CHAPTER 4 WORKSHOP AND DEVELOPMENT NEEDS

4.1 Workshop

4.1.1 Objectives and Schedules of Workshops

Workshops were organized during the course of the Study, between February-September 2008, as tabulated in Table 4.1.1. The participants of the workshops include agricultural development officers (ADOs) and agriculture extension officer (AEOs) of block offices, soil conservation officers and district officers of the Department of Agriculture (DOA), officers of the Marketing Board and officers from other agriculture-allied line departments (Department of Horticulture, Department of Animal Husbandry, and Department of Fishery) in all twelve districts of the State. The objectives of the workshops are to:

i) Absorb the needs of respective 75 blocks for agricultural diversification, especially for crop diversification to vegetables in order to reflect block needs in formulation of the Master Plan (M/P) and Action Plan (A/P), and

ii) Enhance capability of block and district officers of the DOA, Marketing Board and other line departments in agricultural planning.

Table 4.1.1 Schedule and Agenda of the Workshops

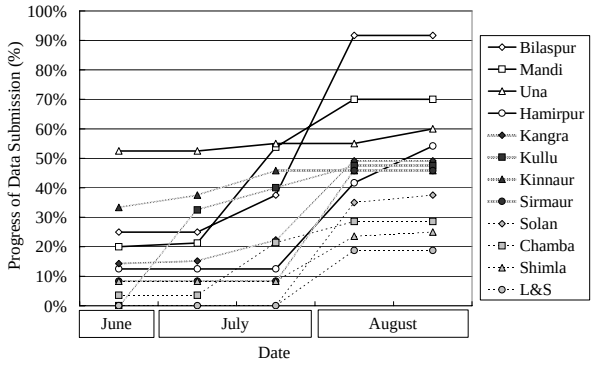
Workshop	Implementation Period/Date	Implementation Place	Agenda
First Workshop	February 25 to March 5, 2008	11 Districts (except Lahaul & Spiti)	✓ Requesting each block officers for collecting information/needs on block basis for crop diversification, and ✓ Explanation of required information/needs
Second Workshop	April 11, 2008	Shimla at SAMETI office	✓ Explanation of M/P and draft Program Components to district officers, and ✓ Re-explanation of required information/needs
Third Workshop	June 12 to 24, 2008	All 12 Districts	✓ Re-explanation of M/P, draft Program Components and target small & marginal farmers, ✓ Re-explanation of required information/needs, and ✓ Check of data collection by blocks and Discussion on the collected data
Final/Fourth Workshop	August 23 to September 6, 2008	All 12 Districts	✓ Re-explanation of M/P, draft Program Components and target small & marginal farmers, ✓ Confirmation of submitted data/information on block basis, and ✓ Discussion on priority Program Components of respective blocks in workshop among participants

Source: JICA Study Team

4.1.2 Analysis of Results of Workshops

(1) Collection Progress of Needs on Block Basis

Fig. 4.1.1 shows the collection progress of the requested data by each district, regarding needs in agriculture, marketing & processing, irrigation, and access farm road. Although the deadline to submit the proposals had been extended twice, (May 15th to June 15th and June 15th to the end of June), the collection progress of the proposals of most of the districts remained low with less than 30% at the end of June, the final deadline. DOA urged the data



Source: JICA Study Team

Fig. 4.1.1 Progress of Data Submission

submission several times. After the final workshop, all the blocks submitted the data, however, some only submitted minimum data. Block officers delayed in the submission explained that this was due to either lack of available officers or busy routinary works.

This fact reveals that capacity of present block officers varies widely. Hence, it is necessary to fill the vacant position of officers and review their routinary works.

(2) Needs of Priority Program Components in Farmers' Support and Infrastructure Development Program

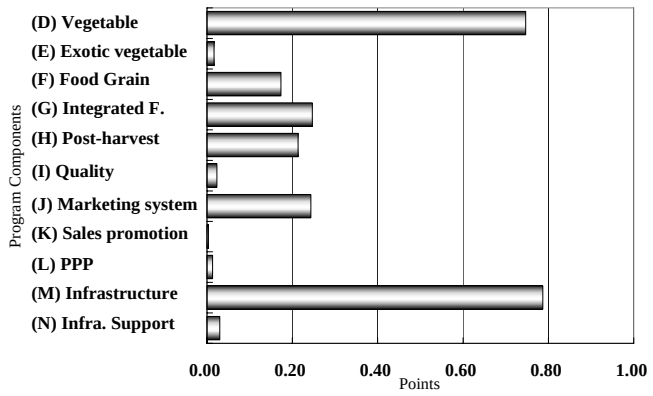


Fig. 4.1.2 Averaged Scouring of Program Components

Fig. 4.1.2 and Table 4.1.2 present the priority program components selected by all 75 blocks in the State. Each block selected first, second, third, and fourth priority components based on respective present conditions, Fig. 4.1.2 shows the priority by scoring (giving first priority with one point, second with 0.75 points, third with 0.5 points, and fourth with 0.25 points; then finally averaged)

Table 4.1.2 Number of Selected Priority Program Components

Program Component	First Priority	Second Priority	Third Priority	Forth Priority
(D) Vegetable Promotion	25	29	17	3
(E) Exotic Vegetable Promotion	0	0	2	1
(F) Food Grain Crop Productivity Improvement	6	5	5	3
(G) Integrated Farm Management	5	5	15	9
(H) Post Harvest Processing Promotion	1	5	7	31
(I) Market-oriented Quality Improvement	0	0	2	3
(J) Marketing System Improvement	2	4	20	13
(K) Sales Promotion	0	0	0	1
(L) Public Private Partnership (PPP) Promotion	0	0	1	2
(M) Infrastructure Development / Improvement	35	26	6	6
(N) Infrastructure Development Support	1	1	0	2
Total	75	75	75	74

Source: JICA Study Team

Program components (M) Infrastructure Development / Improvement and (D) vegetable promotion were given the highest priority. Components (F) Food Grain Crop Productivity Improvement, (G) Integrated Farm Management (Horticulture, Animal Husbandry and Fishery), (H) Post Harvest Processing Promotion, and (J) Marketing System Improvement had higher priorities compared to the other program components. The remaining components were selected as priority by only a few blocks.

Priority in respective categories of the diversified patterns was analyzed using the same data. Fig. 4.1.3 shows category-wise priority program components evaluated using the point system similar to the scoring method.

Based on results, all category blocks have needs for (D) Vegetable Promotion, rated as the highest priority. Other higher priority components are (F), (G), (H), and (J).

i) Highest priority is generally given to (D) Vegetable Promotion and (M) Infrastructure

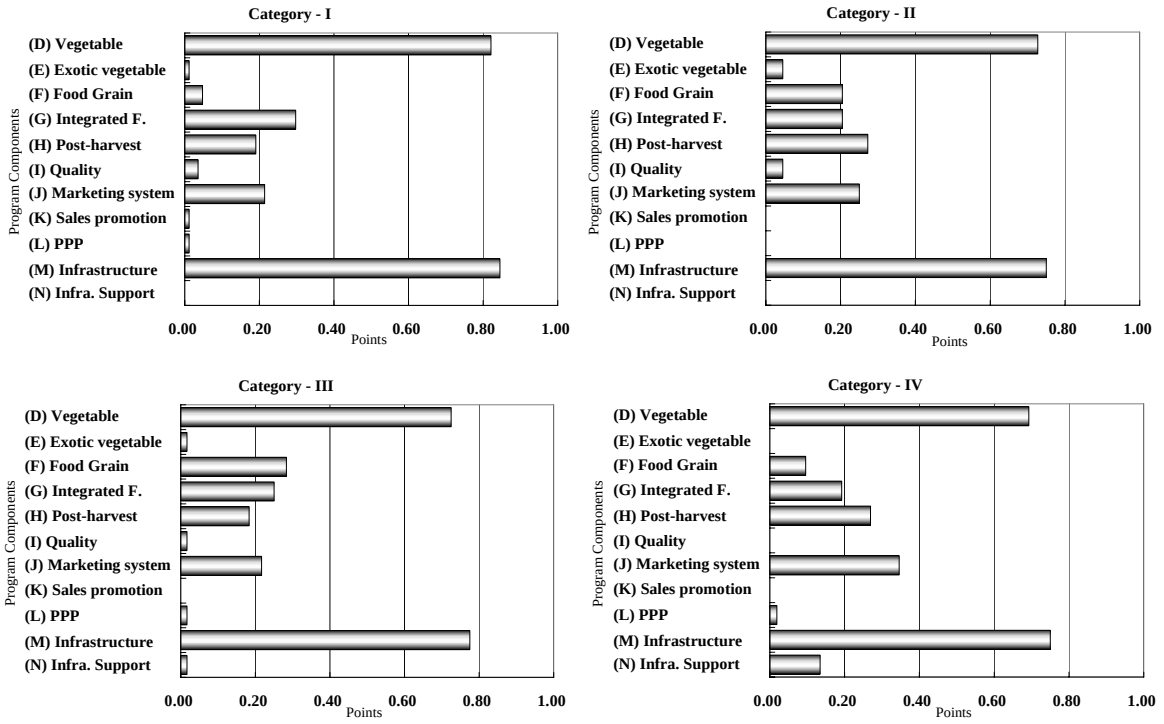
Development/ Improvement,

ii) Higher priority is given to (F) Food Grain Crop Productivity Improvement, (G) Integrated Farm Management (Horticulture, Animal Husbandry and Fishery), (H) Post Harvest Processing Promotion, and (J) Marketing System Improvement in general.

iii) Need for (F) Food Grain Crop Productivity Improvement is highest in Category-III among categories I to III, followed by Category-II and Category-I.

iv) Need for (J) Marketing System Improvement is given a relatively high priority in all three categories.

v) Need for (N) Infrastructure Development Support is given a relatively higher priority in Category-IV.



Source: JICA Study Team

Fig. 4.1.3 Category-wise Priority Program Components by Scoring

From the above category-wise priority, Vegetable Promotion and Infrastructure Development component are given highest priority among the four categories. From this result, characteristics of each category can be derived as follows:

Category-I: This is an advanced block in crop diversification such as vegetable and fruit cultivation. Integrated farm management has relatively higher need, since fruit cultivation promotion is included in the component. Need for food grain productivity improvement component is low, since the farmers do not pay attention to such production for family food security. Some farmers opt to buy grain/cereal within the area.

Category-II: This is a crop diversification starting block and in transition to Category I. Crop conversion from food grain to vegetables is going on but the conversion can be made after keeping family food grain for food security. Accordingly, the need for food grain productivity improvement is much higher than what the farmers in Category-I

have. Farmers in the area feel the necessity for post harvesting, probably from observation of the activities in advanced area, since the need is also relatively higher.

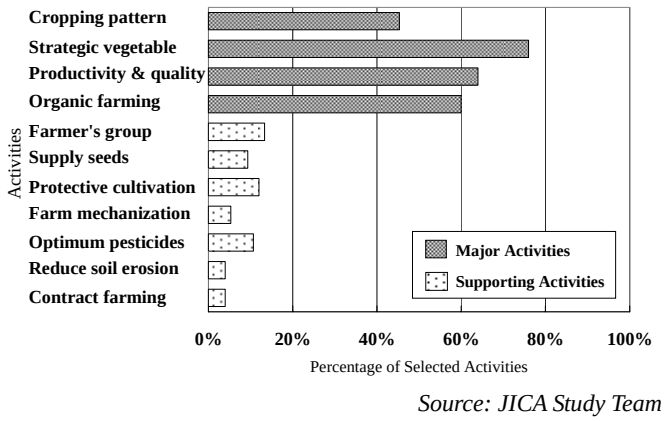
Category-III: This is a block where the diversification has not started and major crops are food grain crops such as wheat in rabi season and maize or rice in kharif season. Need for food grain productivity improvement is highest among four categories. Farmers in the area want to diversify crops to vegetables with infrastructure support especially in irrigation. However, they consider that the grain productivity increase is essential as an initial step for family food security.

Category-IV: This is the block not covered by above categories in diversified patterns. This block does not have much potential for expansion of crop diversification. Farmers want to promote vegetable cultivation, however, food grain area, production and irrigation rates are small. Nevertheless, crop yield is not low and reaches district average level in the block. Need for marketing system improvement is relatively high while that for food grain productivity improvement is low. Infrastructure development support is realized as the highest among the four categories. Crop diversification can be promoted only in limited favorable locations in the block.

(3) Priority Activities of Vegetable Promotion Program Component

General Needs in the State

Fig. 4.1.4 shows the results of priority activities of vegetable promotion program component selected by each block. This program component consisted of four major activities and eight supporting activities, as also shown in Fig. 4.1.4:



Source: JICA Study Team

Fig. 4.1.4 Priority Activities of Vegetable Promotion

Promotion of strategic vegetables such as peas, potatoes, cauliflowers and tomatoes has the highest priority, followed by "improvement of vegetables productivity and quality," and "promotion of organic farming". Organic farming is an attractive activity for farmers in general since it leads not only to saving from costly chemical fertilizer but also environmentally friendly farming. Application of manure and compost such as vermin-composting is becoming popular in the State. Needs for farmer's grouping, protective agriculture (cultivation in green house), seed supply and optimum fertilization are also high among the supporting activities of the components.

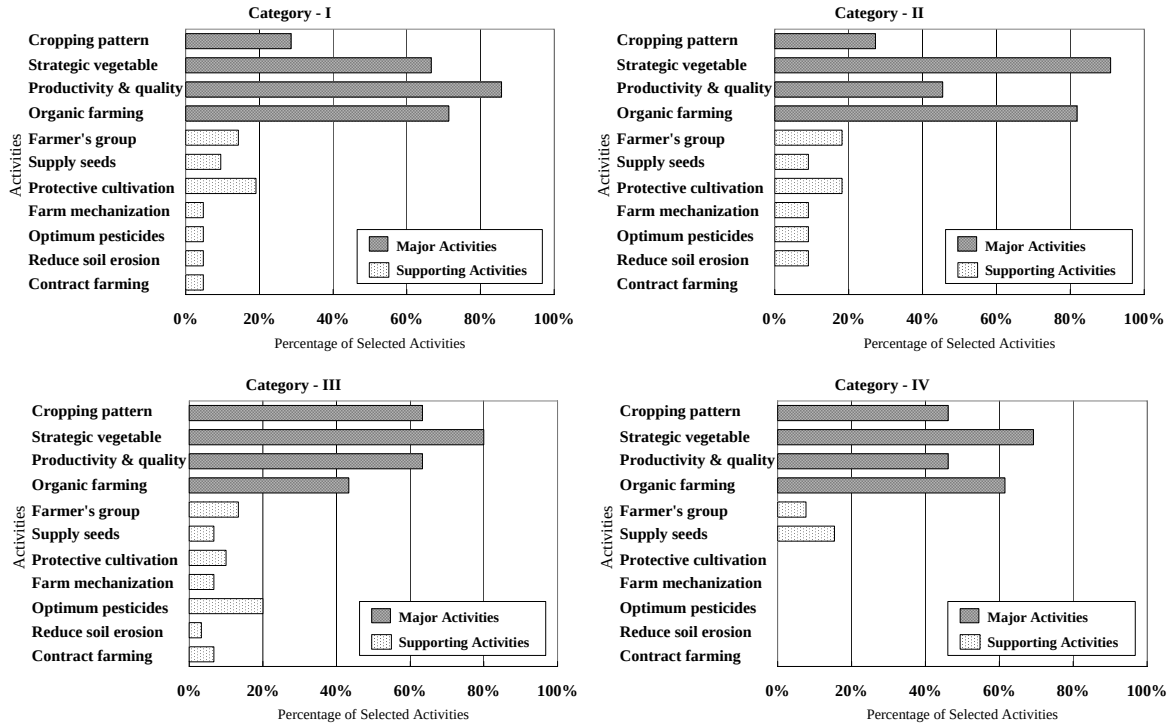
Category-wise Needs in the State

Fig. 4.1.5 shows the results of priority activities of vegetable promotion program component in respective categories.

This figure shows the category-wise results of priority activities of the program component. The results reveal the different needs for vegetable promotion in the each stage of crop diversification. Regarding major activities, "improvement productivity and quality" has the highest priority in blocks of Category-I while "promotion of strategic vegetables" has the highest priority in Category-II. This is considering that Category-I is an advanced area for the diversification and Category-II is in progress.

Regarding supporting activities, "protective cultivation" in Category-I, "farmers' group" and

"protective cultivation" in Category-II, "optimum use of pesticides" in Category-III and "seeds supply" in Category-IV have higher priorities. Protective agriculture is an advanced farming in cool climate zones. Hence, farmer's group is required for joint marketing of vegetables, which are necessary in the diversified blocks such as Category-I and II. On the other hand, needs for optimum use of pesticides or seed supply is the common needs in the State.



Source: JICA Study Team

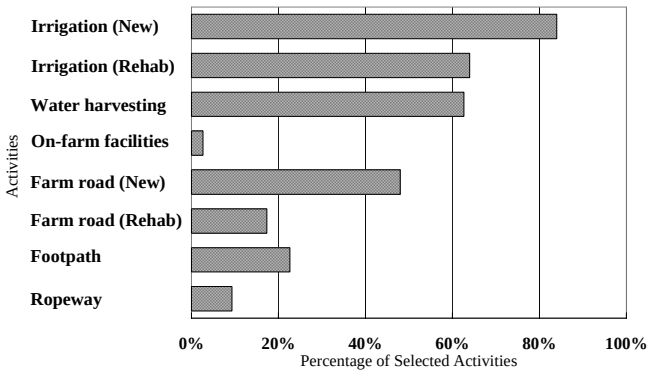
Fig. 4.1.5 Priority Activities of Vegetable Promotion (Category-wise)

(4) Priority Activities of Infrastructure Development Program Component

General Needs in the State

Fig. 4.1.6 shows the results of priority activities of the infrastructure development program component selected by each block. The program component consisting of eight major activities are also given in Fig. 4.1.6:

Construction of "new minor irrigation systems" has the highest priority. Rehabilitation/improvement of "existing minor irrigation and traditional irrigation systems" and construction of "water harvesting facilities" is the second highest priority among irrigation needs.



Source: JICA Study Team

Fig. 4.1.6 Priority Activities of Infrastructure Development/Improvement

Regarding access farm roads, construction of "new farm road not covered by PWD" has relatively higher priority, as compared to repair or rehabilitation of damaged existing farm roads. Some blocks

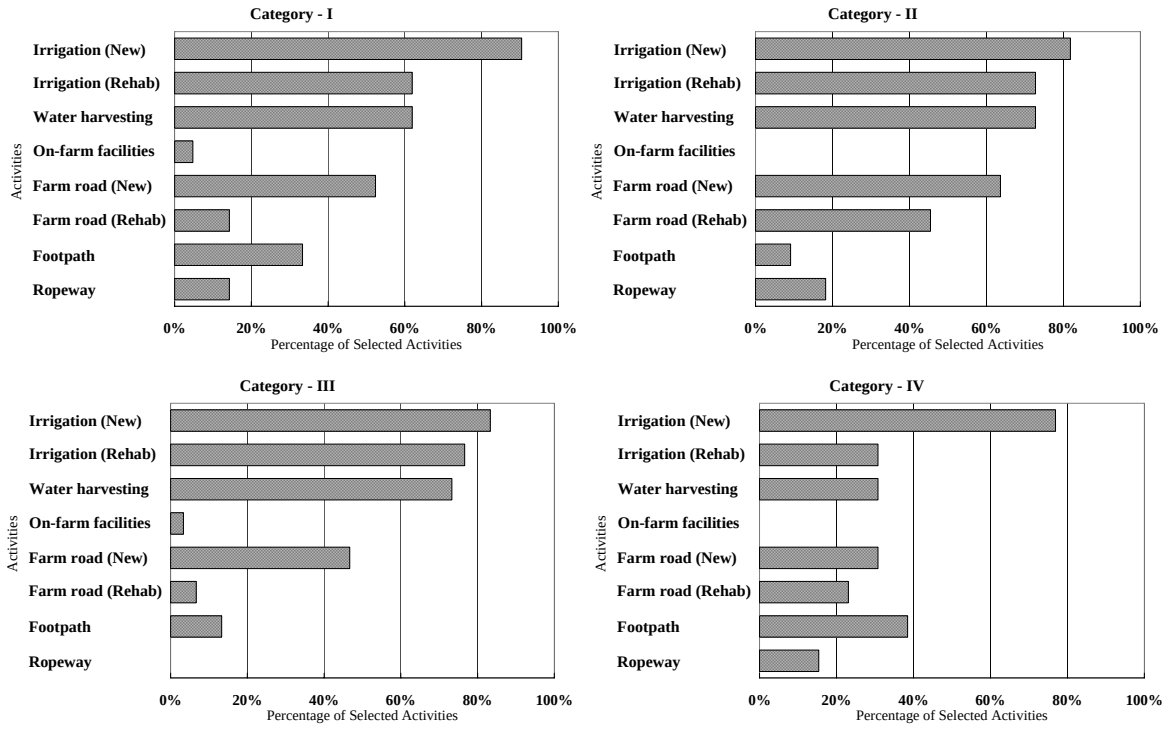
selected construction/improvement of footpath and mule track as priority needs, especially in Chamba district where farmers want to keep minimum farm access.

Most of the blocks put higher priority on irrigation than access farm road; however, opinions on importance of access farm road for vegetable cultivation are clarified by some participants in the workshop. It indicates that some advanced or diversified farmers realize the importance through their daily vegetable cultivation.

Most of the blocks reported only needs of infrastructure development, however, some blocks reported needs of combining infrastructure development and its support such as strengthening of water user's group or the operation and maintenance (O&M) organization. From the viewpoint of sustainability, the infrastructure development support is indispensable.

Category-wise Needs in the State

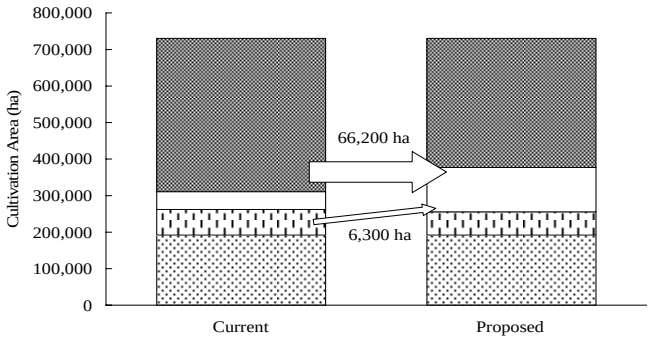
Fig. 4.1.7 shows the results of priority activities of vegetable promotion program component in respective categories.



Source: JICA Study Team

Fig. 4.1.7 Priority Activities of Infrastructure Development / Improvement (Category-wise)

(5) Crop Conversion Area proposed by all of 75 Blocks

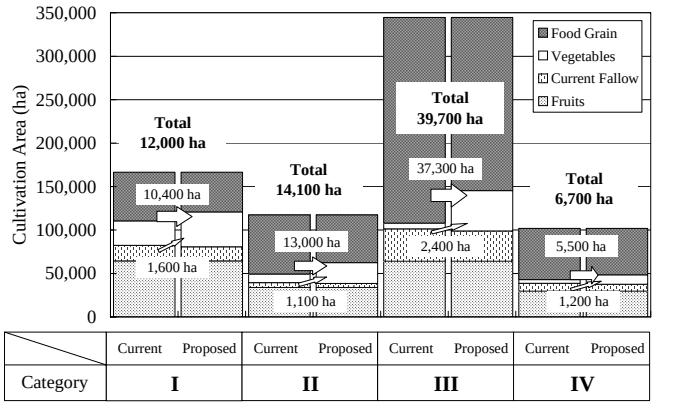


Source: JICA Study Team

Fig. 4.1.8 Possible Crop Conversion Area (Whole State)

Fig. 4.1.8 shows the total conversion area to vegetables planned by each block up to 15 years on the basis of the data obtained and confirmed in the fourth workshop. The possible area for conversion to vegetables submitted by all of the 75 blocks covers 72,500 ha in total out of the current agricultural land of 730,000 ha consisting of 66,200 ha food grain and 6,300 ha fallow lands. Possible crop diversification area is in the whole of State.

Fig. 4.1.9 shows the category-wise possible conversion area to vegetables by blocks up to 15 years. The figure shows that the possible conversion area from food grains to vegetables in category-III is largest among the four categories. Category-II also exhibits a certain possible area for conversion to vegetables. Meanwhile, in advanced area for crop diversification, category-I, possible conversion area is relatively smaller but still has available space for conversion to vegetable. Possible conversion area in Category-IV is the least among the four categories.



Source: JICA Study Team

Fig. 4.1.9 Possible Crop Conversion Area (Category-wise)

(6) Environmental and Social Consideration

Necessary environmental and social consideration in program implementation was discussed in the workshop. Possibility of excessive agro-chemical use, increase of pests and diseases of diversified crops, environmental damage by infrastructure construction such as road construction and decrease of high value local variety are reported as impacts. Countermeasures to mitigate the negative impacts in the workshop are given in Table 4.2.3. The excessive agro-chemical use is the biggest impact for the block officers and its countermeasure is to adopt and promote sustainable and eco-friendly technology such as IPM, organic farming, etc.

