil Bank for Excavated Rock and Soil

In this design, road foundation is original sound ground. Retaining wall can be made by dry masonry with excavated rock. The spoil bank can be used as a farm land for crops. The spoil bank will be constructed by the farmers' participatory through payment. In preliminary evaluation, the construction cost is amortizable by crop production within 5 years.



Attachment H-4 Preliminary Cost Estimate for Infrastructure Development Support

1) Irrigation

WUA Organization	O&M and WUA Strengthneing	O&M Strengthneing in other Area
700 Projects in A/P	700 Projects in A/P	2,300 Projects in A/P
19 ha/nos	19 ha/nos	20 ha/nos
25 Family/nos	25 Family/nos	27 Family/nos
Rs.500/person (Family)	Rs.500/person (Family)	Rs.500/person (Family)
12,500 Rs./Project	12,500 Rs./Project	13,500 Rs./Project
2 times	3 times	2 times
17,500,000 Rs.	**26,250,000 Rs.**	**62,100,000 Rs.**
(say Rs.18,000,000)	**(say Rs.27,000,000)**	**(say Rs.62,000,000)**
(Rs.12,500 x 700 projects x 6 times)	(Rs.12,500 x 700 projects x 3 times)	(Rs.12,500 x 2170 projects x 2 times)

2) Access Farm Road

Organization of Group for Road	O&M Training
890 km in A/P	890 km in A/P
890 nos. in A/P	890 nos. in A/P
Rs.500/person (Family)	Rs.500/person (Family)
12,500 Rs./Project	12,500 Rs./Project
3 times	3 times
33,375,000 Rs.	**33,375,000 Rs.**
(say Rs.34,000,000)	**(say Rs.34,000,000)**
(Rs.12,500 x 890 projects x 6 times)	(Rs.12,500 x 890 projects x 3 times)