It is realized that block officers are aware of the importance of environmental resources for rural people and the State, and will consider mitigation measures against the impacts.

Table 4.1.3 Environmental and Social Negative Impacts by Crop Diversification Conveyed by Each Block

Conceivable Negative Impact	Countermeasures to mitigate Impact	Number of Block
➢ Pollution due to excessive use of chemicals	➢ Adopting and promotion of sustainable and eco-friendly technology such as IPM, organic farming etc.	7 Blocks or 9.3 %
➢ Increase of pests and diseases	➢ Adopting of crop rotation	2 Blocks or 2.7 %
➢ Damage for environment due to infrastructure construction such as road	➢ Adopting eco-friendly technology	2 Blocks or 2.7 %
➢ Decrease of local variety such as millet, which has high value	➢ Synchronised promotion of local variety with vegetable.	1 Block or 1.3 %

Source: JICA Study Team

4.2 Short List and Long List of Infrastructure Needs

4.2.1 Long List of Infrastructure Development Projects

The candidate irrigation projects and access farm road projects for both improvement/rehabilitation and new construction were proposed by each block office in the course of the workshop, including concerned Sub-divisional Soil Conservation Office (SDSCOs). Finally, it was found that there are 1,637 and 1,853 proposed candidates for irrigation and access farm roads, respectively as summarized below.

Table 4.2.1 Summary of Long List

(1) Irrigation Projects

District	Improvement of Existing System		Construction of New Irrigation		Total	
	Nos. of Candidates	Irrigation Area (ha)	Nos. of Candidates	Irrigation Area (ha)	Nos. of Candidates	Irrigation Area (ha)
Bilaspur	40	400	90	855	130	1,255
Chamba	21	254	218	1,080	239	1,334
Hamirpur	24	603	85	1,314	109	1,917
Kangra	167	4,648	151	3,970	318	8,618
Kinnaur	3	130	29	1165	32	1,295
Kullu	9	184	10	195	19	379
Lahaul & Spiti	8	141	0	0	8	141
Mandi	46	1,586	46	1,586	92	3,172
Shimla	3	77	100	3,779	103	3,856
Sirmaur	36	676	106	1,717	142	2,393
Solan	30	388	306	6,130	336	6,518
Una	11	151	98	2,174	109	2,325
Total	398	9,238	1,239	23,965	1,637	33,203

Source ; JICA Study

(2) Access Farm Road Projects

District	Improvement of Existing Access Farm Roads		Construction of New Access Farm Roads		Total	
	Nos. of Candidates	Total Length (km)	Nos. of Candidates	Total Length (km)	Nos. of Candidates	Total Length (km)
Bilaspur	44	130	78	308	122	438
Chamba	79	93	0	0	79	93
Hamirpur	26	28	85	116	111	144
Kangra	64	190	187	309	251	499
Kinnaur	0	0	0	0	0	0
Kullu	7	14	46	143	53	157
Lahaul & Spiti	2	20	0	0	2	20
Mandi	305	826	317	1,213	622	2,039
Shimla	4	12	17	64	21	76
Sirmaur	28	135	149	429	177	564
Solan	53	135	129	174	182	309
Una	12	47	221	229	233	276
Total	624	1,630	1,229	2,985	1,853	4,615

Source ; JICA Study Team

4.2.2 Short List of Infrastructure Development Projects

The candidate projects are preliminarily screened for prioritization in order to estimate realistic work quantities for the action plan. The preliminary screening was conducted with the following criteria.

i) Candidate proposal was submitted within the time limit

ii) Candidate proposal was prepared with necessary important data, especially for the area oriented data (name of Panchayat, exact location and proposed area for irrigation and proposed lengths of roads).

Based on the preliminary screening, a short list is prepared as summarized below, which will be reviewed and finalized after the detailed screening.

Table 4.2.2 Summary of Short List

(1) Irrigation Projects

District	Improvement of Existing System		Construction of New Irrigation		Total	
	Nos. of Candidates	Irrigation Area (ha)	Nos. of Candidates	Irrigation Area (ha)	Nos. of Candidates	Irrigation Area (ha)
Bilaspur	12	202	58	635	70	837
Chamba	18	112	125	523	143	635
Hamirpur	3	35	31	556	34	591
Kangra	122	3,400	108	3,020	230	6,420
Kinnaur	3	130	29	1,165	32	1295
Kullu	9	184	10	195	19	379
Lahaul & Spiti	8	141	0	0	8	141
Mandi	28	397	178	3,157	206	3,554
Shimla	2	17	8	142	10	159
Sirmaur	24	415	84	1,336	108	1,751
Solan	15	154	18	638	33	792
Una	9	91	73	1,344	82	1,435
Total	253	5,278	722	12,711	975	17,989

Source ; JICA Study

(2) Access Farm Road Projects

District	Improvement of Existing Access Farm Roads		Construction of New Access Farm Roads		Total	
	Nos. of Candidates	Total Length (km)	Nos. of Candidates	Total Length (km)	Nos. of Candidates	Total Length (km)
Bilaspur	14	86	21	233	35	309
Chamba	79	93	0	0	79	93
Hamirpur	15	15	5	3	20	18
Kangra	12	85	11	28	23	113
Kinnaur	0	0	0	0	0	0
Kullu	7	14	46	143	53	157
Lahaul & Spiti	2	20	0	0	2	20
Mandi	142	445	119	363	261	808
Shimla	4	12	17	64	21	76
Sirmaur	10	57	48	151	58	208
Solan	12	12	9	44	21	56
Una	0	0	0	0	0	0
Total	297	839	276	1,019	573	1,858

Source ; JICA Study Team

4.3 Present Constraints and Development Needs

The constraints, development potentials and their countermeasures for crop diversification obtained in the Study so far have been summarized as follows. Those of which are utilized for the formulation of M/P and program components.

Table 4.3.1 Constraints and their Countermeasures in Agricultural Organization

Present Conditions / Constraints	Potential / Opportunities	Future Strategy & Measures
a) While DOA is responsible for various activities related to developmental programs and disseminating the relevant technology to increase productivity and production of field crops and vegetables, there are lack of extension staff to carry out these activities. b) Because of the hilly terrain, the mobility of the extension staff is a major problem, considering insufficient mobilization facilities. Besides, there are also shortages in extension and soil conservation survey and drawing equipment. c) Top-down approach is mostly followed in implementing the development schemes, and is sometimes implemented without any analysis of needs at the block or lower level. d) Although some capacity building trainings are conducted on agronomical aspects, not much are conducted on planning aspects. e) Although farmers organizations are set-up under ATMA, their activities are still limited. f) There are insufficient farmers grouping / organizations for extension & shipping their produces. g) Although field-oriented researches are conducted, the linkages between the extension officers, universities and the farmers are limited.	a) There are many young unemployed agricultural graduates in the State. b) If the extension and soil conservation personnel are provided with transport equipment, they will be more actively involved in the field activities. c) Irrigation projects can be carried out more systematically with the provision of soil conservation survey and drawing equipment. d) The field extension officers will be more involved in the planning through suitable capacity building trainings. e) The Himachal farmers are receptive and highly interested in crop diversification and adapting of new technologies. f) There are sufficient State and Central Research stations to carry out area oriented researches. g) The agricultural universities also shares the responsibility for planning, implementation and coordination of various extension education programs in close collaboration with the State DOA, Animal Husbandry, Fisheries and other concerned departments.	a) H.P State is already in the process of increasing the extension staff. However, it should be increased more so as to meet the requirement for each block. b) Necessary equipment and tools should be provided to department, district and block offices, and soil conservation offices for implementation of crop diversification c) Capacity building of staffs shall be carried out on planning, implementation, monitoring and evaluation of crop diversification. d) Organizing or strengthening of farmers' groups (marketing group) aiming at crop diversification is needed. e) Periodical meetings and workshops should be conducted among the research institutes, extension departments and farmers' representatives at the state and district level. f) Research & extension linkage shall be strengthened through field visits of researchers together with extension officers in order to cope up with on-going constraints in the field, and linking of research activities corresponding to the demands of the farmers. g) Linkages with the State/ Central/International Institutions, NGOs, Farmers and Industrialists should be developed.

Table 4.3.2 Constraints and their Countermeasures in Agricultural Extension

Present Conditions / Constraints	Potential / Opportunity	Future Strategy & Measures
a) Insufficient number of staff compared with sanctioned posts b) Inefficient information system and untrained staff for state-wide project implementation and quick decision making c) Not high and timely mobility of staff because of insufficient transportation means d) Insufficient survey and measurement tools and instruments for planning and design e) The present extension activities are more focused towards distribution of inputs and therefore, less attention is paid on extension. f) The linkages between the extension-research-farmers are still lacking. g) Lack of monitoring and evaluation system	a) Possibility of recruitment of post-graduates or university graduates seeking for job opportunities in the State b) Availability of IT experts c) The field extension officers will be more involved in the planning through suitable capacity building trainings. d) The Himachal farmers are receptive and highly interested in crop diversification and adaptation of new technologies. e) There are sufficient State and Central Research stations to carry out area oriented research. f) The agricultural universities also shares the responsibility for planning, implementation and coordination of various extension education programs in close collaboration with the State DOA, Animal Husbandry, Fisheries and other concerned departments.	a) Recruitment of qualified persons and adopting them in vacant posts. b) Capacity building of staffs shall be carried out on planning, implementation, monitoring and evaluation of crop diversification. c) Necessary equipment and tools should be provided to department, district and block offices, and soil conservation offices for implementation of crop diversification d) Organizing or strengthening of farmers' groups (marketing group) aiming at crop diversification is needed. e) Periodical meetings and workshops should be conducted among the research institutes, extension departments and farmers' representatives at the state and district level. f) Research and extension linkage shall be strengthened through field visits with extension officers in order to cope up with on-going constraints in the field, and linking of research activities matching demands of the farmers. g) Linkages with the State/ Central/International Institutions, NGOs, Farmers and Industrialists should be developed. h) Proper monitoring and evaluation of extension activities should be carried out.

Table 4.3.3 Constraints and their Countermeasures in Agriculture/Vegetable Cultivation

Present Conditions / Constraints	Potential / Opportunity	Future Strategy & Measures
a) Majority of the farmers are small and marginal farmers with small landholding size. b) Agriculture is based on traditional food grain production, and crop diversification is gaining attention only in the last decade. c) Land for new reclamation is limited. Large scale development is restricted because of mountainous area. d) The available irrigation facilities are insufficient to convert areas from food grains to vegetables e) The farm access roads are insufficient for transporting agricultural products, especially vegetables f) The crop diversification demonstration schemes carried out are very few with no strategic planning. g) There is shortage of farmers support services including agricultural extension h) The available market information is insufficient. i) There is insufficient farmers grouping / organization for extension & shipping their produces	a) A wide range of food grain and vegetable crops can be cultivated in kharif season (rainy season) because of variations of climate & altitude b) There are already Himachal brand vegetables such as peas. c) There is a high possibility to convert from rainy season food grains to vegetables. d) There is a high possibility in increasing unit yield and quality improvement. e) The farmers are receptive & highly interested towards crop diversification and adaptation of new technologies. f) Market is available in the nearby states g) There are sufficient State and Central Research stations for carry out area oriented research.	a) Increasing vegetable production while ensuring food grain production. b) Improved farming through introduction of high quality vegetable seeds, and protective agriculture, etc. c) Improvement of post harvest activities such as sorting, grading and packing d) Construction/improvement of small scale irrigation facilities and farm access roads e) Strengthening of agricultural extension functions f) Implementation more crop diversification demonstration trials g) Strengthening research & extension linkage, Extension system improvement h) Strengthening of market information system i) Organizing farmers through agricultural extension

Table 4.3.4 Constraints and their Countermeasures in Horticulture, Animal Husbandry & Fishery

Present Conditions / Constraints	Potential / Opportunity	Future Strategy & Measures
<u>Horticulture</u> a) Fruits are promising cash income crops for small and marginal farmers in the hilly and undulating topographic and temperate climatic conditions b) Insufficient farm access road <u>Animal Husbandry</u> c) Feeding cattle & buffalos in most of farm houses and some selling of milk as a cash income source d) Low milking quantity due to insufficient fodder production e) Overgrowing Lantana (foreign ornamental flower introduced) in pasture or fallow land <u>Fishery</u> f) Limited number of fishermen and fishery in dams & lakes g) Low fish seed production and genetic degradation in widely cultivated species.	<u>Horticulture</u> a) Specific climatic and topographic conditions which support temperate fruits (Special region in India) b) In tropical India, there is a high domestic demand for temperate fruits are available <u>Animal Husbandry</u> c) Potential areas for pasture cultivation in the hilly and undulated topography. d) There is potential in increasing the milk/meat production. <u>Fishery</u> e) Potential for cold and warm water fish culture in some regions are available.	<u>Horticulture</u> a) Use of fallow lands or farmland created by crop conversion b) Mixed farming of fruit tree saplings and pasture, vegetable etc. c) Improving of farm access road d) Pasture cultivation by using fallow lands e) Mixed farming including fruit trees and pasture cultivation. <u>Animal Husbandry</u> f) Residual vegetables for animal feed. g) Weeding/control of Lantana on trial basis for large scale implementation in next step <u>Fishery</u> h) Organizing farmers or local community who want to start in fish culture i) Water supply through irrigation system for farmers' fish culture or use of check dam/pond in minor irrigation along with fish seed of pure/genetically upgraded germ-plasm

Table 4.3.5 Constraints and their Countermeasures in Marketing of Vegetable and Fruits

Present Conditions / Constraints	Potential / Opportunity	Future Strategy & Measures
a) It is not easy for farmers to obtain market price information, which is disseminated through AGMARKNET. b) Data in AGMARKNET is insufficient and not updated regularly. c) It is difficult for farmers to negotiate market price with traders, because farmers have no organization. d) Some farmers have severe ties with traders. e) Major farmers have no high consciousness concerning quality control and improvement. f) Some market yards have no sufficient facilities such as office toilet, store, etc.	a) High vegetable demand in Delhi metropolitan & surrounding states, especially during the off-season b) Increase of exotic vegetable demands because of increase of middle class people in Delhi metropolitan & urban area c) There is a regular demand in the markets in the surrounding areas. d) Private retailers start to buy directly from farmers because of deregulation and provide quality guidance to farmers	a) Improvement on O&M for system on data inputting b) Capacity building of staff of Marketing Board and APMC need to be initiated c) Promotion of organizing farmers d) Preparation of quality standard e) Preparation of brand f) New construction and rehabilitation of market yard

Table 4.3.6 Constraints and Countermeasures in Post-Harvest Activities

Present Conditions	Constraints	Future Strategy & Measures
a) Major vegetables are perishable, hence farmers are consider that portion of vegetables are wasted with higher post-harvest and transportation loss, due to shortage of containers and farm roads b) Price of unsorted and low graded vegetables could be lower. c) There are no standard on sorting, grading, and packing for vegetables	a) High vegetable demand in Delhi metropolitan & surrounding states, especially in the off-season b) Increase of exotic vegetable demands because of increase of middle class people in Delhi metropolitan and urban areas c) There is a regular demand in the markets in the surrounding areas. d) Private retailers start to buy directly from farmers because of deregulation and provide them with quality guidance	a) Promotion of small scale cottage industry on agro-processing b) Introduction of PPP for promotion of small scale cottage industry on agro-processing c) Promotion of containers d) Promotion of organizing farmers e) Arrangement of space for activities on sorting, grading, packing, and storing f) Establishment of quality standards g) Promotion of quality standards, which are already established

Table 4.3.7 Constraints and their Countermeasures in Irrigation and Access Farm Road

Present Conditions / Constraints	Potential / Opportunity	Future Strategy & Countermeasures
Irrigation a) Insufficient irrigation facilities to covert from food grains to vegetables b) Restriction of medium and large scale developments because of topographic conditions in most cases c) Limit of type of water intake facility and distribution facility because of steep topography in most cases d) Necessity of water-saving cultivation because of limited water source in dry season Access Farm Road e) Limited farm access in the hilly and undulated terrain.	a) There is potential for 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. d) High needs for access farm roads connecting to the PWD village roads	a) Promotion of small-scale irrigation system, and minor irrigation b) Pump irrigation and pipeline system c) Increase irrigation efficiency by repairing /reconstructing of existing systems and improving O&M d) Life saving irrigation with tank irrigation system and micro catchment rain water harvesting. e) Water saving irrigation facilities such as drip irrigation f) Development and improvement of passable access farm roads and foot paths

CHAPTER 5 DEVELOPMENT POTENTIALS

5.1 Crop Diversification Potential

5.1.1 General

The climatic conditions within the states are extremely diversified; therefore, crops and products have to be proposed corresponding to their specific conditions. In this exercise, the AEZ classification is taken into account as one of the useful guidelines. Based on the potentials and constraints identified in the previous chapters, sector prioritization is made by setting criteria from the view points of natural conditions, marketing and economy. Optimum level of diversification is also determined for farm household by considering food security. Abovementioned analyses are integrated for M/P formulation as well as target setting of the Action Plan.

5.1.2 Prioritization of Sectors for Crop Diversification

To determine the core sector for the crop diversification in Himachal Pradesh, the following criteria are set up in accordance with the potentials and constraints of each sector as well as the present agro-economic conditions.

Table 5.1.1 Criteria for or Sector Prioritization

Criteria	Rating		
	High (5 points)	Medium (3 points)	Low (1 point)
A Number of Coverage of AEZ	4 Zones	3 Zones	2 Zones and below
B Marketing Potential	Delhi and Other States	Himachal Pradesh	Specific Markets
C Impacts on State Economy			
1) Area	More than 50,000ha	1,000 – 50,000ha	Less than 1,000ha
2) Per capita production	More than 150kg	1.0 – 150kg	Less then 1.0kg
D Impacts on Farm Economy			
1) Number of family	More than 10,000	5,000 – 10,000	Less than 5,000
2) Share of farm income	More than 15%	1 - 15%	Negligible small

Source: JICA Study Team

Table 5.1.2 Present Agro-economic Conditions of Sectors

Sector	Area or Heads (ha/no.)	Production		No. of Family	Share of Income (%)
		(ton)	Per capita (kg) ***		
Vegetables	63,064	994,928	163.7	98,540	19.7
Fruits	186,903	692,011	113.9	292,040	15.7
Floriculture	510	2,810	0.5	2,240	NA
Medical and Aromatic Plants	720	NA	NA	7,800	NA
Animal Husbandry	5,046,044	4,543 **	0.7	865,746	11.2
Inland Fishery	15,600*	6,887	1.1	7,000	-

*Note: *= Only fish culture area, **= Including milk, meat and wool, ***= Divided by total population of 6,077,900 in the State, NA = Data not available.*

Source: Department of Agriculture, Horticulture, Animal Husbandry & Fishery and arranged by JICA Study Team

Each sector was assessed based on the above criteria for the prioritization of sectors. The assessment results are shown below.

Table 5.1.3 Sector Assessment for Diversification

Sector	Criteria of Rating (specified in previous page)						Average
	Number of AEZ Coverage	Marketing Potential	Impacts on State Economy		Impacts on Farm Economy		
			Area	Per Capita Production	Number of Family	Share of Farm Income	
1) Vegetables	5	5	5	5	5	5	5.0
2) Fruits	5	5	5	3	5	5	4.7
3) Floriculture	5	5	1	1	1	NA	2.6
4) Medical and Aromatic Plants	3	1	1	NA	3	NA	2.0
5) Animal Husbandry	5	3	5	1	5	3	3.7
6) Inland Fishery	5	1	3	3	3	NA	3.0

Note: NA = Data not available, NA is excluded from average calculation.
Source: JICA Study Team

According to the above results, vegetables, fruits and animal husbandry sectors have higher points compared to the other sectors. Hence, these three sectors are chosen as the priority sectors for the crop diversification in the State. Among the three priority sectors, the vegetable sector is selected as the core sector for the crop diversification in Himachal Pradesh due to the following reasons:

i) The vegetable sector has the highest point in the above assessment and vegetables are widely grown all over the State,

ii) For the fruits sector, the share of apple production is 76.2% of total fruits production. In other words, the fruits sector is almost monopolized by apple, but most apple trees require replacement since many of them are aged. In addition, 95% of fruits production concentrates in top 5 districts and fruits are not widely grown in the State compared to vegetable production Therefore, the promotion of the fruits sector development is of relatively high risk. . In case of mango, there are 6 to 7 years run-up period for fruiting after planting of seedling. Also, there is a possibility of expansion in corn cultivation areas of Zones 1 and 2. The shift from corn to mango depends mainly on the farmers' intention. Therefore, the fruits sector is not selected as the core sector.

iii) For the animal husbandry sector, it is not expected to increase in production due to limited feed supply, especially in winter, and stable production of milk, eggs and wood production. In other words, the animal husbandry in the State is already saturated. Thus, the animal husbandry sector is not selected as the core sector.

5.1.3 Strategic Diversified Crops

Thirteen vegetables with more than 100 ha planting areas are identified for all agro-ecological zones. However, 13 vegetables are too many to handle for the promotion of crop diversification. Therefore, the strategic crops or the core crops are selected based on the following procedures:

i) The 13 vegetables are categorized into the following four vegetable types:

Root Crop	Fruit Crop	Leafy Crop	Legume Crop
1) Potato	1) Tomato	1) Cauliflower	1) Peas
2) Onion	2) Okra	2) Cabbage	2) Beans
3) Radish	3) Cucurbit		
4) Garlic	4) Brinjal		
	5) Chilly		

ii) After categorization of the 13 vegetables into four types, the followings points are mutually agreed between the Study Team and the DOA for the selection of strategic crops:

a) One (1) strategic crop will be selected per vegetable type because the farmers commonly prefer multiple cropping of several crops to monoculture of a specific crop to reduce risks arising from changes in climate and market situation as well as outbreak of pest and diseases.

b) The strategic crops are the major vegetables grown in Himachal Pradesh,

c) The strategic crops are the main trading crops in Azadpur wholesale market in Delhi, and

d) The dietary habit of India is to be also considered in the selection of strategic crops

iii) The selection of strategic crops and assessment of each crop was based on the above conditions for. The results of the assessment are as follows:

Table 5.1.4 The results of Assessment for Diversification

Crops	Major Crops in the State	Main Trading Crops in Delhi	Dietary Habit of India *	Assessment
1) Root Crop				
Potato	14,984 ha	453,800 ton	A	1 (selected)
Onion	1,543 ha	393,500 ton	A	2
Radish	1,194 ha		B	4
Garlic	3,244 ha	26,250 ton	A	3
2) Fruit Crop				
Tomato	8,292 ha	149,200 ton	A	1 (selected)
Okra	1,952 ha	-	A	2
Cucurbit	1,500 ha	-	B	3
Brinjal	516 ha	-	A	4
Chilly				
3) Leafy Crop				
Cauliflower	2,191 ha	57,900 ton	A	1 (selected)
Cabbage	3,062 ha	52,500 ton	B	2
4) Legume Crop				
Peas	19,453 ha	49,800 ton	A	1 (selected)
Beans	3,672 ha	9,000 ton	A	2

*Note: *; A = Variety utilization as cooking materials. B = Limited utilization as cooking materials.*

Source: JICA Study Team

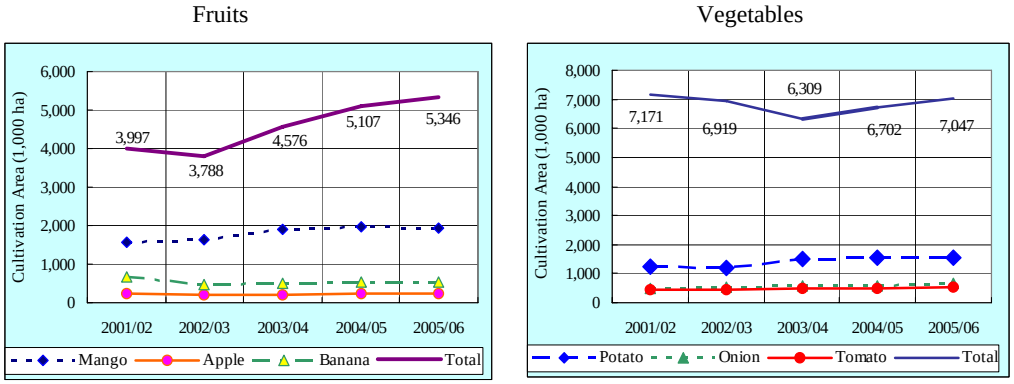
According to the results above, Potato, Tomato, Cauliflower and Peas are selected as strategic crops for crop diversification in the State. In addition, the future market potential of the selected crops is analyzed. The results showed that the future marketing potential for the strategic crops are large enough for promotion of the crop diversification in the State. In addition, exotic will be promising crops in the future to be promoted in the State, since their market potential will become higher and they can be grown in the State. The details of the marketing potential analysis are discussed below.

5.2 Market Potentials for Diversified Crops

5.2.1 Current Demand Trend of Horticulture Crops in India

(1) Cultivated Area of Fruits and Vegetables

The changes of cultivation area of major fruits and vegetables in India (2001/02 ~ 20005/06) are shown in Table 5.2.1 and Fig. 5.2.1 below.



Source: India Horticultural Statistical Database

Fig. 5.2.1 Trend of Fruits and Vegetables Cultivated Area

Table 5.2.1 Cultivated Area of Fruits and Vegetables

Unit: 1,000 h

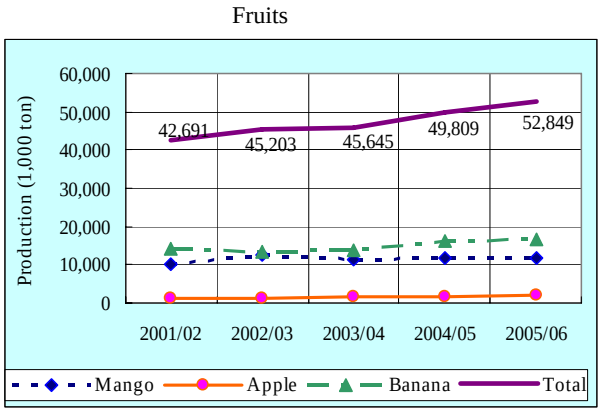
Items		2001/02	2002/03	2003/04	2004/05	2005/06
Vegetables	Potato	1,222	1,210	1,485	1,542	1,566
	Onion	500	530	554	594	658
	Tomato	460	460	503	498	522
	Others	4,989	4,719	3,767	4,068	4,291
	Total	7,171	6,919	6,309	6,702	7,047
Fruits	Mango	1,580	1,623	1,907	1,962	1,926
	Apple	240	193	201	231	236
	Banana	680	475	499	530	539
	Others	1,497	1,497	1,969	2,385	2,646
	Total	3,997	3,788	4,576	5,108	5,347

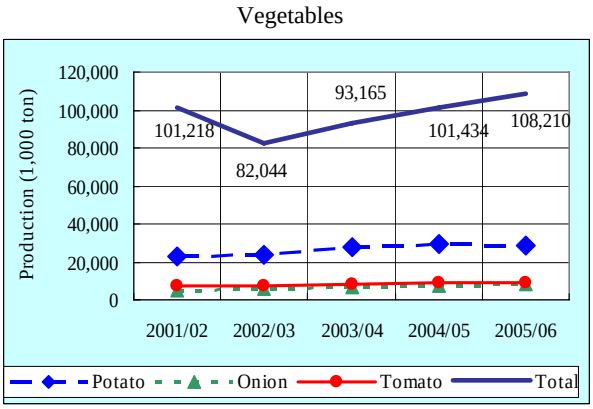
Source: India Horticultural Statistical Database

Fruit cultivation area increased from 4.0 million ha in 2001/02 to 5.3 million ha in 2005/06 while vegetable cultivation area remain stable at around 7 million ha throughout the period 2001/02-2005/06.

(2) Production of Vegetables and Fruits

The trend in the production quantity of major vegetables and fruits in India for the five-year period (2001/02 ~ 20005/06) are shown in Fig. 5.2.2 and Table 5.2.2. Fruit production has increased gradually for the last five years; while vegetable production has recovered its increasing trend since 2002/03 downfall due to sever drought condition. The leading fruit producing States are Maharastra, Andhra Pradesh, Tamil Nadu, Karnataka and Gujarat. On the other hand, the vegetable producers are West Bengal, Uttar Pradesh, Bihar, Orissa and Tamil Nadu.





Source: India Horticultural Statistical Database

Fig. 5.2.2 Change of Vegetables and Fruits Production

Table 5.2.2 Change of Fruit and Vegetable Production

Unit: 1,000 tons

Items		2001/02	2002/03	2003/04	2004/05	2005/06
Vegetables	Potato	22,488	23,920	27,626	29,189	28,870
	Onion	5,250	5,450	6,268	7,515	8,233
	Tomato	7,240	7,460	8,126	8,638	9,064
	Others	66,240	58,124	51,145	56,093	61,043
	Total	101,218	82,044	93,165	101,434	108,210
Fruits	Mango	10,060	12,733	11,490	11,805	11,908
	Apple	1,230	1,348	1,522	1,738	1,842
	Banana	14,210	13,304	13,857	16,225	16,641
	Others	17,191	17,818	18,758	20,239	22,458
	Total	42,691	45,203	45,645	49,809	52,849

Source: India Crop Cultivation Statistics

(3) Crop-wise Production of Fruits and Vegetables in Leading States

Based on the crop statistical data of 2004/05, the crop-wise leading states are listed up in Table 5.2.3 for vegetables and Table 5.2.4 for fruits.

Himachal Pradesh State ranked second in apple annual fruit production and third in peas annual vegetable production. The State produces 30% and 8% of apple and peas production in India, respectively. The competitors of Himachal Pradesh are Jammu and Kashmir for apple and Uttar Pradesh and Madhya Pradesh for peas. However, harvesting period of vegetables in Himachal Pradesh is generally different from that in other states in the plain area.

Table 5.2.3 Crop-wise Leading States of Vegetable Production in 2005/06

(Unit: Area:'000ha, Production: '000ton)

Crop	India		Firstly Ranked State			Secondly Ranked State			Thirdly Ranked State		
	Area	Production	State	Area	Production	State	Area	Production	State	Area	Production
Egg plant	543	9,031	WB	153	2,757	OR	128	1,854	BR	54	1,031
Cabbage	243	5,471	WB	75	1,983	OR	34	932	BR	37	578
Cauliflower	270	5,026	WB	66	1,666	BR	60	939	OR	45	639
Okra	369	3,658	WB	66	719	BR	56	714	OR	71	620
Peas	287	2,270	UP	139	1,147	MP	18	199	HP	16	177
Tomato	530	9,515	AP	84	1,602	OR	100	1,332	KA	45	1,188
Onion	694	9,228	MH	154	1,879	GJ	85	1,877	BR	50	1,012
Potato	1,520	28,697	UP	445	9,987	WB	321	7,107	BR	309	5,703
Sweet Potato	123	1,072	OR	47	394	UP	21	252	WB	26	208
Tapioca	245	7,839	TN	127	4,857	KL	91	2,568	AP	16	322

Note: AP; Andhra Pradesh, AS; Assam, BR; Bihar, GJ; Gujarat, HP; Himachal Pradesh, KA; Karnataka, KL; Kerala,, MH; Maharashtra, MP; Madhya Pradesh, OR; Orissa, PB; Punjab, TN; Tamil Nadu, UP; Uttar Pradesh, UR; Utranchal, and WB; West Bengal

Source: National Horticultural Board http://nhb.gov.in/

Table 5.2.4 Crop-wise Leading States of Fruits Production in 2005/06

(Unit: Area:'000ha, Production: '000ton)

Crop	India		Firstly Ranked State			Secondly Ranked State			Thirdly Ranked State		
	Area	Production	State	Area	Production	State	Area	Production	State	Area	Production
Apple	227	1,814	JK	100	1,152	HP	89	540	UR	29	112
Banana	569	18,845	TN	95	4,648	MH	73	4,609	GJ	49	2,499
Citrus	744	6,154	AP	188	2,228	MH	249	2,469	PB	26	365
Grape	65	1,647	MH	45	1,275	KA	10	193	TN	3	85
Guava	167	1,737	MH	31	224	BR	28	199	UP	16	158
Litchi	63	392	BR	28	200	WB	8	75	AS	5	35
Mango	2,081	12,658	AP	460	3,306	UP	252	2,673	KA	125	1,237
Papaya	68	2,138	AP	11	871	GJ	8	323	WB	10	264
Pineapple	83	1,282	WB	13	379	AS	11	161	KA	3	135
Pomegranate	113	821	MH	91	594	KA	12	139	GJ	4	38
Sapota	140	1,114	MH	63	256	GJ	25	236	KA	23	250

Note: AP; Andhra Pradesh, AS; Assam, BR; Bihar, GJ; Gujarat, HP; Himachal Pradesh, KA; Karnataka, KL; Kerala,, MH; Maharashtra, MP; Madhya Pradesh, OR; Orissa, PB; Punjab, TN; Tamil Nadu, UP; Uttar Pradesh, UR; Utranchal, and WB; West Bengal

Source: National Horticultural Board http://nhb.gov.in/

Among other horticulture crops, spice crops were grown in 2.4 million ha throughout the country with a total production of 3.7 million tons in 2005/06. The top leading state is Rajastan, followed by Andhra Pradesh, Kelara, Karnataka and Madhya Pradesh.

5.2.2 Future Projected Demands of Major Vegetables around the State

(1) Demand Projection Method

The demand for major vegetables was projected based on the demand function program prepared by the Agro-Economic Research Centre of Himachal Pradesh University. Prior to calculation of the demand projection in 2006, the Centre conducted an interview survey intended for marketers and other stakeholders in order to collect basic data on parameters required for the demand projection. The interview survey was carried out in the main consuming centers of Himachal vegetables such as Delhi and Chandigarh, and other markets from neighboring states of Haryana and Punjab.

The demand projection for the period from 2005/06 to 2024/25 was calculated using some parameters such as per-capita income, disposable income, relative price changes, population growth and

disposable income.

(2) Future Demand for Vegetables in Delhi and Surrounding States

The target markets of Himachal vegetables are the national capital Delhi and Chandigarh regions as well as the two states of Haryana and Punjab surrounding the State of Himachal Pradesh where urbanization growth occurs now. The future demand of principal vegetables of these areas was estimated based on the above-mentioned parameters. The results are shown in the following table.

Table 5.2.5 Total Demand of Major Vegetables in Delhi and Surrounding States

(Unit: ton)

Year/Season		Strategic Vegetables				Other Commercial Vegetables			**Total**
		Cauliflower	Pea	Tomato	Potato	Cabbage	Capsicum	Beans	
2005/06	Summer	83,340	87,027	298,422	411,372	100,825	73,743	42,457	1,097,186
	Rainy	65,044	73,984	243,985	440,382	74,839	59,733	47,620	1,005,587
	Winter	144,456	126,213	194,691	535,943	137,259	22,167	35,491	1,196,220
	Total	292,840	287,224	737,098	1,387,697	312,923	155,643	125,568	**3,298,993**
2017/18	Summer	119,792	155,635	442,266	656,101	144,445	124,726	63,965	1,706,930
	Rainy	104,627	133,348	381,421	688,250	107,854	104,423	66,978	1,586,901
	Winter	198,858	198,730	329,418	882,634	201,341	34,666	50,202	1,895,849
	Total	423,277	487,713	1,153,105	2,226,985	453,640	263,815	181,145	**5,189,680**
	Increment	45%	70%	56%	60%	45%	70%	44%	**57%**
2022/23	Summer	141,585	200,474	527,868	802,369	169,707	157,221	76,123	2,075,347
	Rainy	129,047	172,380	462,214	833,661	128,601	134,254	77,385	1,937,542
	Winter	229,424	240,065	410,220	1,086,307	237,094	42,717	58,399	2,304,226
	Total	500,056	612,919	1,400,302	2,722,337	535,402	334,192	211,907	**6,317,115**
	Increment	18%	26%	21%	22%	18%	27%	17%	**22%**

Remarks: Summer: March to June, Rainy: July to September, Winter: October to February
Note: Modified by the JICA study team, based on the result calculated by Agro-Economic Research Centre
Source: Agro-Economic Research Centre, Himachal Pradesh University, 2008 and modified by JICA study team

The cities of Mumbai and Kolkata with city population of above 10 million will have a vegetable demand equal to Delhi, and both cities are considered to be the future target markets of Himachal Pradesh vegetables, taking into consideration the development progress of long distance transportation network and cold chain services.

(3) Future Demand of Major Vegetables for Share of Himachal Pradesh

The future demand for Himachal vegetables was estimated based on the result of the interview survey for share of Himachal vegetables in major markets in Delhi, Punjab, Haryana, and Chandigarh, conducted by Agro-Economic Research Centre in 2005, as shown in the following table.

Table 5.2.6 Demand Projection of Major Vegetables for Share of Himachal Pradesh

(Unit: ton)

Year/Season		Strategic Vegetables				Other Commercial Vegetables			**Total**
		Cauliflower	Pea	Tomato	Potato	Cabbage	Capsicum	Beans	
2005 /06	Summer	14,088	21,591	46,912	25,830	15,201	0	3,687	127,309
	Rainy	28,521	55,756	141,401	102,807	40,096	20,834	22,744	412,159
	Winter	0	2,035	183	3,632	1,844	393	1,065	9,152
	Total	42,609	79,382	188,496	132,269	57,141	21,227	27,496	**548,620**
2017 /18	Summer	19,366	39,910	69,142	42,075	21,785	0	5,692	197,970
	Rainy	45,204	100,473	220,520	161,514	57,444	36,373	32,203	653,731
	Winter	0	3,586	293	6,308	3,244	565	1,506	15,502
	Total	64,570	143,969	289,955	209,897	82,473	36,938	39,401	**867,203**
	Increment	52%	81%	54%	59%	44%	74%	43%	**58%**
2022 /23	Summer	22,388	52,189	82,375	51,933	25,596	0	6,841	241,322
	Rainy	55,384	129,862	266,964	196,031	68,299	46,745	37,298	800,583
	Winter	0	4,529	356	7,918	4,094	665	1,752	19,314
	Total	77,772	186,580	349,695	255,882	97,989	47,410	52,732	**1,061,219**
	Increment	20%	30%	21%	22%	19%	28%	34%	**22%**

Note: Modified by the JICA study team, based on the result calculated by Agro-Economic Research Centre
Remarks:
**1: Three seasons such as summer, rainy, and winter were used only for demand projection. The periods for three seasons are shown as follows: Summer: March to June, Rainy: July to September, Winter: October to February*
In this report, Kharif and Rabi are generally used for indicating agricultural season. The periods of Kharif and Rabi are shown as follows: Kharif: June to October, Rabi: November to May
**2: Provisionally, three seasons of summer, rainy, and winter could be linked for reference with two cultivation seasons of Kharif and Rabi as follows: Kharif includes Rainy season, Rabi includes Summer and Winter seasons.*
Source: Agro-Economic Research Centre, Himachal Pradesh University, 2008 and modified by JICA study team

(4) Future Production to be Required in Himachal Pradesh

The net production to be required in Himachal Pradesh is estimated based on the demand for Himachal vegetables mentioned above, the assumed local consumption in the State, as well as marketing and transportation losses, as shown below.

Table 5.2.7 Production Projection to be additionally Required for Major Vegetables in Himachal Pradesh.

(Unit: ton)

Year/Season		Strategic Vegetables				Other Commercial Vegetables	**Total**
		Cauliflower	Pea	Tomato	Potato		
2017/18	Kharif	21,000	115,000	102,000	81,000	65,000	
	Rabi	7,000	42,000	1,000	1,000	7,000	
	Total	**28,000**	**157,000**	**103,000**	**82,000**	**61,000**	**431,000**
2022/23	Kharif	33,000	189,000	159,000	123,000	99,000	
	Rabi	10,000	75,000	17,000	15,000	13,000	
	Total	**43,000**	**264,000**	**176,000**	**138,000**	**103,000**	**724,000**

Remarks i. Kaharif season: June to October, Rabi season: November to May
ii. Increment in existing vegetable cultivated area is also considered
iii. The local consumptions in the State and transportation loss is assumed at approximately 20% of total products. The remaining vegetables of 80% are assumed to be marketed outside of the State (Delhi and Surrounding States 85% and other big consumption area 15%).
Source: Agro-Economic Research Centre, Himachal Pradesh University, 2008 and modified by JICA study team

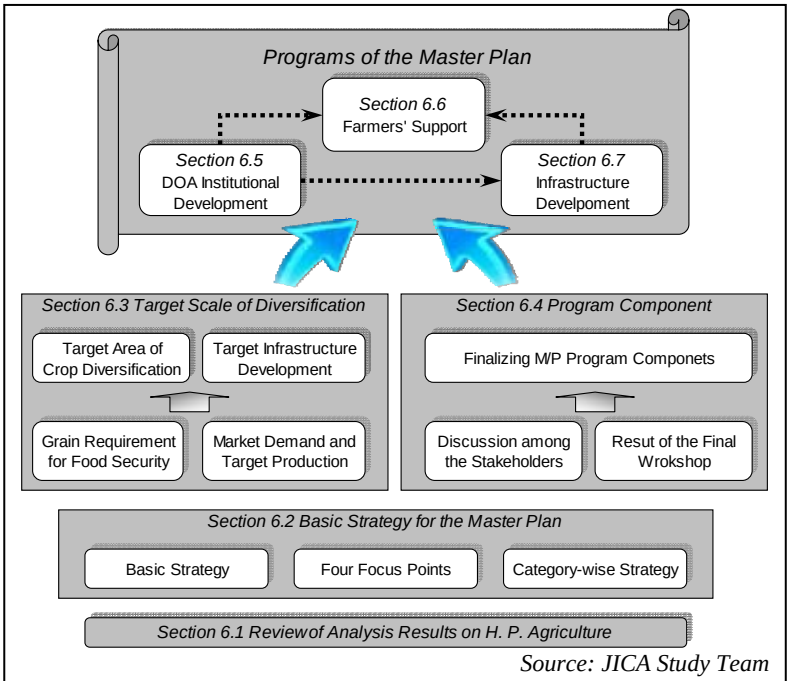
CHAPTER 6 MASTER PLAN FOR DIVERSIFIED AGRICULTURE

6.1 General

The agriculture sector is the main economic activity in the rural area where 90% of the people live and it sustains the livelihood of the rural people in the state. The result of the state economic review indicates that the agriculture sector has been growing, but its share in the Gross State Domestic Product (GSDP) has been constantly declining since 1980s and is now less than 20% of the total GSDP. This declining share of agriculture sector has been causing stagnation of the rural economy and the income growth in the rural areas is far lower than in the urban areas. The agriculture sector needs to transform its economic structure in order to change the declining economic trend in the rural area.

Based on the above situation, the Study is carried out to formulate the Master Plan (M/P) for 2022/23 and the Action Plan (A/P) for 2017/18 on rural development in order to promote diversified agriculture for enhanced farm income. The formulation process of the M/P is shown in the Fig. 6.1.1. The M/P contains the basic strategy, target scale and development programs.

In this perspective, a series of analysis are conducted on food grain requirement, target production, future market potential and crop area expansion of the strategic crops as the quantifiable framework for the M/P and A/P.



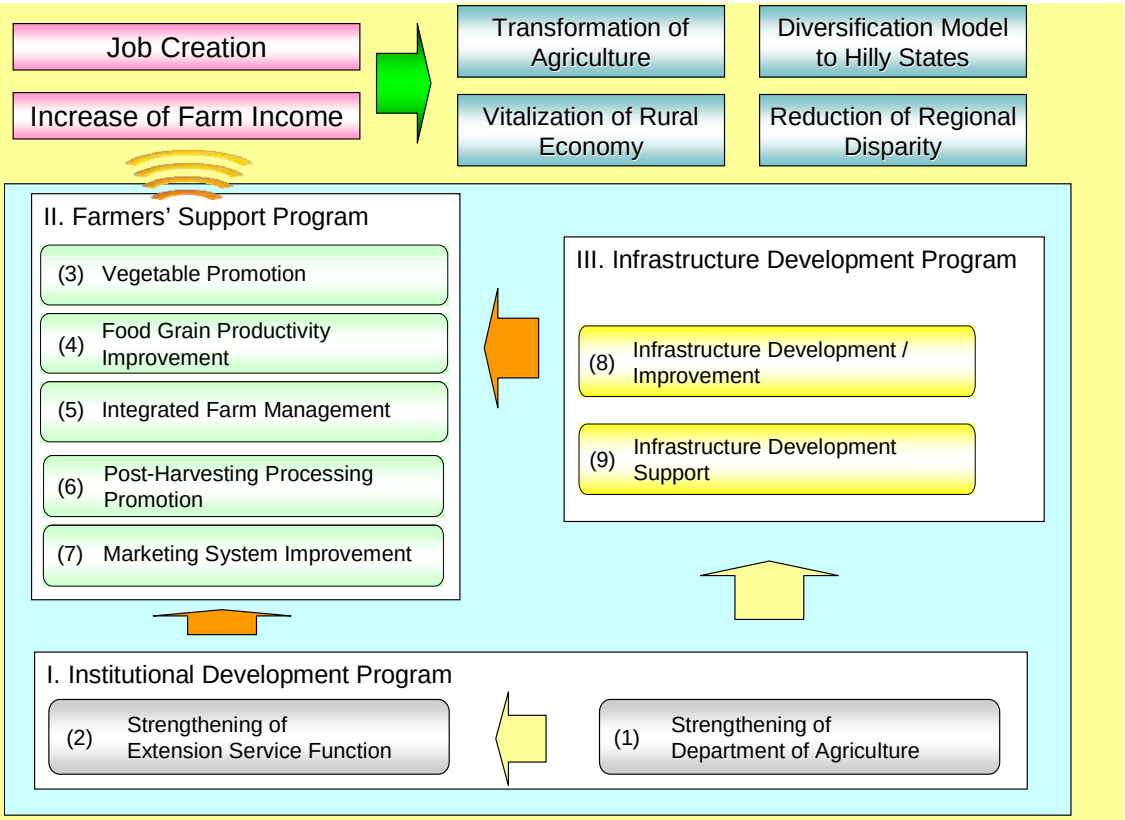
Source: JICA Study Team

Fig. 6.1.1 Formulation Flow of Master Plan

Regarding on government policy, the Central Government and the State Government put their stress on crop diversification from traditional crops to commercial crops as one of the key issues to increase farm income and rural employment in the agricultural sector. These stress points are taken into account in the formulation of the M/P.

In addition, there are 11 hilly states in India and one of these is Himachal Pradesh. It is expected that the experience and knowledge to be learned in Himachal Pradesh through the proper implementation of the M/P will be extended to the other ten hilly states.

Three programs for the promotion of agricultural diversification such as “Institutional Development”, “Farmers’ Support” and “Infrastructure Development” are created. These programs are composed of a series of program components which are groups of activities to satisfy the development needs. Nine program components are prepared and their correlation flow among the programs is illustrated below.



Source: JICA Study Team

Fig. 6.1.2 Correlation Flow among Programs and Components for the Promotion of Diversified Agriculture

The development needs are identified based on constraints and potential/opportunity of the present condition for the promotion of agricultural diversification as mentioned in Section 4.3. In order to satisfy the development needs, a series of activities are organized and grouped based on the above program components. In the process of preparing the activities, the development needs are modified to include the objectives of the activities. Table 6.1.1 shows the development needs and related activities grouped in the program components:

Table 6.1.1 Relationship between Development Needs and Program Components

Development Needs based on the Constraints, Potential and Opportunity	Activities in the Program Components
	I. Institutional Development Program
<u>Supporting Organization</u> - Recruitment of personnel to fulfill the vacant posts to intensify farmers support for crop diversification and staff capacity development - Establishment of MIS system for state-wide project implementation and monitoring - Improvement of staff activities by supply of transportation means - Improvement of planning and design capacity for irrigation and farm road by supply of equipment with training of staff	(1) <u>Strengthening of Department of Agriculture</u> - Capacity development of staff to establish PCDA(Plan-Do-Check-Action) cycle for planning, implantation, monitoring & evaluation in crop diversification - Establishment of MIS for crop diversification, and training of staff to utilize the system - Provision of vehicles, motor cycles, tools and instruments - Increase of extension and soil conservation staff
<u>Agricultural Extension</u> - Changing of farmers support activities from input distribution to technical and managerial services, and	(2) <u>Strengthening of Extension Services Function</u> - Utilization of ATMA model for coordinating extension officers and conducting their trainings

Development Needs based on the Constraints, Potential and Opportunity	Activities in the Program Components
intensification of support by sufficient staff - Collaboration between research institute and extension to satisfy farmers' needs utilizing the resources of research stations and universities - Monitoring of program progress and feedback of evaluation results to extension activities for regular improvement	- Establishment of farm schools for demonstration - Preparation of information for dissemination through mass media and popularization of Farm Call Center - Improvement of soil diagnosis services - Support to farm women on post-harvest & processing - Dissemination of subsidy schemes available for crop diversification - Strengthening of linkage with the research institute through workshops and field visit - Monitoring and evaluation of extension activities
	II. Farmers' Support Program
Vegetable and Food Grain Cultivation - Increase of off-season vegetable production utilizing favourable climate in Kharif season in better production and demand - Reducing cultivation area for food grains by improvement of productivity of marginal and small farmers by small scale irrigation as well as improvement of farming practice under rainfed condition - Educating the next generation in primary and secondary education through creating school farming gardens and field visits by pupils	(3) Vegetable Production - Demonstration and dissemination for 1) suitable cropping patterns, 2) farming practices, 3) introduction of exotic vegetables, and 4) improvement of productivity and quality of vegetables - Supporting activities such as organizing farmers' marketing groups, supply of seed and planting materials, extension of protective farming, optimum use of pesticide and IPM, farming practices to reduce soil erosion, and contract farming arrangement (4) Food Grain Productivity Improvement - Demonstration and dissemination of optimum farming practices and cropping pattern - Monitoring and evaluation of component progress and feeding back of the evaluation results for improvement - Supporting activities (promotion of organic farming)
Agriculture Allied Activity - Mixed farming with vegetables and pasture in orchard for gestation period after plantation - Expansion of fodder production and grazing land to improve milk production for supplemental cash income - Trial weeding control of "Lantana", which is disturbing livestock grazing in large area - Promotion of small scale fish culture for home consumption or supplemental income at local market utilizing water from small sources	(5) Integrated Farm Management - Improvement of productivity and quality of horticultural crops - Promotion of fodder production and reuse of vegetable residues under integrated farming in crop diversification - Promotion of warm water fish culture under integrated farming in irrigation system with supplying fish seed and fry - Organizing or strengthening of farmers' marketing groups and contract farming arrangement, monitoring and evaluation
Post-Harvest and Processing - Utilization of containers and road improvement in order to avoid loss and waste of perishable vegetables during transportation - Promotion of small scale cottage industry on agro-processing for perishable vegetables - Quality Improvement and price increase by sorting and grading of vegetables applying quality standard	(6) Post-Harvesting Processing Promotion - Improvement of such post harvest activities such as grading, sorting and packing with using containers in accordance with the quality standard - Introduction of small scale agro-processing activities - Organizing and strengthening of farmers' marketing groups

Development Needs based on the Constraints, Potential and Opportunity	Activities in the Program Components
for sorting, grading and packing - Improvement of circumstance to enable private sector to work in vegetable trading as a service provider in PPP	
Marketing of Vegetables and Fruits - Training of staff of the Agricultural Marketing Board and APMCs for record keeping on auction prices and quantities - Establishment of interactive market information system and training for data processing and dissemination to farmers and traders	(7) Marketing System Improvement - Capacity development for staff of the Agricultural Marketing Board and APMCs - Preparation of quality standard for vegetables - Improvement and enhancement of market information system among producers and marketers - Construction and rehabilitation of market facilities - Market promotion through branding, advertisement, campaign, exhibition, etc.
	III. Infrastructure Development
Irrigation and Access Farm Road - Construction and rehabilitation of small scale and minor irrigation for utilization of irrigation potential through community-based activity to diversify crops from food grains to vegetables - Application of pump irrigation and pipeline systems in the topographically difficult areas for gravity irrigation. - Water-saving cultivation to utilize limited water resources in Rabi season - Increase of density of motorable access farm roads and foot paths to connect the PWD village road in hilly and undulated terrain - Better maintenance of farm road and foot path for regular marketing activities of products and inputs	(8) Infrastructure Development / Improvement - Construction of small scale irrigation systems, and rehabilitation and improvement of existing minor and traditional irrigation systems - Construction of water harvesting facilities to expand vegetable cultivation in Kharif season - Construction of access farm roads, and improvement and upgrading of existing farm roads - Construction and improvement of existing footpath and mule track - Construction of ropeway (9) Infrastructure Development Support - Organizing of farmers' group for participatory infrastructure development - Capacity development of farmers' group for O&M and water management

Prepared by JICA Study Team

6.2 Basic Strategy for Master Plan

6.2.1 Basic Strategy and Approach

Based on the review of the present condition, the major characteristics of the state economy, agricultural sector and rural socio-economy are described below.

The major characteristics of the agriculture sector in the state economy are summarized below:

(1) Macro Economic View Point

The state economy has been growing at the rate of 6.8% per annum since 1995/96 to 2006/07, but the share of agriculture sector in Gross State Domestic Product (GSDP) has been constantly declining since 1980s, and is now below 20% of the total GSDP.

i) Out of the total population of 6.1 million, 90% are categorized as rural population, and the agricultural sector employs 68% of the total workers in the state.

ii) In 2006/07, GSDP per worker in the state is calculated at Rs.73,300 per annum. Sector wise, the GSDP per worker shows a large difference between Rs.25,800 in the agriculture

sector and Rs.168,000 in other sectors.

iii) The above situation indicates that the agriculture sector is the mainstay to sustain the livelihood of rural population, but economic disparity has been expanding between urban and rural areas. In this regard, the agriculture sector needs to increase its productivity and transform into vital economic sector.

(2) Micro Economic View Point of Farm Households

i) The majority (86%) of farm households are marginal and small scale which is less than 2.0 ha, and their farm lands are situated on the mountain slopes. This situation encourages farmers to traditionally cultivate food crops for food security and prevented them to diversify their produce to highly profitable commodities regardless of favorable climate and market opportunity for off-season produces.

ii) One of the advantage of the state is the cool climate in the higher altitudes, enabling to produce off-season production of temperate vegetables and fruits. Off-season vegetables have large market in urban cities with better prices, and the demand is still expanding. Temperate fruits show high profitability, but approximately 94% of production are limited to only five districts in the state. Accordingly, vegetable farming is chosen for crop diversification due to its large market demand and vegetables are being grown in all districts of the state.

(3) Socio-economic View Point in Rural Area

i) Below poverty line in the State is estimated at about 24% which is slightly higher than the national average of 26%. While the absolute poverty is not a major issues in the state, some 22% of total households are assessed with high vulnerability to falling into poverty due to economic turn down (vulnerable group). This means that 46% of total households belong to the poverty and vulnerable group.

ii) Supplementary definition of poverty includes the basic needs of human life. A monthly per capita expenditure of more than Rs.840 would be required to secure the basic needs of human life like nutrition, health, education. This income class is estimated at about 60% of the rural population, mostly categorized as small and marginal farm households.

Taking the above situation into account along with the policy target of the government, the target of the Master Plan is set along with the basic strategy and approach below:

Target: Agriculture Diversification through Diversification from Food Grains to Diversified Crops, especially to Vegetables for Enhanced Farm Income of Small and Marginal Farmers in the State

Basic Strategy:

a) To maximize special agro-climatic advantage of the State for the diversification of food grains to value-added produce, particularly off-season vegetables, to the growing domestic market in large cities in India

b) Improvement of food grain productivity to sustain food security of small & marginal farmers and infrastructure development to support the diversification

c) To increase farm income based on the production of food grains and vegetables with post-harvest and market system improvement, integrating horticulture, animal husbandry and fishery

d) Institutional strengthening of organizations and stakeholders

Basic Approach for Diversification of Enhanced Farm Income:

a) To increase production area by crop diversification from traditional food grains
b) To increase productivity of diversified produces
c) To improve quality of the produces, animal husbandry and fishery
d) To sell the produces at higher prices
e) To improve support services and infrastructure for the stable diversified production

Livestock and inland fishery will be discussed in the Master Plan as one sphere of the integrated agriculture where they are applicable around the production area for supply to local markets. Major focus will be given firstly, to vegetables and secondarily, to fruits in the state.

The present situation of the state has been classified into four categories corresponding to the different conditions and progress of agricultural diversification in the area, and each category represent the stages of diversification. Category I is a relatively advanced area, then followed by Category II, III, IV in order of the stage. With the increase of presently available government human and financial resources, it is expected to step up the stages of diversification to reach the targets for 10 years and 15 years.

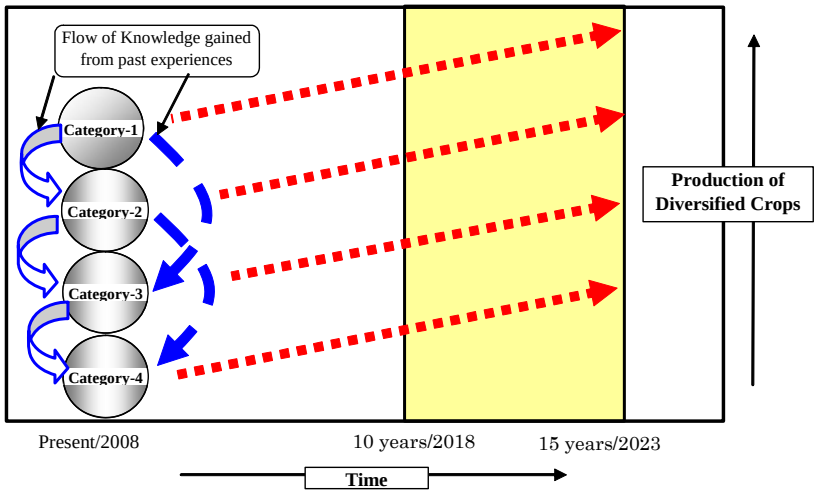


Fig. 6.2.1 Conceptual Diagram for Development

6.2.2 Focus Points for Formulation of Master Plan

The following focus points will be taken into consideration in the formulation of the Master Plan based on the analysis of present conditions:

Focus points in the formulation of Master Plan:

i) Step-by-Step Diversification corresponding to Farmers' Needs and their Cultivation Techniques,
ii) Farmers' Self-active Diversification,
iii) Step-down Support to Diversified Farmers for their Sustainability, and
iv) Extension System considering Public-Private sector Partnership

Focus Point-1: Step-by-step diversification corresponding to farmers' needs and their cultivation technique

Traditional farmers grow food grains to sustain their family food security. Crop diversification involves risks in production and marketing. In order to mitigate the risks, crop diversification should gradually start from food grain to diversified crops coupled with a gradual increase in area for crops in a step-by-step manner until the optimum area for crops is attained as planned.

Focus Point-2: Farmers' self-active diversification

The ownership mind of the farmers is fully respected in the planning process. The farmers' desires, collected through workshops, will be fully evaluated and incorporated in the planning if they are applicable. Active dissemination of new technology and outside market information to the farmers is necessary to educate and enlighten them to diversify their produces. In order to motivate the farmers to diversify, an awareness campaign of the advantages of diversification and the agro-diversity needs of the state has to be pursued. In addition, physical inputs such as irrigation and access farm roads have to be provided.

Focus Point-3: Step-down support to diversified farmers for their sustainability

Even self-active diversified farmers, especially the marginal ones, need some types of supports depending upon the crops or activities to be introduced in their farms. It is necessary, however, to give time limits to direct support in kind or subsidy but to provide continuous support on dissemination of new technology, market information, and so on. This time limit is recommended from the view-point of not only the state budgetary constraint, but also respect for self-active farmers.

Focus Point-4: Extension system considering public-private sector partnership

Dynamism in private sector will be incorporated in the plan formation as practical as it is possible. The private sector has already entered and started in some businesses related to diversified crops.

Technology dissemination of the autonomous ATMA model has been piloted in the state, taking public sector and private sector in the model. Some private companies such as Reliance Fresh, ADANI, ITC, etc. have already started some direct purchases of vegetables from farmers. Also, many processing plants for fruit juice, frozen vegetables, etc are being operated by private companies.

6.2.3 Category-Wise Diversification Strategy

As mentioned in Section 3.6, the diversified agriculture pattern has been divided into four categories focusing on vegetables in this study. Crop diversification strategy has been studied for respective four categories and summarized in the following table:

Table 6.2.1 Category-Wise Diversification Strategy

Category	Characteristics	Future Development Direction
Category-I	Advanced crop diversification area with less area expansion possibility	Further enhancement of farm income through productivity and quality improvement
Category-II	Crop diversification starting area with area expansion possibility	Enhancement of farm income through acceleration of crop diversification
Category-III	Predominantly grain crop cultivation and least crop diversification area with diversification area expansion potential	Enhancement of farm income through promotion of crop diversification
Category-IV	Area not covered by the above Category I to III	Enhancement of farm income through introduction of crop diversification, followed by integrated farming consisting of horticulture, animal husbandry or fishery.

(1) Development Direction in Category I Area

Twenty-one blocks in the State have been classified into Category I. Category I area is characterized by advanced areas with less diversified area expansion possibility. Targets in this category are quality improvement and productivity increase. Produces, mainly vegetables and temperate fruits, in Category I area have some market channels and their current market share should be maintained at least or be increased. Exotic vegetables are also growing and their further market cultivation is needed.

Vegetable-oriented Area

Vegetable cultivation is advanced in the 12 blocks out of the 21 blocks, and focus point are as follows:

i) Targets of vegetable cultivation are i) saving of production cost, ii) introduction of new varieties, iii) productivity improvement, iv) quality improvement and v) selling higher prices;

ii) Harvesting period is to be off-season (March to October) of other competitive producing areas outside the State where vegetable prices are higher in the target markets such as Delhi. Accordingly planting time is decided in recommended cropping pattern corresponding to the harvesting period and growing period. Rabi season vegetables will be planted after December and harvested after February;

iii) The quality is to be improved for getting reputation of consumers and higher prices through i) high quality seeds, ii) organic farming for food safety and iii) post-harvest technology in sorting, grading and packing. Protective farming (green house) is to be promoted.

iv) Pilot demonstration is required, targeting to farmers i) to demonstrate farming practices of new varieties and exotic vegetables, and ii) to disseminate market channel possibility including direct channels to middle-class and higher consumers in urban area;

v) Farmers' livelihood condition is expected to be improved and stabilized based on income generation from quality-improved vegetable-basis farming.

Fruits-oriented Area

Fruit production is advanced in the nine blocks out of the 21 blocks, and focus point in the area are as follows:

i) Quality of apple is to be improved through replacement of old trees to new varieties;

ii) Temperate fruit varieties are to be extended in order to create niche markets;

iii) Soil conservation and soil fertility improvement are to be promoted in fruit areas on steep or hilly slopes, and one of its methods is to grow forage crops mixing with fruit trees. Such practices also aim at creation of fodder production sources for cattle and sheep; and

iv) New commercial crops like flowers, medical/aromatic plants also have potential. Marketing efforts to specific end users must be made for medical/aromatic plants.

(2) Development Direction for Category II Area

Eleven blocks have been classified as Category II, characterized by crop diversification starting area with area expansion possibility. The main target in Category II is increase in production of diversified crops, mainly vegetables, by means of expansion of cropped area through the crop diversification and increasing productivity of diversified crops. Increase in production and shipping is the most important priority in this category. Focus points in the area are as follows:

i) Vegetable producing area is to be newly created by the crop diversification from existing traditional crop area. Market shares of produced vegetables in existing vegetable growing areas are to be maintained or to be increased by new market cultivation;

ii) Reputation and market share of the main strategic vegetables is expected to be gained in the target markets in Delhi. Harvesting period is to be off-season (March to October) of other competitive producing areas outside the State.

iii) The productivity in existing vegetable growing area is to be improved through introduction of i) high quality seeds, ii) upgraded farming practices, iii) irrigation and iii) post-harvest technology in sorting, grading and packing. Protective farming (green house) is to be promoted.

iv) Pilot demonstration is required i) to demonstrate farming practices of new varieties, ii) to introduce post-harvest technology and iii) to disseminate market channel, iv) to show protective farming (green house). Nurturing of talented farmers is also target;

v) Initial priority is to be given for expansion of cropped area followed by raising crop productivity. Farmers' livelihood conditions will be improved, following income generation from vegetable-basis farming.

(3) Development Direction for Category III Area

Thirty blocks have been classified as Category III, where vegetable cultivation has not started yet, but there is high potential in area expansion and productivity increase. Most of the areas in this category belong to Agro-ecological Zone 1 and parts of Zones 2 and 3. Targets in Category III are increase in production of vegetables by means of expansion of cropped area through diversification from traditional food grain. Delivery of the produces to target markets is also important priority.

Majority of the farmers in this category are growing food grains and vegetables are produced in small scale for domestic consumption. The farmers' income in this category is farm income with additional non-farm income. Farm income comes from selling surplus grains and milk while non-farm income comes from labor wage from seasonal or temporary works. Part-time farmer, whose non-farm income

is bigger than farm income, is also cultivating food grains.

In order to promote vegetables in Category III, the target farmers are not the part-time farmers but the farmers whose income depend upon farming. Highly motivated and willing farmers will start crop diversification to vegetables and become core vegetable farmers. By impact of these core vegetable farmers, other farmers nearby are expected to follow and start diversification.

Awareness camp will be organized to encourage motivation and willingness to start vegetable cultivation as a first step, and workshop for vegetable farming practices will be organized for motivated and willing farmers as the second step. Farmers will do some rethinking themselves towards diversification step by step. Diversification from traditional food crops to vegetables will be made gradually.

Focus points in the area are as follows:

i) Vegetable producing area is to be newly created by the crop diversification from existing traditional food grain area with productivity increase for family food security. Existing market yards will be used as a market channel.

ii) Promotion of new crop diversification is to be centered on vegetable cultivation paying careful attention to identification and selection of adaptable crops from a viewpoint of agro-climatic limitations and market demands;

iii) Crop diversification is to be initially based on current strategic crops in Agro-ecological Zones-2 and -3. Proper cropping seasons must be selected matching with crop growth condition and the off-season period in target markets;

iv) Research & development activities are to be focused on practical topics such as breeding of new variety for the blocks belonging to Agro-ecological conditions of Zones-1 and -2;

v) Area expansion is to be supported by introduction of i) awareness camp & workshop ii) irrigation, iii) quality seeds, and iii) introduction of sorting, grading and packing.

vi) Initially, priority is to be put on promotion of crop diversification on existing cropped area and then increase of crop productivity. Farmers' livelihood conditions will be improved based on income generation from vegetable-basis farming gradually.

(4) Development Direction for Category IV Area

Thirteen blocks in the State have been classified into Category IV, presently predominant in food grain production. The potential or area expansion for crop diversification is comparatively small in this category. Therefore, promotion of diversified agriculture through alternative means of integrated management such as the promotion of livestock and inland fishery are the keys.

These blocks should focus on raising crop productivity of food grain, since there is less potential for conversion to diversified crops due to high population pressure or low productivity there. Focus points in the area are as follows:

i) Food grain productivity is to be raised and improved as a first step. Small potential exists in Category IV, and diversification can be made after raising productivity of food grains currently grown in Kharif season. In such area vegetable promotion will be made;

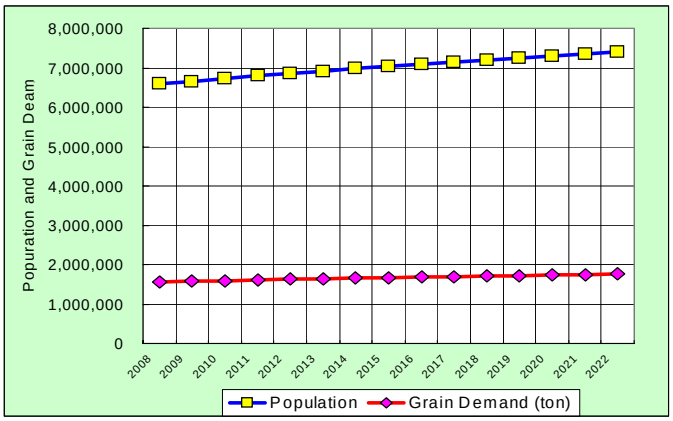
ii) In parallel, integrated farming is to be promoted which contains planting sub-tropical or temperate fruit trees, milk production by cattle and local buffalos or fish culture using irrigation pond or storage in irrigation system.

6.3 Target Scale of Crop Diversification

6.3.1 Future Demand and Supply of Food Grains

(1) Future Demand of Food Grains at the State Level

The food demand in the State in the target year of 2017/18 and 2022/23 for the Master Plan is estimated based on the population projection and per capita consumption. According to the population projection by the National Commission on Population, future population will increase to 6,595,000 in 2008, 7,151,000 in 2017 and 7,408,000 in 2022. Food demand is estimated based on the above population projection and per capita consumption of 237 kg per annum calculated from the minimum daily intake of 650 g. Population and food demand is illustrated in the right figure.



Source: Prepared by JICA Study Team, based on Population Census

Figure 6.3.1 Population Projection and Food Demand in the State

Future production of food grains is estimated based on the analysis result of the present agricultural condition as well as the following assumptions:

- Irrigated area will increase by converting rainfed area into irrigation area under the on-going projects as well as the Development Program of the Master Plan.
- Food grains are maize and rice in Kharif season and wheat in Rabi season. Proportion of cropped area for these crops are assumed as the same as the present condition.
- Crop yields of food grains under irrigation are expected to increase from the present one by applying the measures assumed in the Development Components in the Master Plan.

The result of the future demand and production of food grains in the State are shown below:

Table 6.3.1 Future Demand and Production of Food Grains

Year	Population in H.P. State	Food Demand	Increment of Demand	Food Grain Production	Increment of Production	Balance
2008	6,595,000	1,563,000 ton	-	1,571,000 ton	-	+8,000 ton
2017	7,151,000	1,695,000 ton	+132,000 ton	1,730,000 ton	+159,000 ton	+35,000 ton
2022	7,408,000	1,756,000 ton	+193,000 ton	1,803,000 ton	+232,000 ton	+47,000 ton

Source: Population Projection for India and States 2001-2006, Report of the Technical Group on Population Projections Constituted by the Nation al Commission on Population May 2006, Office of the Registrar General & Census Commissioner, India, 2A, Mansingh Road, New Delhi. Demand and production are estimated based on the assumption mentioned in the above.

The above table indicates that the future food grain production will increase by 232,000 ton in 2022 sufficient in the State level, with slight surplus of 47,000 ton or 2.6% of total production.

(2) Food Balance and Food Security at Household Level

Based on the number of farm households, the average farm size consisting of net sown area and current fallow land is estimated at about 0.75 ha, ranging from 0.66 ha in Category IV to 0.85 ha in Category I. The present situation of average farm household in each category is presented regarding farm size, cropped area, production, etc.

Table 6.3.2 Average Cropped Area per Farm Household by Category

	Category I	Category II	Category III	Category IV	Average
Farms Size	0.85 ha	0.76 ha	0.72 ha	0.66 ha	0.75 ha
Food Grains	0.29 ha in Kharif 0.24 ha in Rabi total 1.15 ton	0.44 ha in Kharif 0.44 ha in Rabi total 1.83 ton	0.50 ha in Kharif 0.49 ha in Rabi total 2.08 ton	0.38 ha in Kharif 0.37 ha in Rabi total 1.55 ton	0.44 ha in Kharif 0.42 ha in Rabi total 1.77 ton
Vegetables	0.14 ha in Kharif 0.04 ha in Rabi total 3.04 ton	0.06 ha in Kharif 0.06 ha in Rabi total 1.45 ton	0.01 ha in Kharif 0.01 ha in Rabi total 0.40 ton	0.03 ha in Kharif 0.01 ha in Rabi total 0.54 ton	0.05 ha in kharif 0.02 ha in Rabi total 0.54 ton
Fruits	0.33 ha	0.22 ha	0.13 ha	0.19 ha	0.20 ha
Total Cropped Area	1.04 ha	1.22 ha	1.14 ha	0.98 ha	1.12 ha
Cropping Intensity	122%	161%	158%	148%	149%

Source: Total area and cultivated area by category are estimated by the JICA Study Team, based on the block data as of 2005/06 collected in the course of the study, and the AEZ zoning maps.

The above table indicates that the farm household has diversified 24% of the cropped area or 0.27 ha into vegetables and fruits on the average. In promoting crop diversification from food grains, food security at household level has to be considered. The food consumption requirement per household is estimated based on the average family size and minimum food intake per capita. Then, food balance is calculated based on grain production and requirement, as shown below.

Table 6.3.3 Food Balance at Farm Household Level by Category

	Category I	Category II	Category III	Category IV	Average
Family Size	5.7 persons	5.9 persons	6.2 persons	5.1 persons	5.9 persons
Food Consumption	1.36 ton	1.41 ton	1.47 ton	1.22 ton	1.40 ton
Grain Production	1.15 ton	1.83 ton	2.08 ton	1.55 ton	1.77 ton
Balance	-0.21 ton	+0.42 ton	+0.61 ton	+0.33 ton	+0.37 ton
Unit Yield of Food Grain	2.2 ton/ha	2.1 ton/ha	2.1 ton/ha	2.1 ton/ha	2.1 ton/ha
Area after Food Balance	**-0.10 ha**	**+0.20 ha**	**+0.29 ha**	**+0.16 ha**	**+0.18 ha**

Note: Average food consumption per capita is estimated at 237 kg per annum based on the minimum daily food intake of 650g per.
Source: Estimation by the JICA Study Team, based on the block level data collected in the course of the Study.

The result shows that the present food grain production exceeds household consumption (except Category I) and farm land equivalent to produce surplus grains would be available for crop diversification within the range from 0.18 ha in the average farm household.

The above assumption is for the average scale of farm households while the real situation reveals that 84% of farm households are marginal and small farmers. For this farm size class, food security needs to be secured first to avoid any vulnerable situation, thereafter, diversification would be promoted. In this case, yield increase of food grains would be effective to secure food security within the marginal and small scale farm households.

6.3.2 Future Market Volume and Target Production

In the Chapter 5, the development potentials are studied for potential crops and their market potential. For potential crops, vegetable are selected as the core crop sector in view of coverage of Agro-ecological Zones, marketing characteristics, impacts on the State economy, and impacts on farm economy. Then, from 13 vegetables growing in more than 100 ha area in the state, four vegetables such as potato, tomato, cauliflower and peas are selected from the vegetable types of root, fruit, leafy and legume as the present major vegetables grown in the state.

The present market flow shows that the major destinations of vegetables grown in the state are the large consuming areas of Delhi, Haryana, Punjab and Chandigarh. The market potential in these areas are studied to estimate the strategic vegetables and other major vegetable grown in the state by projecting market demand.

Referring to the analysis in Section 5.2, the future target production is estimated at the stage of Master Plan (2022/23) and Action Plan (2017/18), considering the irrigation type such as irrigation, life saving irrigation, and rain fed, and summarized as follows:

Table 6.3.4 Production Projection to be Additionally Required for Major Vegetables for Master Plan

(Unit: ton)

Year	Season	Type	Cauliflower	Peas	Tomato	Potato	Other Commercial Vegetables	Total
2022 /23	kharif	Irrigation	26,000	153,000	129,000	100,000	71,000	479,000
		Life Saving	3,000	19,000	16,000	12,000	10,000	60,000
		Rainfed	4,000	17,000	14,000	11,000	9,000	55,000
		Total	33,000	189,000	159,000	123,000	90,000	594,000
	Rabi	Full	10,000	75,000	17,000	15,000	13,000	130,000
		Life Saving	0	0	0	0	0	0
		Rainfed	0	0	0	0	0	0
		Total	10,000	75,000	17,000	15,000	13,000	130,000
	All Seasons	Full	36,000	228,000	146,000	115,000	84,000	609,000
		Life Saving	3,000	19,000	16,000	12,000	10,000	60,000
		Rainfed	4,000	17,000	14,000	11,000	9,000	55,000
		Total	**43,000**	**264,000**	**176,000**	**138,000**	**103,000**	**724,000**

Remarks: (1) see Section 5.2
(2) Other major commercial vegetables: such as cabbage, capsicum, and beans for demand projection
Source: Prepared by JICA Study Team, referring to the results calculated by Agro-Economic Research Center

Table 6.3.5 Production Projection to be Additionally Required for Major Vegetables for Action Plan

(Unit: ton)

Year	Season	Type	Cauliflower	Peas	Tomato	Potato	Other Commercial Vegetables	Total
20017 /18	Kharif	Full	17,000	93,000	83,000	66,000	41,000	300,000
		Life Saving	2,000	12,000	10,000	8,000	7,000	39,000
		Rainfed	2,000	10,000	9,000	7,000	5,000	33,000
		Total	21,000	115,000	102,000	81,000	53,000	372,000
	Rabi	Full	7,000	42,000	1,000	1,000	7,000	58,000
		Life Saving	0	0	0	0	0	0
		Rainfed	0	0	0	0	0	0
		Total	7,000	42,000	1,000	1,000	7,000	58,000
	All Seasons	Full	24,000	135,000	84,000	67,000	48,000	358,000
		Life Saving	2,000	12,000	10,000	8,000	7,000	39,000
		Rainfed	2,000	10,000	9,000	7,000	5,000	33,000
		Total	**28,000**	**157,000**	**103,000**	**82,000**	**60,000**	**430,000**

Remarks: (1) see Section 5.2
(2) Other major commercial vegetables such as cabbage, capsicum, and beans for demand projection
Source: Prepared by JICA Study Team, referring to the results calculated by Agro-Economic Research Center

6.3.3 Target Crop Diversification Area by Irrigation Type

In order to meet the target production in 2017/18 and 2022/23, cropped areas required for respective strategic crops are estimated based on the projected crop yields. Crop yields for Master Plan and Action plan have been estimated based on the potential yields of major vegetable crops estimated from the research data (see Table 3.7.1). The projected crop yields are given in Table 6.3.6 below.

Table 6.3.6 Projected Crop Yields Major Vegetables for Action Plan

Crop	Current Yield 2005/06	Potential Yield Evaluated by Study Team	Target Yield for Planning	
			Action Plan 2017/18	Master Plan 2022/23
Peas	10.4 ton/ha	13.0 ton/ha	**10.4 ton/ha**	**10.4 ton/ha**
Potato	11.5 ton/ha	20.0 ton/ha	**14.7 ton/ha**	**16.0 ton/ha**
Tomato	30.0 ton/ha	40.0 ton/ha	**31.4 ton/ha**	**32.0 ton/ha**
Cauliflower	15.9 ton/ha	21.0 ton/ha	**16.5 ton/ha**	**16.8 ton/ha**
Maize	2.5 ton/ha	4.6 ton/ha	**4.0 ton/ha**	**4.0 ton/ha**
Rice	2.1 ton/ha	4.0 ton/ha	**3.5 ton/ha**	**3.5 ton/ha**
Wheat	1.9 ton/ha	3.5 ton/ha	**3.0 ton/ha**	**3.0 ton/ha**

Remarks :Target Yield for 2022-23 is estimated as approx. 80% of the Potential Yield
Source: JICA Study Team

Based on the above production projection and projected crop yields, target crop diversification areas up to 2017/18 for Action Plan and 2022/23 for Master Plan have been estimated as given below.

Table 6.3.7 Target Crop Diversification Area

(Unit: ha)

Year	Irrigation Type	Cauli-flower	Peas	Tomato	Potato	Other Commercial Vegetables	Sub-Total	Other Vegetables	Total
2017/18	Full Irrigation	1,400	12,900	2,600	1,000	2,900	20,800	2,800	23,600
	Life Saving	200	1,300	400	0	500	2,400	1,000	3,400
	Rainfed	200	1,200	400	0	300	2,200	1,000	3,200
	Total	**1,800**	**15,400**	**3,400**	**1,000**	**3,800**	**25,400**	**4,800**	**30,200**
2022/23	Full Irrigation	2,100	21.900	4,500	2,000	5,100	35,600	5,200	40,800
	Life Saving	200	2,300	600	0	800	3,900	1,000	4,900
	Rainfed	200	2,700	700	0	900	4,600	1,000	5,600
	Total	**2,600**	**26,900**	**5,800**	**2,000**	**6,800**	**44,100**	**7,200**	**51,300**

Remarks: *(1) Modified by the JICA study team, based on the result calculated by Agro-Economic Research Centre*
(2) Other major commercial vegetables: cabbage, capsicum, and beans for demand projection
*(3) *: Based on production projection for potato, cropped areas to be required in 2017/18 and 2022/23 are estimated at 5,800ha and 9,200ha, respectively. It is, however, conservatively estimated that cropped areas in those period might be 1,000ha and 2,000ha, considering the current situation, in which potato cultivation has been stagnant. As a result, the remaining crop conversion areas of 4,800ha and 7,200ha could be allotted for other vegetables.*
(4) Other vegetables: onion, garlic, okra, cucurbits, egg plant, etc.
Source: Agro-Economic Research Centre, Himachal Pradesh University, 2008 and modified by JICA study team

As shown in the above table, it is estimated that about 51,000 ha of the crop diversification from food grain to the strategic crops is required in the State. Cropped area for vegetables to be required in the Action Plan (2017/18) and Master Plan (2022/23) are respectively shown in the following table:

Table 6.3.8 Cropped Area to be Required

(Unit: ha)

Year	Cauliflower	Peas	Tomato	Potato	Other Commercial Vegetables	Sub-Total	Other Vegetables	Total
2005/06	3,200	19,500	8,300	15,000	9,300	55,300	17,700	**73,000**
2017/18	5,000	34,900	11,700	16,000	13,100	80,700	22,500	**103,200**
2022/23	5,800	46,400	14,100	17,000	16,100	99,400	24,900	**124,300**

Remarks: (1) Cropped area in 2005/06 in the State of H.P. is estimated 73,000ha, based on the data from DOA.
(2) Other major commercial vegetables: cabbage, capsicum, and beans for demand projection
(3) Other vegetables: onion, garlic, okra, cucurbits, egg plant, etc.
(4) Modified by the JICA study team, based on the result calculated by Agro-Economic Research Centre

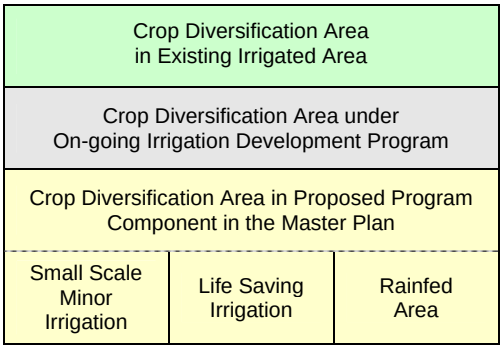
Source: Agro-Economic Research Centre, Himachal Pradesh University, 2008 and modified by JICA study team

6.3.4 Target Infrastructure Development

(1) Irrigation

Target crop diversification area, equivalent to total incremental vegetable production area in Kharif and Rabi seasons, is further categorized into the followings, according to 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
   * 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

Fig. 6.3.2 Demarcation of Crop Diversification Area in Irrigation Area

In this Study, irrigation development area is estimated under 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.

(6) 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 6.3.9 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 6.3.10 Proposed Irrigation Development Area

Unit ; ha

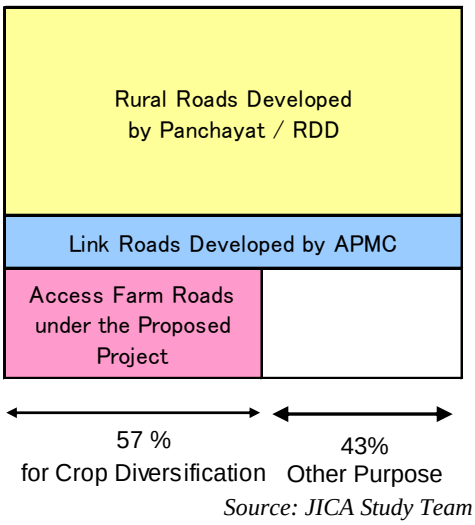
Category	Proposed Irrigation Development Area					
	In Existing Irrigated Area	On-going Program (DOA+IPH)	Under Proposed Program			Total
			Minor Irrigation	Life Saving Irrigation	Rainfed Area	
I	-	9,300	3,000	2,400	-	14,700
II	-	6,900	2,300	1,900	-	11,100
III	-	24,400	9,300	200	-	33,900
IV	-	4,400	1,400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

Source: JICA Study Team

(2) Access Farm Road

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 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 6.3.3.



Source: JICA Study Team

Fig. 6.3.3 Demarcation of Farm Road Development

- 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 6.3.11 Required Length of Farm Road

Farm Road	Entire Rural Area	Crop diversification Area (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

6.4 Proposed Institutional Development Program

6.4.1 Strengthening of Department of Agriculture

(1) Description of the Component

The Department of Agriculture (DOA) has limited staff in number and equipment/tools for the implementation of crop diversification policy. In line with the national policy of decentralization, the department has already transferred the administrative responsibilities for planning, implementation and monitoring to the district and block level offices. There is a need to provide these offices with a package program consisting of capacity development and enhancement of planning and monitoring tools.

A Management Information System (MIS) to link the department-district-block offices by a computer network is proposed as a tool for planning and monitoring of agriculture diversification program. The information to be managed by the MIS, among others, are crop area, crop yield and production, irrigated and non-irrigated areas, and progress monitoring of each relevant project and program.

In this context, the program component has been worked out with its target, outputs, executing organization and proposed activities of this component as listed below:

Table 6.4.1 Outline of Strengthening of Department of Agriculture

Item	Outline of Component
Target	Department, district and block agricultural officers will be able to implement crop diversification policy in an efficient and effective manner.
Outputs	1. Agricultural officers in department, districts and blocks will be able to work out a need-based crop diversification plan in prompt and realistic manner. 2. The agricultural officers will be able to renew, retrieve and examine data regularly on cropped area and production by using MIS. 3. The agricultural officers will be able to monitor the diversification progress, and to report it at any time.

Item	Outline of Component
Activities	Major activities 1. Capacity development of staffs on PCDA (Plan-Check-Do-Action) cycle in planning, implementation, monitoring and evaluation of crop diversification 2. Establishment of the MIS with staff training for implementation of crop diversification 3. Capacity development on the effective use and maintenance of the MIS system 4. Provision of equipment and tools to department, district and block offices, and soil conservation offices for implementation of crop diversification 5. Increase of the number of extension and soil conservation staff in the department of agriculture, and filling up the vacancies.
Related Components	Strengthening of extension service functions
Executing Organization	Execution: Department of Agriculture / District and Block Agriculture Offices / Soil Conservation Divisional and Sub-divisional Offices

Source : JICA Study Team

(2) Proposed Plan

The proposed plan related to each activity is mentioned below.

Table 6.4.2 Proposed Plan of Strengthening of Department of Agriculture

Activity	Proposed Plan	Schedule
Capacity development of staff on planning, implementation, monitoring and evaluation of crop diversification	• Trainings shall be carried out at regular interval for extension staff. • Trainings shall be carried out at regular interval on infrastructure facilities for soil conservation staff.	5-day training program for extension and soil conservation staff
Establishment of the MIS with staff training for implementation of crop diversification	• Establishment of the MIS system at the state, district and block levels, and soil conservation offices. • Updating of information on yearly basis. • Trainings shall be carried out at regular interval on operation and maintenance of the MIS system for both extension and soil conservation staff.	MIS System in the first years;
Provision of necessary equipment and tools to department, district and block offices, and soil conservation offices for implementation of crop diversification	• Transport vehicles such as pick-up van and motor cycles shall be provided for the 75 blocks. • Data storage and maintenance equipment such as computers shall be provided for the 75 blocks (procured by MIS). • Visual aids extension equipment such as projectors shall be provided for the 75 blocks. • Survey, design & maintenance equipment for soil conservation offices shall be provided. • Project Room Renovation at DOA, District and Soil Conservation Offices at the district level	Equipment and facilities shall be provided in the first 2 years.
Increasing the number of extension, and soil conservation staff in DOA	• Recruitment of staff and utilization of out-resources	Within the first 2 year period.

Source : JICA Study Team

(3) Strengthening of DOA Headquarter and Soil and Water Conservation Division

To attain the required progress of crop diversification, organization of DOA headquarter needs to be strengthened. One new post of Joint Director in charge of integrated crop diversification is proposed, who will conduct overall management and control of the activities of the crop diversification exclusively. The Joint Director will be responsible for implementation of three programs and will be supported by SMS. The proposed overall organization chart of DOA is given in Fig.7.5.1.

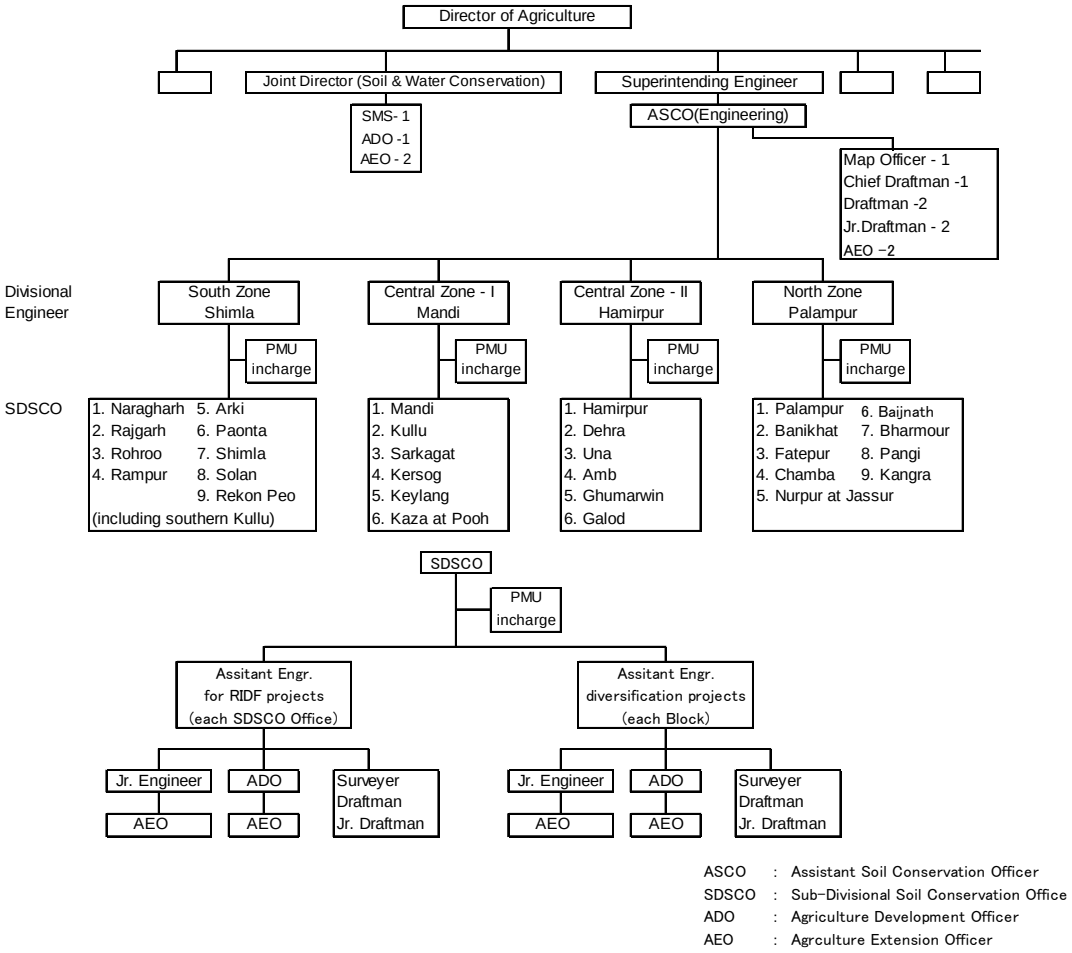
The engineering activities for the program are under the responsibilities of the Soil and Water Conservation (SWC) Division of DOA. The capacity of the SWC should also be strengthened by enhancing its Sub-divisional Soil Conservation offices and through training and increasing the number

of staff members. The appointment of a Superintending Engineer to manage the SWC Division is recommended in the proposed organization. The proposed organization of SWC is summarized below.

Table 6.4.3 Proposed Staff of Soil and Water Conservation

Position	Head Office	Divisional Office	Sub-divisional Office			Total
			for Regular Activities	for Master Plan	Sub-total	
Superintending Engineer: SE	1	-	-		0	1
Ass. Soil Conservation Officer: ASCO	1	-	-		0	1
Divisional Engineer: DE	-	4	-		0	4
Sub-div. Soil Conservation Officer: SDSCO	-	-	30		30	30
Subject Matter Specialist: SMS	1	-	-		0	1
Assistant Engineer: AE	-	-	30	30	60	60
Jr. Engineer: JE	-	-	60	60	120	120
Agr. Develop. Officer: ADO	1	4	75	30	105	110
Agr. Extension Officer: AEO	2	4	60	60	120	126
Map Officer	1	-	-		0	1
Chief Draftman	1	4	-		0	5
Surveyor	-	-	60	60	120	120
Draftman & Jr. Draftman	4	16	60	60	120	140
Total	12	32			675	719

Note; RIDF: Rural Infrastructure Development Project (on-going) by Central & State budget.
Source: Soil and Water Conservation Division 2008.



Source Prepared by JICA Study Team based on the information obtained from SWC

Fig.6.4.1 Proposed Organization of Soil Water Conservation Division

6.4.2 Strengthening of Extension Service Functions

(1) Description of the Component

In line with the national extension reform policy to match the various farmers' needs at the grass root level, the Agricultural Technology Management Agency (ATMA) model are being followed in India, and the model has covered all the 12 districts of the state. However, it is necessary to strengthen the functions of ATMA so that the extension service activities of the ATMA model become popular and user-friendly.

Also, a close communication between the extension departments and research institutes is essential to develop applicable farming techniques for crop diversification and to disseminate these newly developed techniques to the farmers. Therefore, this program is aimed at providing sustainable linkages among the extension departments, research institutes, universities, and farmers. The extension departments will collect from the farmers all the information on the constraints in the implementation of crop diversification and will provide these to the research institutes. The research institutes will then develop suitable countermeasures to solve these constraints. The extension departments and research institutes will play an important role in the dissemination and monitoring of the proposed countermeasures.

The targets, outputs, executing organization and proposed activities of this component, under the agricultural extension system in the state, are listed below:

Table 6.4.4 Outline of Strengthening of Extension Service Functions

Item	Outline of Component
Target	1. By ATMA model, the farmers will be able to access extension services based on their requirements in a timely and effective manner. Synergy between public and private sector extension service providers will be ensured. 2. Farmers will be well motivated to achieve diversified agriculture. 3. A linkage for crop diversification will be maintained between the research institutes and extension departments, and information on farmers' constraints and their countermeasures will be shared among them. 4. For improvement of productivity and quality of farm outputs, suitable farming practices developed by the researchers will be disseminated to the farmers in a timely manner through extension officers.
Outputs	1. Using ATMA model, farmers will be able to access the extension officers easily, through resolving overlapping between the line departments and lack of extension activities. 2. Innovative farmers will act as trainers of farmers who intend to practice diversified agricultural activities. The farmers will be able to receive immediate technical advices and guidance in practicing diversification of agriculture. 3. Useful information on crop diversification will be available through television & radio networks, and Kisan (Farm) Call Center. 4. Farmers will be able to access easily to soil and plant diagnosis services, and to obtain technical advices in a proper and timely manner. 5. Farmers and their groups will be annually appraised in communities depending on their performance and achievement of diversified agriculture activities. 6. Farmers' constraints and demands in crop diversification will be grasped by the researchers in the universities through extension officers in a timely manner. 7. Countermeasures against the farmers' constraints will be proposed to the extension officers.
Activities	<u>Major activities</u> 1. Coordinating the extension officers of the line departments under ATMA model, and conducting trainings of trainers 2. Preparation of useful information on diversified agriculture and dissemination through television & radio networks, and popularization of existing Kisan (Farm) Call Center. 3. Improvement of soil diagnosis services of the DOA.

Item	Outline of Component
	4. Information dissemination on subsidy by extension works 5. Periodical meetings and workshops among the research institutes, extension departments and farmers' representatives at the state and district level. 6. Field visits of researchers with extension officers in order to cope up with constraints in the field, and linking of research activities matching demands of the farmers. 7. Monitoring and evaluation of program component progress
Related components	Strengthening of DOA
Executing Organization	Execution: 12 Districts ATMA / Department of Agriculture / Line Departments / Agricultural & Horticultural Universities

Source : JICA Study Team

(2) Proposed Plan

The proposed plan related to each activity is mentioned below:

Table 6.4.5 Proposed Plan of Strengthening of Extension Service Functions

Activity	Proposed Plan	Schedule
Coordinating the extension officers, and conducting trainings of trainers under ATMA model	Trainings on technical and management aspects of crop diversification shall be conducted for the extension trainers at regular intervals.	2-day training in each districts
Preparation of useful information on diversified agriculture, dissemination through mass media, and popularization of the existing Kisan Call Center	Area specific information at block level on crop diversification shall be prepared by the DOA, and shall be disseminated through mass media networks on a regular basis. Kisan Call Center shall be popularized.	First 2 years
Improvement of DOA soil diagnosis services	Equipment and facilities of the soil testing laboratories need to be strengthened.	First 2 years
Information dissemination on subsidy by extension works	Available subsidy for crop diversification shall be disseminated to farmers through leaflets, TV, radio etc.	First 2 years
Periodical meetings and workshops among research institutes, extension departments and farmers	Periodical meetings and workshops shall be organized among the researchers, extension officers and farmers at the state and district level.	First 2 years
Field visits of researchers with extension officers for with constraints in the field, and linking of research activities	Researchers and extension officers shall conduct joint field visits to analyze the constraints and to link their research activities matching the demands of the farmers	First 2 years
Monitoring and evaluation	Monitoring and evaluation of all the extension activities shall be carried out	First 2 years

Source : JICA Study Team

6.5 Proposed Farmers' Support Program

6.5.1 Vegetable Promotion

(1) Description of the Component

The program of crop diversification will be implemented mainly in the current cropped area of food grain such as maize, wheat and rice. Crop diversification will focus on the strategic vegetables such as potato, tomato, cauliflower and peas where they are cultivable and profitable. In vegetable cultivation, the essential points are cultivation area expansion, productivity improvement, and quality improvement.

In Himachal Pradesh, some of the progressive farmers produce exotic vegetables and sell them directly to buyers (wholesalers, retailers, hotels) in Delhi and other large consuming areas. Exotic vegetables are profitable, but the demand is still low. Although the consuming area is currently limited to such big cities as Mumbai, Delhi, Kolkata and Chennai, its demand is expected to increase in the

future.

The target, outputs, executing organization and proposed activities of this component are listed below:

Table 6.5.1 Outline of Vegetable Promotion

Item	Outline of Component
Target	Crop diversification to vegetables, particularly strategic vegetables of potato, tomato, cauliflower and peas will be accelerated, and productivities and quality will be improved. Exotic vegetables will be promoted in the suitable areas and will be sent to big cities.
Outputs	1. Practical cropping pattern will be introduced. 2. Production areas, and yield of strategic vegetables will increase. 3. Exotic vegetables will be cultivated in a wider area. 4. Quality of strategic vegetables will be improved. 5. Organic farming will become popular.
Activities	Major Activities 1. Introduction of cropping patterns suitable for markets 1.1 Review of cropping patterns 1.2 Demonstration and dissemination of recommended cropping patterns 2. Promotion of strategic vegetables such as potato, tomato, cauliflower and peas 2.1 Demonstration and dissemination of cropping pattern with farming practices 2.2 Demonstration and dissemination of promising varieties 2a. Introduction and promotion of exotic vegetables 1.1 Demonstration and dissemination of recommended farming practices 1.2 Demonstration and dissemination of promising varieties 3. Improvement of productivity and quality of vegetables 3.1 Review of farming practices 3.2 Demonstration and dissemination of recommended cropping pattern 3.3 Demonstration and dissemination of promising varieties and quality seeds 4. Promotion of organic farming Supporting activities 5. Organizing or strengthening of farmers' groups (marketing group) 6. Supply of certified seeds for vegetables and planting materials 7. Extension of protective cultivation (greenhouse) by facilities provision in model farms 8. Introduction of farm mechanization through identification of suitable machinery and equipment for hilly area. 9. Promotion of optimum use of pesticides under Integrated Pest Management (IPM) and biological control of pests and diseases. 10. Promotion of farming practices to reduce soil erosion 11. Introduction of contract farming 12. Monitoring and evaluation of program component progress
Related components	Strengthening of extension service functions, infrastructure development and improvement, post-harvest processing promotion, marketing system improvement
Execution Organization	Execution: Department of Agriculture, District & Block Agriculture Offices Supporting: ATMA, Agriculture & Horticulture Universities

Source : JICA Study Team

(2) Future Direction of the Program Component

Among the program components, the highest priority was given to vegetable promotion and infrastructure development/improvement in the workshop conducted for the 75 blocks. Based on the results of the workshop, future direction of the component is decided as follows:

1) The total area with potential to convert food grains to vegetables is 66,200 ha as shown in the Table 6.5.2. Among the categories, Category III has the highest potential with 37,300 ha while Category IV has the lowest with only 5,450 ha.

Table 6.5.2 Block-wise Area of Crop Diversification Proposed by Blocks

Category of Blocks	No. of Blocks	Food Grain Area to Vegetables	Fallow Area to Vegetables	Increase Area of Strategic Vegetables	Increase Area of Multiple Vegetables	Increase Area of Exotic Vegetables	% of Diversification from Kharif Food Area
Category - I	21	10,420 ha	1,630 ha	5,350 ha	6,200 ha	490 ha	18.6%
Category - II	11	13,030 ha	1,150 ha	7,270 ha	6,240 ha	670 ha	19.2%
Category - III	30	37,320 ha	2,370 ha	14,160 ha	24,110 ha	1,420 ha	15.8%
Category - IV	13	5,450 ha	1,250 ha	3,240 ha	2,960 ha	500 ha	9.2%
State-Total		66,220 ha	6,400 ha	30,020 ha	39,510 ha	3,080 ha	15.8%

Source: JICA Study Team (Results of the Workshop)

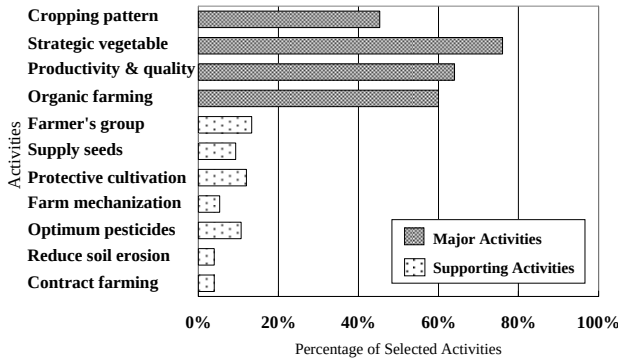
2) About 19% of the food grain area in Category I and II can be converted to vegetables, 16% in Category III and less than 10% in Category IV.

3) Since many of the blocks in Categories I and II are located in the Agro-Ecological Zones of 3 and 4 suitable for vegetables and fruits, a higher proportion of food grain area in these zones is to be converted to vegetables. Many blocks in Category III are extending over the lower AEZs of food grains production area, and the farmers in this area prefer to keep a certain portion of the land for food grain production. Hence, the percentage of area to be converted in Category III is less than in Category I and II.

4) While the focus on vegetable promotion is on the strategic vegetables (tomato, potato, cauliflower, and peas), a high proportion of area will be used for other multiple vegetables (cabbage, capsicum, beans, garlic, okra, etc.) considering suitability of the area and marketing demand.

5) Although exotic vegetables are not selected as the higher priority component, at least 10-100 ha in each block can be converted based on the suitability, marketing demand and willingness of the farmers. Farmers' group should be established so that exotic vegetables can be sold in a larger quantity to the larger markets such as Delhi.

6) Among the 12 activities in the program components of "Vegetable Promotion", the priority activities are selected by the blocks as shown Figure 6.5.1. Among the main activities, the promotion of strategic vegetables was selected with the highest priority, followed by improvement of productivity and quality of vegetables, and organic farming.



Source: Result of Workshops in August 2008

Fig. 6.5.1 Priority Activities of Vegetable Promotion

7) Although the supporting activities were selected with lower priority, the activities including organizing and strengthening of farmers' groups (marketing group), supply of certified seeds for vegetables and planting materials, extension of protective cultivation (greenhouse, net-shade house, etc) and provision of facilities in model farms, and promotion of optimum use of pesticides under Integrated Pest Management (IPM) and biological control of pests and diseases were selected with a relatively higher priority.

(3) Proposed Plan

The proposed plan and schedules related to each activity is mentioned below.

Table 6.5.3 Proposed Plan of Vegetable Promotion

Activity	Proposed Plan and Schedule
Introduction of cropping patterns suitable for markets	• Demonstration trials • Organizing of training camps – to be included in demonstration trials • Exposure visits of farmers – to be conducted as component of demonstration trials, if

Activity	Proposed Plan and Schedule
	necessary • Field days to be included in demonstration trials
Promotion of strategic vegetables such as potato, tomato, cauliflower and peas	• Demonstration trials • Organizing of training camps –to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field days to be included in demonstration trials
Introduction and promotion of exotic vegetables	• Demonstration trials • Organizing of training camps –to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field days to be included in demonstration trials
Improvement of productivity and quality of vegetables	• Varietal demonstration trials –21 blocks in Category – I • Demonstration trials on package of practices (POP) Organizing of training camps –to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field days to be included in demonstration trials
Promotion of organic farming	• Demonstration of organic farming practices (including IPM, biological control) • Organizing of training camps –to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field days in farm schools – 4 times in a year to be included in demonstration trials
Organizing or strengthening of farmers' groups (marketing group)	• Workshops for group activities • Capacity development of farmers on organizational management
Extension of protective cultivation (greenhouse) and provision of facilities in model farms	• Demonstration trials on package of practices (POP) under protective cultivation • Organizing of training camps to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field days to be included in demonstration trials • Protective cultivation units to be supplied by on-going and newly proposed programs as demonstration activity
Introduction of farm mechanization by identifying suitable machinery and equipment for hilly area.	• Demonstration of farm machinery • Organizing of training camps to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field days to be included in demonstration trials
Promotion of optimum use of pesticides under Integrated Pest Management (IPM) and biological control of pests and diseases.	• Demonstration of IPM and biological pest control – one demonstration per block • Organizing of training camps to be included in demonstration trials • Exposure visits of farmers – to be conducted as component of demonstration trials, if necessary • Field days to be included in demonstration trials
Promotion of farming practices to reduce soil erosion	• Demonstration of farming practices (contour farming) • Organizing of training camps to be included in demonstration trials • Exposure visits of farmers - to be conducted as component of demonstration trials, if necessary • Field days to be included in demonstration trials
Introduction of contract farming	• Workshops and promotion of linkage between farmers and private traders.
Monitoring and Evaluation	• Employment of third part local consultant

Source : JICA Study Team

6.5.2 Food Grain Crop Productivity Improvement

(1) Description of the Component

Crop diversification from food grains will be attained through increase of productivity of food grains, since many small and marginal farmers live on food grain production in the State. Under this situation, this component is planned and outlined below:

Table 6.5.4 Outline of Food Grain Crop Productivity Improvement

Item	Outline of Component
Target	Crop diversification will be accelerated.
Outputs	1. Unit yield of food grains will increase. 2. Crop diversification area from food grains to vegetables will be increased.
Activities	Major activities 1. Promotion of cropping patterns suitable for productivity increase of food grain 1.1 Review of cropping pattern and farming practices 1.2 Demonstration and dissemination of suitable cropping pattern and farming practices 2. Promotion of optimum quantities of farm inputs such as seeds and fertilizers Supporting activities 3. Promotion of organic farming 4. Organizing and strengthening of farmers' groups (marketing group) 5. Introduction of farm mechanization through identification of suitable machinery and equipment for hilly area 6. Promotion of optimum use of pesticides under Integrated Pest Management (IPM) and biological control of pests and diseases 7. Promotion of farming practices to reduce soil erosion 8. Monitoring and evaluation
Related components	Strengthening of extension service functions, infrastructure development and improvement
Execution Organization	Execution: Department of Agriculture, District & Block Agriculture Offices Supporting : Department of Agriculture, Agriculture & Horticulture Universities

Source : JICA Study Team

(2) Future Direction of the Program Component

The future direction of the program component is decided as follows:

1) In the workshop conducted for the 75 blocks, food grain improvement was ranked by the block officers as 6th priority overall. However, six blocks located in the lower AEZs selected this component as the highest priority.
2) While crop diversification focuses on vegetable promotion, food grain productivity improvement and food security is given ample importance to sustain food security.
3) By increasing the food grain productivity, the food grain areas can be converted for vegetable cultivation.

(3) Proposed Plan

The proposed plan related to each activity is mentioned below.

Table 6.5.5 Proposed Plan of Food Grain Crop Productivity Improvement

Activity	Proposed Plan and Schedule
Promotion of diversified cropping patterns suitable for food grain productivity improvement	• Demonstration trials • Organizing of training camps - to be included in demonstration trials • Exposure visits of farmers – to be conducted as component of demonstration trials, if necessary • Field days r to be included in demonstration trials
Promotion of optimum quantities of farm inputs such as seeds and fertilizers	• Varietal demonstration trials • Demonstration trials on package of practices (POP) - • Organizing of training camps - to be included in demonstration trials • Exposure visits of farmers – to be conducted as component of demonstration trials, if necessary • Field days to be included in demonstration trials
Promotion of organic farming	• Demonstration of organic farming practices (including IPM, biological control) Organizing of training camps - to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field days to be included in demonstration trials
Organizing or strengthening of farmers' groups (marketing group)	• Training on organizational management
Introduction of farm mechanization through identification of suitable machinery and equipment for hilly area.	• Demonstration of farm machinery • Organizing of training camps - to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field day to be included in demonstration trials
Promotion of optimum use of pesticides under Integrated Pest Management (IPM) and biological control of pests and diseases.	• Demonstration of Integrated Pest Management (IPM) and biological control of pests and diseases - • Organizing of training camps - to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field day to be included in demonstration trials
Promotion of farming practices to reduce soil erosion	• Demonstration of farming practices (contour farming) • Organizing of training camps - to be included in demonstration trials • Exposure visits of farmers –to be conducted as component of demonstration trials, if necessary • Field day to be included in demonstration trials
Monitoring and evaluation	• Employment of third party local consultant under Project Management Unit

Source : JICA Study Team

6.5.3 Integrated Farm Management (Horticulture, Animal Husbandry and Fishery)

(1) Description of the Component

The main objective of the M/P is crop diversification, particularly diversification to vegetable cultivation. However, there are potentials to enhance the farm income of small and marginal farmers in horticulture, animal husbandry and fisheries sub-sectors. Accordingly, it is worthwhile to pay attention to horticulture production, fodder production for animals, and fish production aiming at increasing the supplemental cash income sources of farmers who will be involved in diversified

agriculture activities. Based on this concept, an integrated farm management component is planned and outlined below:

Table 6.5.6 Outline of Integrated Farm Management

Item	Outline of Component
Target	Farm income sources under diversified agriculture will be enhanced by exploiting potential of horticulture production, fodder production for animal feeding and/or fish culture locally available.
Outputs	1. Production of horticulture crops will increase and the quality will be improved. 2. Cattle milk production and sheep and goat meat production to local consumers will be expanded by increased fodder production or reuse of vegetable residues in the crop diversification. 3. Fish culture will be practiced on the farmers' group basis by using irrigation system.
Activity	Major activities 1. Improvement of productivity and quality of horticulture crops 2. Promotion of fodder production and reuse of vegetable residues under integrated farming in crop diversification 3. Promotion of fish culture under integrated farming including the irrigation system. Supporting activities 4. Organizing or strengthening of farmers' groups (marketing group) 5. Introduction of contract farming 6. Monitoring and Evaluation
Related Components	Strengthening of extension service functions, vegetable cultivation, food grain crop productivity Improvement, Infrastructure Development / Improvement
Executing Organization	Execution : Department of Agriculture / District & Block Agriculture Offices Supporting: Departments of Horticulture, Animal Husbandry, and Fisheries

Source : JICA Study Team

(2) Future Direction of the Program Component

The future direction of improvement of the component is decided as follows:

1) In the workshop conducted for the 75 blocks, the 3rd priority was given to integrated farm management.
2) Integrated farm management is vital to sustain supplemental income for marginal and small farmers in the area where diversification potential is low.
3) Under the ATMA model, the line departments involved in horticulture, animal husbandry, and fisheries jointly work towards the promotion of integrated farm management.
4) Horticulture is an integral component of vegetable promotion. Mainly, exposure visits to be conducted for vegetables promotion will be integrated with fruits and other horticulture activities. Any other training and field schools instead of exposure visits might be also conducted, according to farmers' needs.
5) Promotion of fodder production will also be considered under integrated farming.
6) In integrated farming, the fish culture is proposed in an integral part of irrigation system. When irrigation ponds or check dams are constructed, fishery activities could be included, wherever the farmers have interest in this activity. During workshops for crop diversification, the DOA will invite various experts in integrated farming to orient and disseminate to the farmers new and advanced technology.

(3) Proposed Plan

The proposed plan related to each activity is mentioned below.

Table 6.5.7 Proposed Plan of Integrated Farm Management

Activity	Proposed Plan and Schedule
Improvement of productivity and quality of horticulture crops	• Workshops for horticulture • Training camps • Exposure visits of farmers • Field days
Promotion of fodder production and reuse of vegetable residues under integrated farming in crop diversification	• Demonstration trials including fodder in the cropping pattern • Workshops for fodder production and vegetable residue reuse
Promotion of fish culture under integrated farming including the irrigation system	• Workshops for fish culture • Exposure visits of farmers
Organizing or strengthening of farmers' groups (marketing group)	• Workshops for group management and marketing • Training on organizational management
Monitoring and Evaluation	• Establishment of third party monitoring and evaluation system and employment of third party

Source : JICA Study Team

6.5.4 Post Harvest Processing Promotion

(1) Description of the Component

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

Category (a) Large scale agro-processing on plant basis,
Category (b) Small scale agro-processing on farm family or group basis, and
Category (c) Post-harvest activities by farmers or farmers' 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 3.12. 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 below:

1) The agricultural extension officer organizes farmers and women willing to start agro-processing business into small groups, assists them to prepare an application and sends it to the DOA through block and district officers.
2) After approval of the application, the DOA instructs SAMETI to deploy appropriate trainers to group, while DOA sends simple instruments to the group.
3) Using the instruments supplied by DOA, the trainer conducts a training camp for the group members at the community.
4) Each training camp will be held for some aggressive farmers' groups each block for one day.

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 promotion of post-harvest activities such as grading, sorting, and packing as well as farmer's small agro-processing, and outlined below:

Table 6.5.8 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 be motivated to promote and improve post-harvest activities. 2. Farmers' group (especially women's groups) will be involved in small scale agro-processing activities.
Activities	Major 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 P.P.P activities. Supporting activities 3. Organizing or strengthening of farmers' groups (marketing group)
Related Components	Vegetable cultivation, Integrated farm management
Execution Organization	Execution: Himachal Pradesh State Agricultural Marketing Board / District & Block Agriculture Offices / Department of Horticulture Supporting: Department of Agriculture / HPMC

Source : JICA Study Team

(2) Proposed Plan

The proposed plan related to each activity is mentioned below:

Table 6.5.9 Proposed Plan of Post Harvest Processing Promotion

Activity	Proposed Plan	Schedule
Introduction and promotion of post-harvest activities of grading, sorting & packing, in accordance with the quality standard.	Transfer of technology to farmers on appropriate grading, sorting and packing technology by staff of Marketing Board / APMC and extension trainers s, through farmers' training on vegetable promotion, improvement of food grain productivity, and promotion of integrated farm management..	2 years
Introduction and promotion of small scale agro-processing activities.	Organization of farmers and women into small scale agro-processing groups Dissemination of agro-processing technology by extension camp. Provision of simple instruments for small scale agro-processing. 2 activities each block	4 years
Introduction and promotion of P.P.P activities	Dissemination of policy of state and district for PPP Arrangement of opportunity for introduction between stakeholders and farmers	3 years

Source : JICA Study Team

6.5.5 Market System Improvement

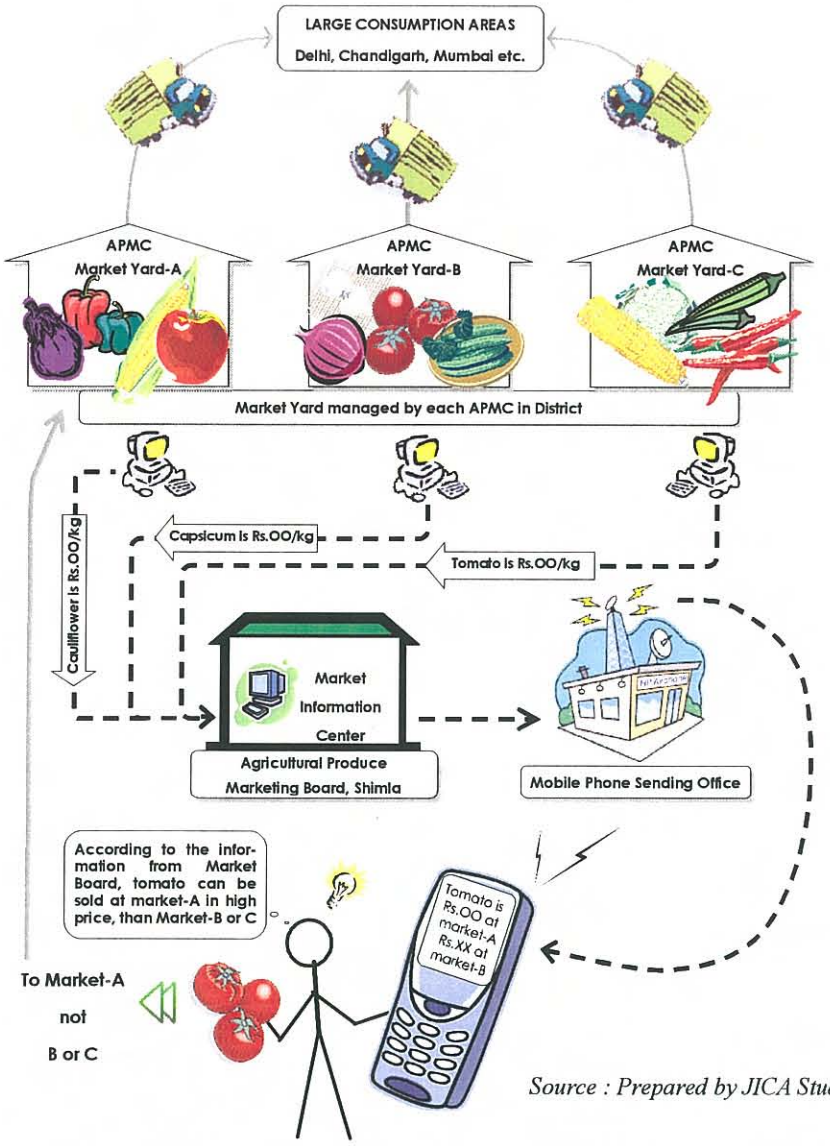
(1) Description of the Component

The aim of crop diversification is not only increased production but also increased farm income. Therefore, marketing aspects are important. The following points are considered:

1) Easy access to marketing information system from the internet;
2) Formulation of integrated information system;
3) Establishment of standard criteria on grading; and
4) Registration of brand / trademark.

Market information concerning daily market price and arrival quantity is available in the limited market yards. All market yards are expected to be connected to the internet, thus market information will be available in every market yard. Furthermore, the trend of market price as well as arrival quantity can be easily predicted by individual users.

Also, a market information system with cellular phone is proposed to be established in order to react to the daily market situation. The concept of the market information system is shown in Fig. 6.5.2 below.



Source : Prepared by JICA Study Team

Fig. 6.5.2 Market Information System with Cellular Phone

There are no standard criteria for vegetables and fruits grading in the state. It is necessary to establish a uniform grade as well as standard criteria for agricultural commodities in order to strengthen the bargaining power on the prices of these commodities. Furthermore, it is necessary to promote the use of plastic containers for easy transportation and mitigation of transportation and marketing losses.

Date: March 27, 2008
Place: Shimla
Subject: Unequal strawberry with simple plastic box

Date: April 7, 2008
Place: Pune, Maharashtra
Subject: Uniform strawberry with nice carton box

Date: June 11, 2008
Place: Shimla
Subject: Plastic containers

The target, outputs, executing organization and proposed activities of this component are listed below:

Table 6.5.10 Outline of Market System Improvement

Item	Outline of Component
Target	Farmers as well as other stakeholders will be able to obtain sufficient market information, and to trade farm produces efficiently.
Outputs	1. Market information required for producers as well as marketers will be available on time. 2. Market yards and other market facilities will be rehabilitated or newly constructed. 3. Loss on collection and marketing will be reduced. 4. Brand name of Himachal vegetables is broadly recognized and vegetable trade will be boosted.
Activities	Major activity 1. Capacity development for staff of Agricultural Marketing Board and APMCs 2. Preparation and dissemination of quality standard 3. Improvement and enhancement of the system for recording and two-way communication of marketing information among producers and marketers 4. Provision of computer system and improvement of marketing network 5. New construction or rehabilitation of market yards and other market facilities 6. Market promotion through branding, advertisement, campaign, agricultural fair, etc.
Related Components	Strengthening of DOA, Strengthening of extension service functions
Execution Organization	Execution: H. P. State Agricultural Marketing Board / Agricultural Produce Market Committee Supporting: Department of Agriculture / Department of Horticulture

Source : JICA Study Team

(2) Proposed Plan

The proposed plan related to each activity is mentioned below.

Table 6.5.11 Proposed Plan of Market System Improvement

Activity	Proposed Plan	Schedule
Capacity development for staff of Agricultural Marketing Board and APMCs	Trainings on technical and management aspects of market system improvement, through capacity development for extension staff in Department of Agriculture.	2 years
Preparation and dissemination of quality standard	- Preparation of quality standard for HP vegetables - Dissemination of quality standard through training activities	1 year
Improvement and enhancement of the system for recording and two-way communication of marketing and other technical information	- Awareness camp and hands-on training. - Provision of computer system to each market yard - Improvement and maintenance of data base for AGAMRKNET	- 15 years - 1st and 2nd years - the 1st year of the project implementation
New construction or rehabilitation of market yards and other market facilities	Five-year plan should be reviewed for construction and rehabilitation of market yard and other related infrastructure should be reviewed and Detailed Plan Report (DPR) for construction and rehabilitation should be prepared.	One market yard in each APMC within 2 years, and one collection centre in each district within 2 years
Market promotion through branding, advertisement, campaign, agricultural fair, etc.	- To collect brand name or trade mark from the public - Registration of brand name or trademark - Dissemination of quality vegetables in related campaign, and other agricultural fair in and outside H.P.	1st and 2nd years

Source : JICA Study Team

6.6 Proposed Infrastructure Development Program

6.6.1 Infrastructure Development/Improvement

Infrastructure Development/Improvement Program covers irrigation and farm roads. The program components include new development and rehabilitation of existing irrigation systems and construction, rehabilitation and up-grading of access farm roads in crop diversification areas.

(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.

The development target of increased irrigation area by 2023 is discussed in Section 6.3.4 considering the progress of the macro-frame of required diversified area under irrigation and on-going development. This development program is proposed to be implemented though bottom-up way with need-based planning under farmers' participatory approach.

The two types of irrigation in this M/P are proposed ie. “Full Irrigation” or “Assured Irrigation” and “Life Saving Irrigation” or “Protective irrigation”. The former is to assure full water supply to the crops as required with certain dependability (80%) while the latter is to supply water at minimum level in order to save the crop at critical times and to keep minimum level of the yield, which is supplementary to rain water in Kharif season. The irrigation development covered in this M/P is summarized below.

(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)

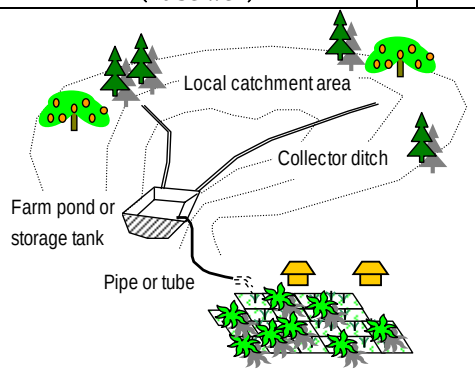
The valleys in Kangra, Mandi, Sirmaur, Solan and Una districts have potential aquifer, where groundwater can be exploited for small scale irrigation and micro-irrigation. The discharge of the wells generally varies from 10 to 40 lit/s, which can be utilized by construction of tube well schemes (mostly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

<table>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Flow Irrigation</td><td>Irrigation Canal of
Flow Irrigation</td><td>Water Harvesting Check Dam</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Groundwater Irrigation
（Tube well）</td><td>Tank Irrigation</td><td>Micro Catchment Rain Water
Harvesting Tank</td></tr>
<tr><td colspan="2"> 
</td><td colspan="2">  </td></tr>
<tr><td colspan="2">Sketch of Micro Catchment Rain Water Harvesting</td><td colspan="2">Micro Catchment Rain Water Harvesting (Trial and research in Palampur university)</td></tr>
</table>

- 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.6.6.1.

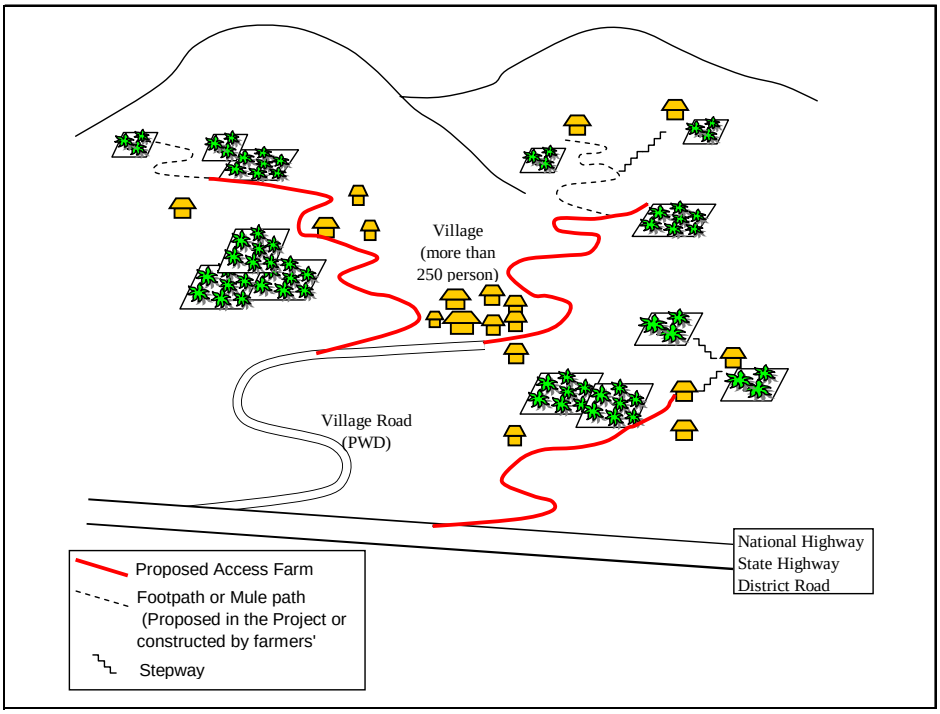


Fig. 6.6.1 Sketch of Typical Farm Access Roads in Hilly Area

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.

(3) Program Component of Infrastructure Development/Improvement

The target, outputs, executing organization and proposed activities of this component are listed below:

Table 6.6.1 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 to markets will be increased.
Activities	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

Source : JICA Study Team

(4) Proposed Plan

The proposed plan related to each activity is mentioned below.

Table 6.6.2 Proposed Plan of Infrastructure Development/Improvement

Activity	Proposed Plan	Schedule
Irrigation	Improvement of existing minor irrigation system Construction of new minor irrigation system Construction of micro irrigation for demonstration	15 years 3 years
Access Farm Road	Improvement of existing access farm road Construction of new farm road Improvement or construction of foot path	15 years

Source : JICA Study Team

6.6.2 Infrastructure Development Support

(1) Irrigation

Since the actual irrigated area is about 50% of the area developed with irrigation facilities, proper operation and maintenance (O&M) is required to improve this situation together with strengthening of Water Users Associations (WUA). As for farmers' own irrigation facilities, either private or communal, such facilities as irrigation tanks, micro-irrigation facilities including sprinkler and drip irrigation are provided by themselves under the subsidy of the government.

(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: Infrastructure Development Support

Table 6.6.3 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. Strengthening of WUA for improvement of water management 2. Strengthening of O&M activities for farm road and other infrastructures managed by farmers' groups 3. Strengthening of supporting system for farmers' irrigation system by demonstrating micro irrigation (sprinkler and drip irrigation, etc.) Supporting activities 4. Monitoring and evaluation of physical and financial progress
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 DOA Supporting：District & Block Agriculture Offices

Source : JICA Study Team

(4) Proposed Plan

The proposed plan related to each activity is mentioned below.

Table 6.6.4 Proposed Plan of Infrastructure Development Support

Activity	Proposed Plan	Schedule
Irrigation	Organization of WUA for construction of irrigation system Training to WUA for improvement of water management	15 years
Access Farm Road	To strengthen O&M activities for road and other infrastructures concerned by farmers' groups	15 years

6.7 Implementation Schedule

The implementation schedule for the Master Plan over a period of 15 years is from fiscal year 2008/09 to 2022/23, and the outline is described below.

a) The Institutional Development Program will start as a first step as given in Fig. 6.7.1. Recruitment of staff of DOA will be conducted, followed by capacity development of DOA staffs, establishment of and operation of MIS, and procurement of equipment.

Trainings of staff for capacity building will be carried out over a period of two years, and

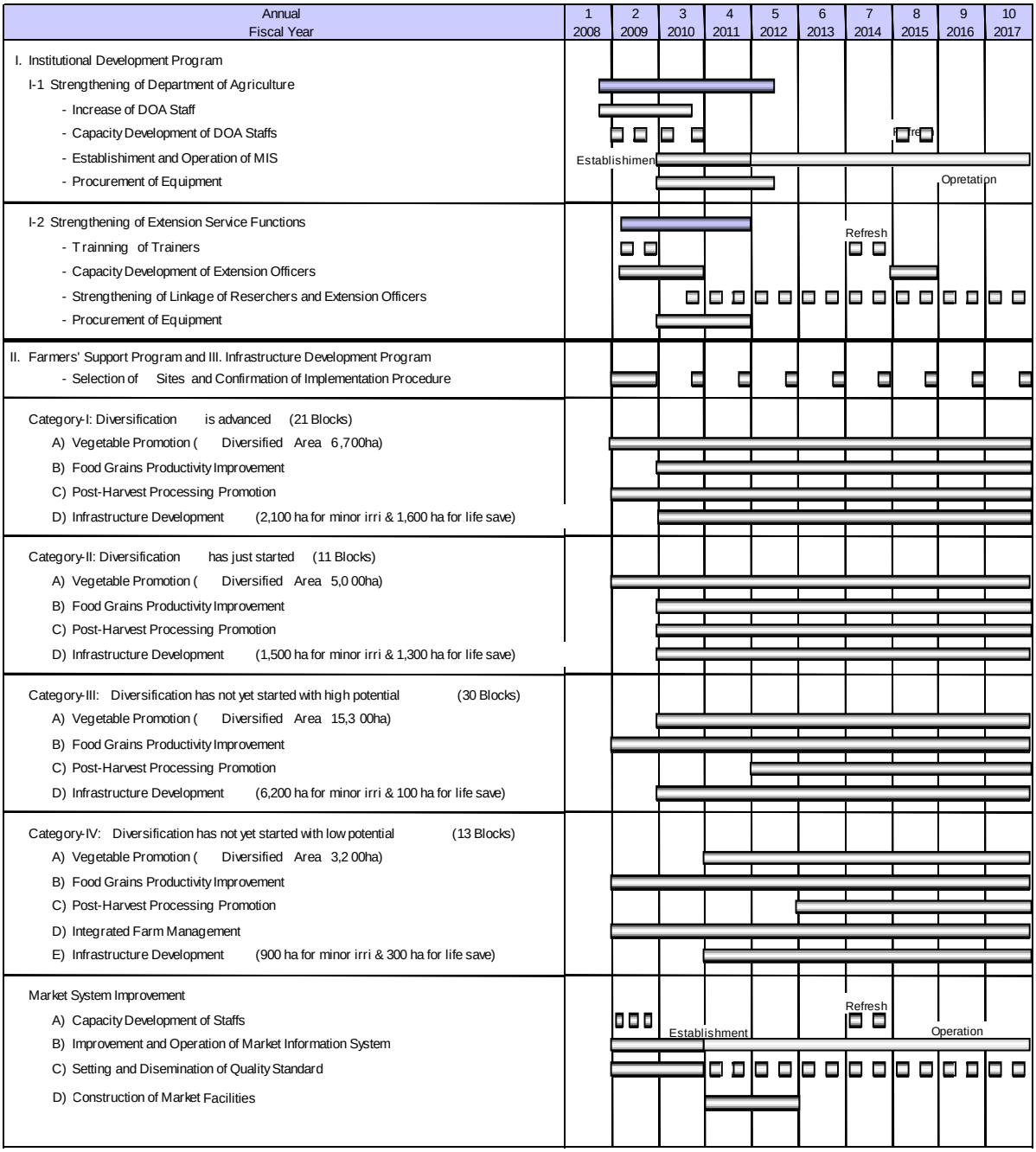
refresher training courses will be conducted every five years.

b) The Farmers' Support Program and Infrastructure Development Program will be implemented at the sites. In the initial stage, site selection procedure, selection criteria and process will be established, and then trial will be conducted in the first year.

In this process, group formation of farmers will be conducted throughout the communities. Experiences and lessons learned in the previous year are utilized in the site selection in the following year to improve the process.

c) There are four categories, i.e. Category-I to IV. In respective categories, implementation schedule is different from one another. In Category II, vegetable promotion will be implemented first to accelerate diversification. In Category III, food grain productivity improvement will be first, followed by crop diversification. Integrated farm management is the priority component for Category IV in order to increase the farm income from livestock and fishery wherever possible.

d) In the Market System Improvement, capacity development of staffs, improvement & operation of Market Information System and setting of quality standard will start in parallel in the first year. Construction of market facilities will start in the fourth year.



Source : JICA Study Team

Fig. 6.7.1 Implementation Schedule of the Master Plan

6.8 Sample Study at Pre-Feasibility Study Level

6.8.1 Objectives of Sample Study at Pre-feasibility Study Level

The objectives of the Sample Study at Pre-Feasibility Study Level are to upgrade maturity of proposed programs from technical, economic and social view points and to give feedback to Draft M/P and A/P for its finalization, especially in infrastructure planning and cost estimates. The study results are expected to contribute to the acceleration of diversified agriculture and the realization of the targets of M/P and A/P.

6.8.2 Selection of Representative Model Areas and Study Sites

The following are the eleven criteria considered in the selection of representative model areas (blocks) for effective and efficient promotion of diversified agriculture project in the State of Himachal Pradesh:

- 4~6 model areas on block basis
- Consideration to progress pattern of diversified agriculture
- Coordination with Governing Board of ATMA
- Consideration to soil and water conservation scheme in Hamirpur
- Type of vegetable cultivation areas in Zone 2 and Zone 3
- Diversified agriculture in low-lying areas of Zone 1 and Zone 2
- Diversified agriculture based on fruit planting
- High irrigation needs (potential)
- Accessibility within the blocks
- Condition of market yard
- Integrated agriculture potential

As a result, six areas consisting of:

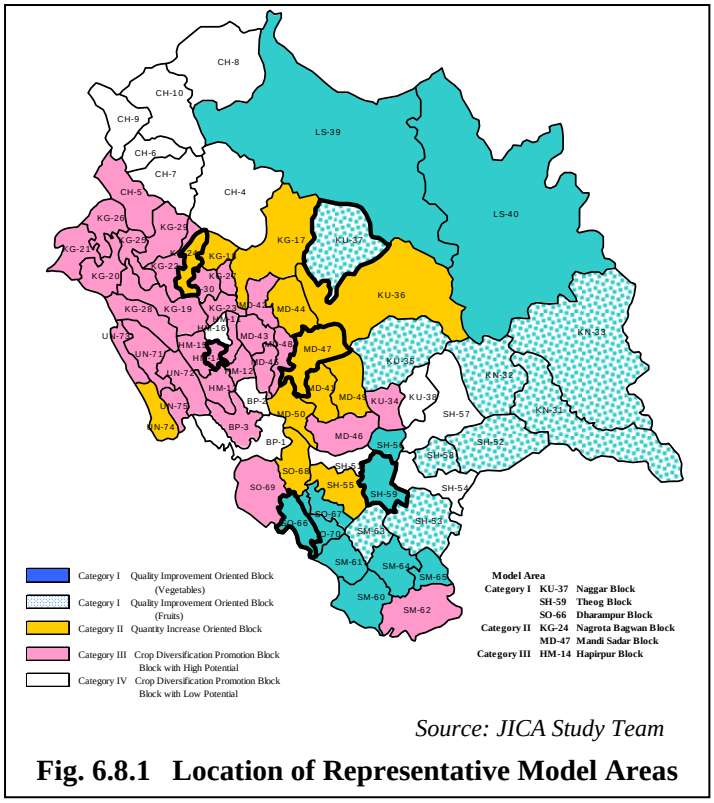
- three blocks from Category I (Quality Improvement - oriented Block)
- two blocks from Category-II (Quantity Increase-oriented Block), and
- one block from Category-III (Crop Diversification Promotion Block with High Potential)

were selected as shown in Table 6.8.1 and Fig. 6.8.1.

Table 6.8.1 Representative Model Areas and Study Sites

Category of Block	Agro-ecological Zone	District	Model Area (Block)	Study Site
I	Zone-2	Solan	Dharampur	Chamo
I	Zone-3	Shimla	Theog	Bagain
I (Fruits)	Zone-3	Kullu	Naggar	Hallan-I
II	Zone-2	Kangra	Nagrota Bagwan	Malan
II	Zone-2	Mandi	Mandi Sadar	Nagwain
III	Zone-1	Hamirpur	Hamirpur	Lalri

Prepared by JICA Study Team



Source: JICA Study Team

Fig. 6.8.1 Location of Representative Model Areas

6.8.3 Sample Study Results

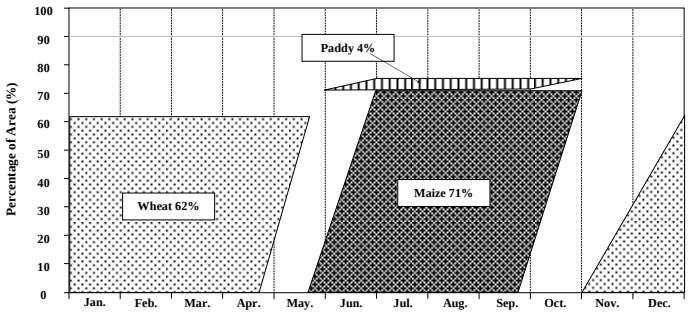
The results of six Sample Studies at Pre-feasibility Study Level are explained in following section.

(1) Lalri

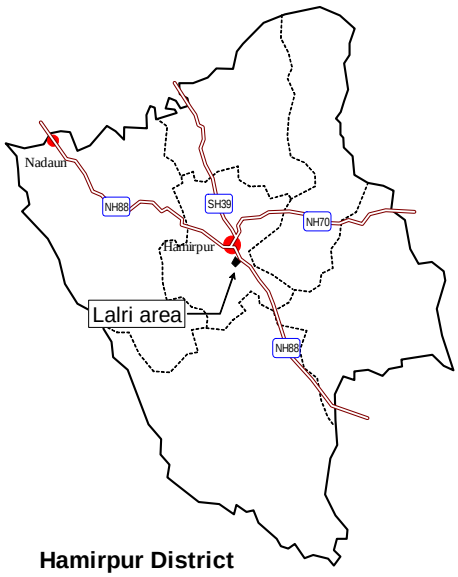
Present Condition

Socio-economic and Natural Conditions

District	Hamipur	Category	III
Block	HM-14 Hamirpur	Agro-ecological zone	Zone-1
Panchayat	Lalri	Annual rainfall (mm)	1,359
Village	Lalri	Average Temperature	22.5
Total Population	380	Average Max. Temperature	36.8
No. of FHH	120	Average Min. Temperature	10.9
		Total area (ha)	90
		Cultivated area (ha)	68



Present Cropping Pattern



Location Map

Present Situation, Constraints and Measures

(1) Agriculture

Food grains are mostly cultivated under rainfed condition, and are used mostly for self-consumption. The yield of food grains are relatively law. Vegetables, such as tomato, capsicum, ginger, cucumber, peas and garlic are cultivated in Rabi season mostly in kitchen garden. The major constraints include: i) no availability of irrigation facility, ii) Law quality of food grain crop seeds, iii) lack of finance in procurement of agro-chemicals and fertilizers, and iv) Damage by animals (monkeys) and weed. About 40% of farm households purchase cereal crop seeds from outlets of the department, while remaining 60% purchase seed from other farmers in the village. Main supplier of fertilizers in IFFCO and HIMFED.

The farmers in the site are highly interested in crop diversification. If the irrigation facilities are available, they hope that at least 50% of the site can be converted for vegetable production. Since Hamirpur APMC is located close to the site, the vegetables to be produced in Lalri can be easily marketed at Hamirpur APMC.

Since Lalri site is identified as a frost prone area, therefore no orchard has been developed.Few hundred fruit trees are grown in home yards, including hill lemon, lime, jhamiri, plum, peach, guava, walnut, Pecan nut and Banana. While animal husbandry is also popular in the site. On average, every farm family keeps approx. two heads or more.

(2) Post-harvesting and Marketing

Agro-processing in this district is nor so active in general, since fruits production in Hamirpur District is quite small. There are no agro-processing facilities operated by HPMC, which is governmental or semi-governmental sector, while three private processing plants are available in Hamirpur.

Hamirpur Market Yard is nearby the Pre-F/S site in Lalri area. This Market Yard is a regulated market yard, and the office of APMC is located in this market, and other sub-market yards are controlled by this office of APMC. All the information on arrival quantity and market price of major vegetables are collected by market supervisor of the APMC.

(3) Infrastructure

There is one check dam on the tributary of the Hathli Khad river. Though it was expected to utilize this check dam for irrigation by installing pump equipment by the farmers, it remains unutilized till now due to the high installation cost of pump facilities beyond the capacity of the farmers. There is no other irrigation possibility in the site.

There is one PWD village road passing through the center of the Site from NH88 to the south. This road is expected to connect village Baral (with population of 150) by extension of the PWD village road (VR). There are many wide and narrow footpaths. New road construction is not proposed, while only widening of existing village road from NH-88 is proposed.

Farm Land

Hamirpur Market Yard

Existing Check Dam

Footpath

Proposed Plan

(1) Agricultural Development Plan

Vegetable promotion and agricultural support for the Lalri site are planned as follows:

i) Among the cultivable area of 68 ha, the farmers are cultivating 51.0 ha in Kharif season and 42.0 ha in Rabi season. By using the current fallow area of 17.0 ha for food grains cultivation, the food grains area shall be maintained at the same level,

ii) With the introduction of irrigation system, vegetables shall be cultivated newly in 17 ha area which is equivalent to 25% of the total area.

iii) Selection of vegetables is made in consideration of existing farming conditions, experience of the farmers in the area on vegetable cultivation, intention of the farmers, and the current market conditions,

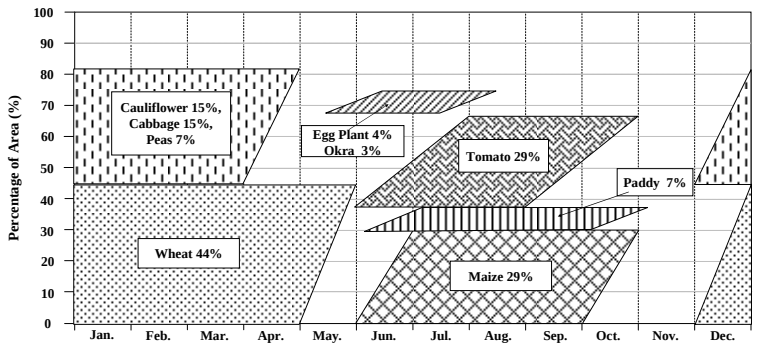
iv) Since the Lalri site belongs to Category - III, which has a high potential to convert from food grains to vegetable production, 25% of the total food grains area (17 ha) shall be converted for vegetable production.

(2) Post-Harvesting and Marketing Plan

Training program shall be proposed to promote agro-processing activities in the site, and further one multi-purpose collection centre is proposed near Lalri village. At a later stage, collection, grading, and storage facilities shall be additionally planned based on the necessity, after vegetable cultivation will be broadly promoted in a few years.

(3) Facility Plan

In this area, construction of new lift irrigation system utilizing the existing check dam will be beneficial with the construction of the raising main pipeline, delivery tank and distribution system. This system will cover 40 ha. For reducing manual transportation of vegetable, improving one existing road (W=2.5m) is proposed which will cover the beneficially area of 17 ha.



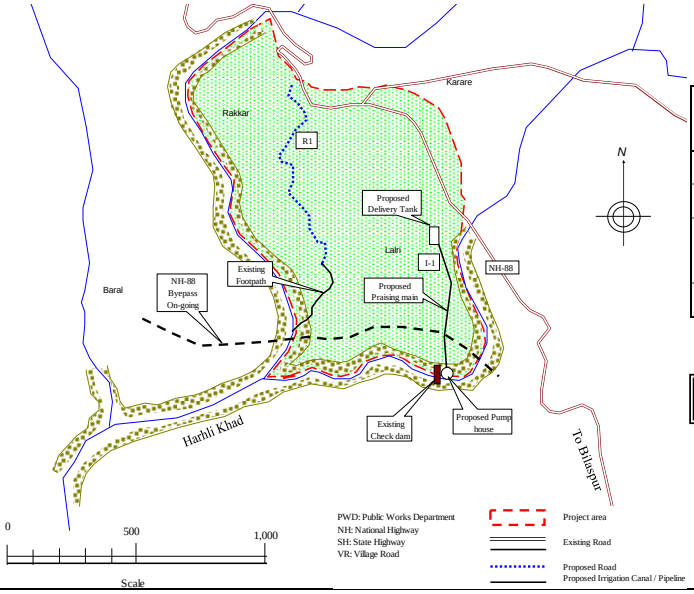
Proposed Cropping Pattern

Farmers' Support Program

Especially, the following support programs are required for improvement of the situation of the Pre-F/S site.

(1) Vegetable Promotion
- Promotion of strategic crops
- Introduction of suitable cropping pattern

(2) Market system improvement
- Promotion of improvement of quality control
- Improvement of market information system



Salient Features and Estimated Cost of Infrastructure development

Proposed works	Description	Cost (Rs.000)
Construction		
- Lift irrigation, I-1	CCA=40 ha	6,378
- Improvement of Existing Road, R1	L=837 m	708
- Collection Center	240 m^2	3,120

Economic Internal Rate of Return = 11.7 %

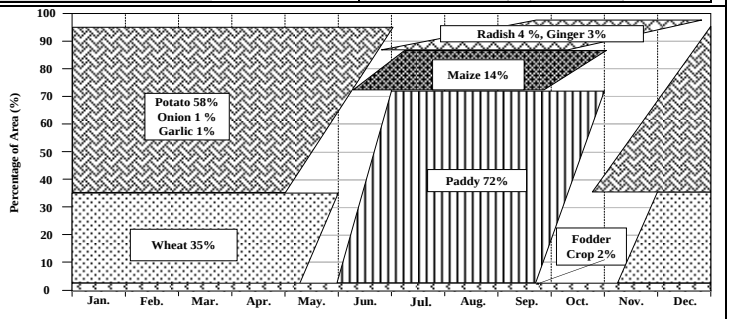
Note: Economic internal rate of return after cost allocation. For detail, refer to Annex-L section L-9.

(2) Malan

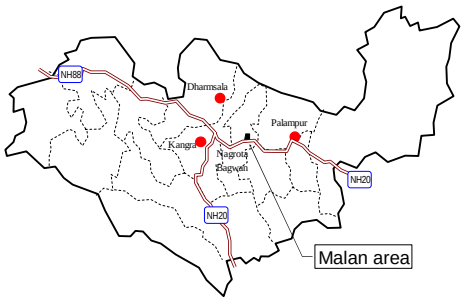
Present Condition

Socio-economic and Natural Conditions

District	Kangra	Category	II
Block	KG-24 Nagrota Bagwan	Agro-ecological zone	Zone-1
Panchayat	Malan	Annual rainfall (mm)	1,481
Village		Average Temperature	19.8
Uprali Majhetli, Malan, Pankhar, Bhuli Majhetli, & Bamnehar		Average Max. Temperature	32.1
		Average Min. Temperature	4.4
Total Population	2,970	Total area (ha)	600
No. of farm household	830	Cultivated area (ha)	197



Present Cropping Pattern



Kangra District

Location Map

Present Situation, Constraints and Measures

(1) Agriculture

Malan site is fully facilitated with the existing irrigation system so that the both food grain crops and vegetables are grown under irrigated condition. During Kharif season, maize and paddy are the main crops, while during Rabi season potato occupies half of the cropped area. The major constraints include: i) High cost of seed potato and diseases because of continuous cultivation of potato, ii) Transport and marketing for vegetables. There are no marketing farmers' groups in the site.

Suitable horticulture crops in the site are: Mango, Litchi, Peaches, Aonla and Strawberry for promoting fruit planting; Gladiolus, Chrysanthemum, Lillium, Gerbera and Carnation for promoting floriculture; and Kaunch, Tulsi, Ashwagandha, Satawar, Safedmusli and Aloevera for diversifying medical and aromatic plant cultivation. As ancillary activities, mushroom cultivation and bee keeping have high potentials.

(2) Post-harvesting and Marketing

Processing activities in Kangra District are relatively active. Mainly, agro-products are processed by comparatively small scale groups or by housewives in their houses. Meanwhile, regarding governmental or semi-governmental sector, Himachal Pradesh Fruit Canning Unit (himcu) is operating two (2) Community Fruit Processing and Training Centers at Dehra and Nurpur, and also operating Fruit Canning Unit at Nagrota Bagwan with the processing capacity of 200 tonnes per year.

In the District, there are some active farmers, who have cultivated exotic vegetables such as yellow and red capsicums, applying the protective cultivation. While some farmers have tried to cultivate tomato as well as marigold. They directly supply their produces to wholesalers in Delhi or other big consuming area.

(3) Infrastructure

Existing irrigation system covers almost all the parts of this area. There exist some irrigation systems, most of which have been developed by farmers themselves since more than 100 years ago and partly rehabilitated and/or upgraded with the assistance of IPH Department. Though this site is fully facilitated with the existing irrigation system, farmers are aware the lack of adequate water management and maintenance works. They propose to frame a rule for water management and to form a committee over WUA, in addition to some up-grading works of the existing system.

There are many wide and narrow footpaths with various type of pavement (compacted earth, stone and concrete), which starts from the village road and ends in crop fields or connects to another path or roads. The most farmers satisfied with the present village road and footpaths, expecting some improvement works.

Vegetable Cultivation

Vegetable Cultivation

Paddy-Potato Field

Palampur Market Yard

Proposed Plan

(1) Agricultural Development Plan

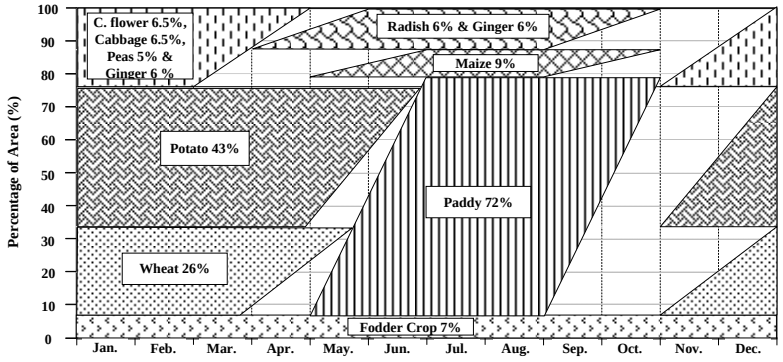
Vegetable promotion and agricultural support for the Malan site are planned as follows: i) The food grain yields are planned to be increased further by better water management practices, ii) About 25% of the wheat area shall be converted to vegetables such as peas, cauliflower which has much higher value than wheat. The areas which are used for rice cultivation shall be continued for food security, iii) In consideration of crop rotation, 25% of potato area (30 ha) is planned to be converted to other vegetables such as peas, cauliflower etc, iv) It is planned to introduce exotic vegetables in 6 ha area, v) DOA should also conduct exotic vegetable promotion activities including demonstration trials, training camps, exposure visits and field days.

(2) Post-Harvest Processing and Marketing Plan

It is proposed that one collection centre be established near Malan village for marketing and farmers should control marketing of table potatoes to fetch higher selling price by storage. Meanwhile, existing market yards are readily available in Nagrota Bagwan, Palampur, etc., so it is not necessary to newly establish market yards.

(3) Facility Plan

In this area, irrigation and farm road network have less constraint compared to the other areas, requiring only improvement works of the existing facilities and short length of new roads. In this study, one improving works of existing irrigation intake is proposed from temporary intake to permanent structure, which commands about 50 ha. For access farm road, improving one existing farm road and one footpath, and construction of two new roads are proposed. These roads will contribute to improve manual transportation in beneficially area of 50 ha approximately.



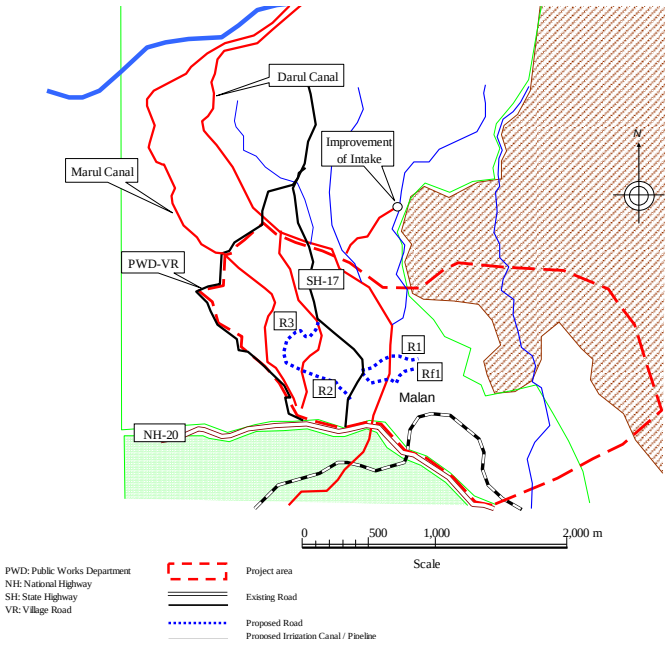
Proposed Cropping Pattern

Farmers' Support Program

Especially, the following support programs are required for improvement of the situation of the Pre-F/S site.

(1) Vegetable Promotion
- Quality improvement
- Introduction of exotic vegetables
- Introduction of promising varieties

(2) Market system improvement
- Quality control
- Improvement of market information system
- Improvement of bargaining power of farmers' groups



Salient Features and Estimated Cost of Infrastructure Development

Proposed works	Description	Cost (Rs.000)
Construction		
- Improvement of Intake		1,032
- New Road, R1	L=499 m	790
- New Road, R2	L=2,398 m	882
- New Footpath, Rf1	L=556 m	286
- Improvement of Existing Road, R3	L=560 m	361
- Collection center	240 m^2	3,120

Economic Internal Rate of Return = 18.7 %

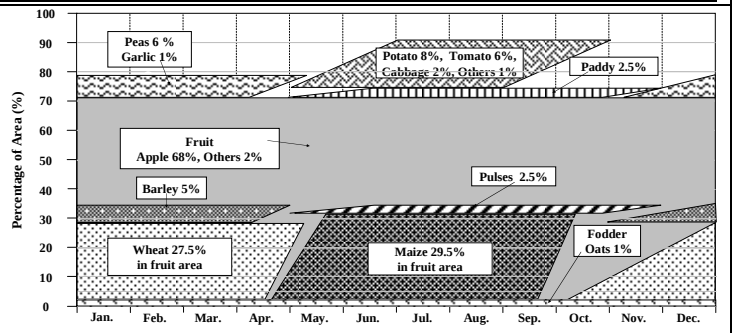
Note: Economic internal rate of return after cost allocation. For detail, refer to Annex-L section L-9.

(3) Hallan-I

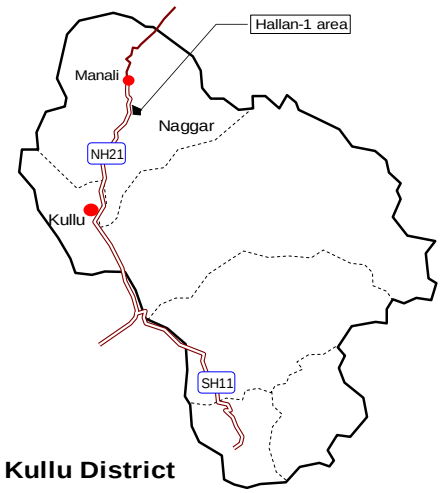
Present Condition

Socio-economic and Natural Conditions

District	Kullu	Category	I
Block	KU-37 Naggar	Agro-ecological zone	Zone-3
Panchayat	Hallan-1	Annual rainfall (mm)	838
Village		Average Temperature	16.7
Dashal, Sarsai, Barka, Boshi, Batahr, Rongri, Chhakki, Raman, Balthaa, Charanag, Damadi, Kumarti, Bdehragran		Average Max. Temperature	24.6
		Average Min. Temperature	7.7
		Total area (ha)	773
		Cultivated area (ha)	407



Present Cropping Pattern



Location Map

Present Situation, Constraints and Measures

(1) Agriculture

Hallan-I site is a fruits dominated area occupying 70% of the cultivable area, where food grains including maize and wheat are cultivated in the fruits area. Strategic vegetables including potato, tomato, peas, and cauliflower are cultivated in the area. Besides, other vegetables such as cabbage, broccoli, and beans are also cultivated. The major constraints include: i) transport and marketing, ii) poor or no irrigation facilities, iii) not enough manpower for farming, and iv) pests and diseases.

The farmers are interested in crop diversification to grow vegetable crops such as potato, tomato, peas, garlic, broccoli, cauliflower, and cabbage. Since the tourist town Manali is located close to the site, it shall be possible to sell exotic vegetables in the hotels are Manali.

Diversification potential area will be waste land or other fallow area around in Hallan-1 site. Potential horticulture crops are: apple, pear, hazelnut, walnut and strawberry for promoting fruit planting; gladiolus, chrysanthemum, tulip, lillium and carnation for promoting floriculture; and stevia, jatamansi, salvia, tulsi, satawar, rosemary and safed musli for diversifying medical and aromatic plant cultivation.

In Hallan-I site, there is deficit supply of green and dry fodder. The dairy production in this site can be enhanced by improving feeding situation through mix cropping of fruits and fodder in orchard.

(2) Post-harvesting and Marketing

Agro-processing activities in Kullu District, particularly apple processing is active, because this District is the one of largest apple production District.

In Kullu District, there are six (6) market yards. Out of six market yards, four (4) market yards except Kullu and Bhuntar Market Yards are seasonal market yards. Patlikhal Sub-Market Yard is nearby the Pre-F/S site in Halan-1. In this sub-market yard, there is no staff of APMC, further major commodities are apple and other fruits. Therefore, daily market price information of vegetables is not available.

(3) Infrastructure

In plain and rolling area they have irrigation system under operation, while there is no irrigation in the mountainous area. These existing systems have free intakes constructed with stone placing in the river. Farmers in the mountainous area, like Raman, Balthaa, Charanag, Damadi, Kumarti, Bdehragran villages are requesting new irrigation system to be constructed for which water source is snow-fed perennial water in a mountain torrent. Maximum transportation distance is more than one km on foot and the number of transportation trip increases with the recent promotion of vegetable and fruit crops. The farmers are requesting improvement or widening of the existing footpath so as to be passable in the rainy season in the rolling area, and construction of new feeder roads to connect farm land to the existing PWD VR in the steep area.

Farm land

Patlikul Seasonal Market

Apple Collection Place

Apple Seasonal Market

Proposed Plan

(1) Agricultural Development Plan

Vegetable promotion and agricultural support for the Hallan-I site are planned as follows: i) Fruits cultivation areas will be kept in the present level, ii) The area under strategic (potato, tomato, cauliflower) multiple (cabbage) vegetables can be increased by using current fallow areas, and provision of full irrigation, iii) It is planned to increase the exotic vegetables area to 9 ha, iii) DOA should also conduct exotic vegetable promotion activities including demonstration trials, training camps, exposure visits and field days.

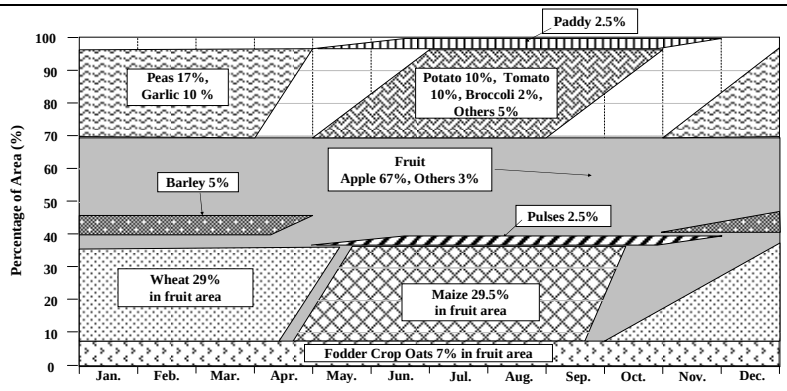
In comparison with the livestock population, the green fodder supply is much low having a high shortage of animal feed. Therefore, it is planned to increase the fodder area from 5.0 ha to 30.0 ha under fruit trees.

(2) Post-Harvest Processing and Marketing Plan

Farmers in Hallan-I area have sufficient experience for vegetable cultivation. However, they do not have any experience on group marketing. It is expected that they try to strengthen their ability for selling their produces by group, in order to improve quality of their vegetable produces, and strengthen their bargaining power

(3) Facility Plan

There is no irrigation in the mountainous area, where the farmers are requesting new flow irrigation system utilizing snow-fed water source. Due to the steep topographic condition of the canal route and that canal will pass in the demarcated protected forest area, pipe line system is proposed. In existing irrigation area improvement and extension of existing canal system is also proposed. In addition, tank irrigation is also suitable in the hilly area. For access road, construction of one new road and improvement of two existing roads are proposed, total length of which is 1,150 m.



Proposed Cropping Pattern

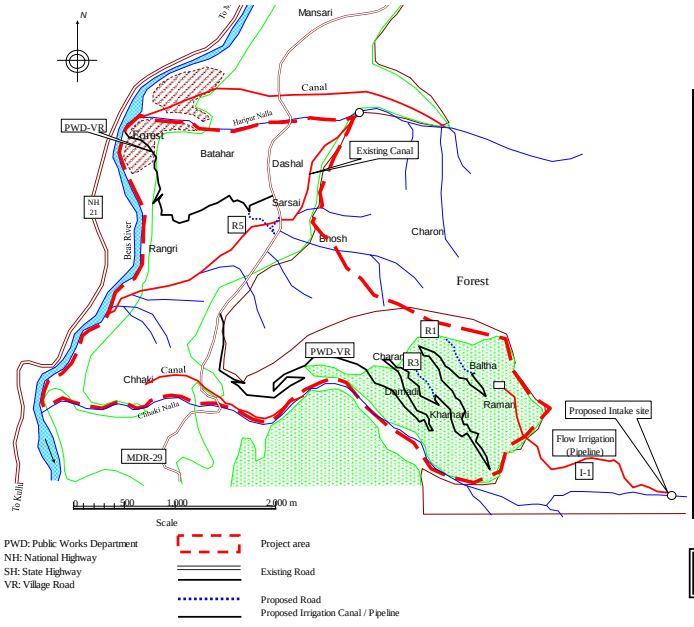
Farmers' Support Program

Especially, the following support programs are required for improvement of the situation of the Pre-F/S site.

(1) Vegetable Promotion
- Promotion of exotic vegetables
- Improvement of quality control

(2) Integrated Farm Management
- Promotion of fodder crops

(3) Market system improvement
- Promotion of improvement of quality control
- Improvement of market information system
- Promotion of farmers' groups



Salient Features and Estimated Cost of Infrastructure Development

Proposed works	Description	Cost (Rs.000)
Construction		
- New flow irrigation, I-1	CCA=52 ha	11,528
- Improv. Existing flow irrigation		1,602
- Water harvesting facilities		620
- New Road, R1	L=397 m	1,127
- New footpath, R3	L=435 m	175
- Improv. Exist. Road, R5	L=318 m	294
- Collection Center	240 m^2	3,120

Economic Internal Rate of Return = 18.5 %

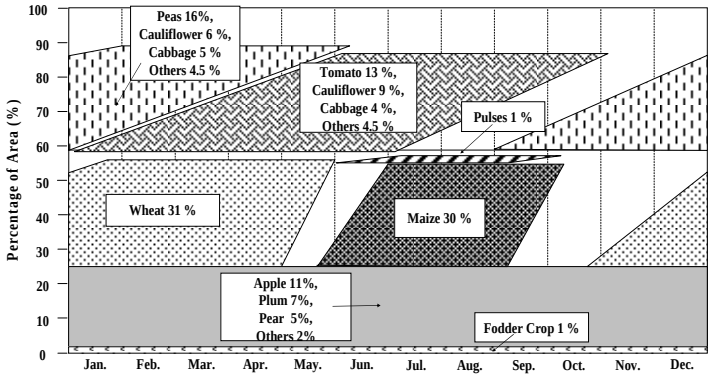
Note: Economic internal rate of return after cost allocation. For detail, refer to Annex-L section L-9.

(4) Nagwain

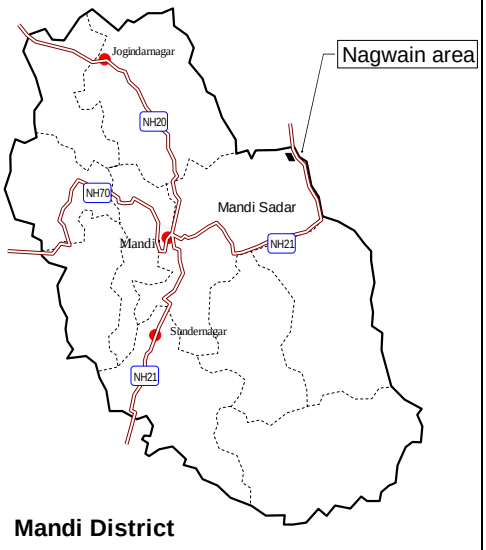
Present Condition

Socio-economic and Natural Conditions

District	Mandi	Category	II
Block	MD-47 Mandi Sadar	Agro-ecological zone	Zone-3
Panchayat	Nagwain	Annual rainfall (mm)	838
Village		Average Temperature	18.5
Nagwain, Shil Mashora & Palsehr		Average Max. Temperature	32.5
Total Population	3,920	Average Min. Temperature	1.8
No. of Farm Household	1,250	Total area (ha)	600
		Cultivated area (ha)	340



Present Cropping Pattern



Location Map

Present Situation, Constraints and Measures

(1) Agriculture

In Nagwain site, integrated farming including food grains, vegetables, and fruit cultivation is carried out. Food grains and vegetables are cultivated in about 31% of the cultivated area respectively. Fruits including apple, plum, pear, etc. are grown in about 10% of the area in the higher elevation. The farmers are already cultivating exotic vegetables in a small area and are interested to increase the area under exotic vegetables The major constraints include: i) transport and marketing, ii) poor or no irrigation facilities, iii) pests and diseases.

All the households purchase cereal crop seeds from departmental outlet. In case of vegetable seeds, 50% of the households purchase from retail shops outside the village, and 50% purchase from the departmental outlet. In case of fruit crops, 30% of the households purchase from certified nursery owners, and about 50% purchase from horticulture department. The remaining 20% purchase seedlings from the university.

If stable irrigation water supply is available, the farmers are interested to convert at least 75-80% of the food grains area to vegetables. The farmers are interested in crop diversification to grow vegetable crops such as tomato, cabbage, cauliflower, capsicum, and egg plant.

(2) Post-harvesting and Marketing

Processing activities in Mandi District are relatively active. Agro-processing in this district is not so active in general, since fruits production in Hamirpur District is quite small. In the District, there are some active farmers, who have cultivated exotic vegetables such as broccoli, mushroom, etc., applying the protective cultivation. They have some contract with wholesalers in Delhi or other big consuming area, thus their shipped-out produces are brought into wholesalers directly not through any kind of market yards.

(3) Infrastructure

There is one IPH lift irrigation system covering three villages, Nagwain, Shil Mashora and Palsehr. This system was constructed to irrigate the area of 100 ha, however the system has been deteriorated and actual irrigated area has decreased to 30 - 40 ha in these years. Other than this, no irrigation system exists except individual tank irrigation with water source from springs and small stream in hilly areas, private lift irrigation using small pump and private tubewell irrigation in low area in Lah. There are many wide and narrow footpaths, which start from the PWD VR and end in the crop fields or connect to another path or PWD VR. Maximum transportation distance is more than one km on foot and number of crop transportation trip increases with recent promotion of vegetable. The farmers propose improvement and new road linkage such as improvement of the existing Panchayat road and path, and construction of new farm road where only foot paths are available.

Harvesting of Cauliflower

Pump System

Pump Outlet Tank

Existing Farm Road

Proposed Project

(1) Agricultural Development Plan

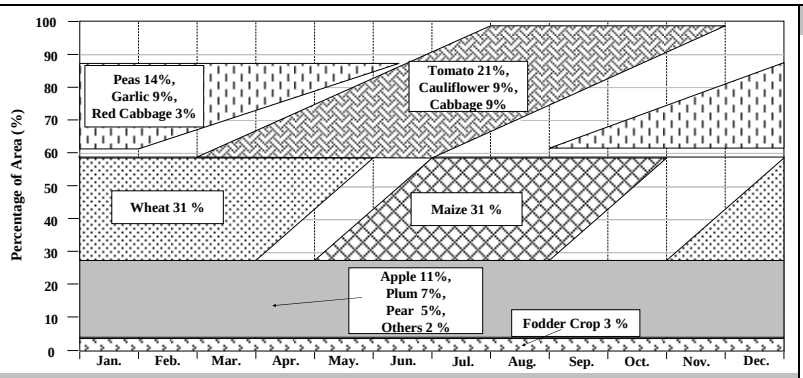
Vegetable promotion and agricultural support for the Nagwain site are planned as follows: i) In Nagwain Area, about 45 ha (12.9% of total cultivable area) is left as current fallow area, and a part of the fallow area can be converted for food grains production., ii) The area under strategic (peas, tomato, cauliflower), and multiple (cabbage, garlic) vegetables shall be increased with the assured irrigation facilities. Tomato area shall also be increased by using supplementary irrigation, iv) It is planned to increase the exotic vegetables area to 10 ha, v) DOA should also conduct exotic vegetable promotion activities including demonstration trials, training camps, exposure visits and field days.

(2) Post-Harvest Processing and Marketing Plan

Farmers in Nagwain area have sufficient experience for vegetable cultivation. However, they do not have any experience on group marketing. It is expected that they try to strengthen their ability for selling their produces by group, in order to improve quality of their vegetable produces, and strengthen their bargaining power.

(3) Facility Plan

As the water resources in the Beas River is sufficient even in the driest months, new lift irrigation system is considered. However, due to the high construction cost and operation cost because of high pumping head more than 100 m, most of the plans are not economically feasible. Also, high pump output capacity will be beyond the capacity of farmers' operation and maintenance. In case that lift irrigation will not be feasible, communal tank irrigation utilizing small stream or springs is proposed. For access farm road, 11 roads in total including new, improvement and footpath are proposed to connect from existing PWD road to the left out areas in both for hilly and lower area.



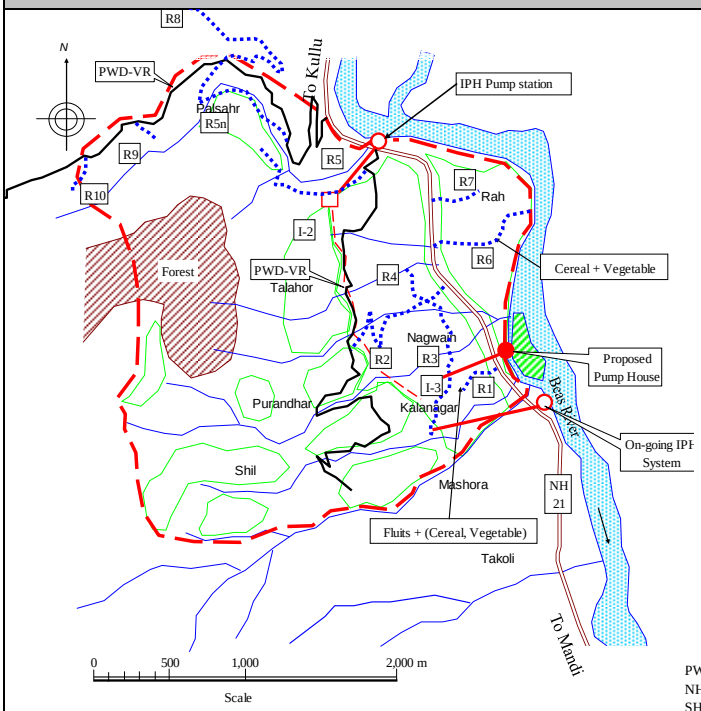
Proposed Cropping Pattern

Farmers' Support Program

Especially, the following support programs are required for improvement of the situation of the Pre-F/S site.

(1) Vegetable Promotion
- Promotion of exotic vegetables
- Improvement of quality control

(2) Market system improvement
- Promotion of improvement of quality control
- Improvement of market information system
- Promotion of farmers' groups



Salient Features and Estimated Cost of Infrastructure Development

Proposed works	Description	Cost (Rs.000)
Construction		
- New Lift Irrigation, I-3	25 ha	4,994
- Rehabilitation of IPH Lift Irrigation		1,630
- Water Harvesting Facilities		1,860
- New Road, 4 nos.	L=3,128 m	7,362
- Improv. Exsit, road, 8 nos	L=5,301 m	7,596
- Collection Center	240 m^2	3,120

Economic Internal Rate of Return = 10.1 %

Note: Economic internal rate of return after cost allocation. For detail, refer to Annex-L section L-9.

PWD: Public Works Department
NH: National Highway
SH: State Highway
VR: Village Road

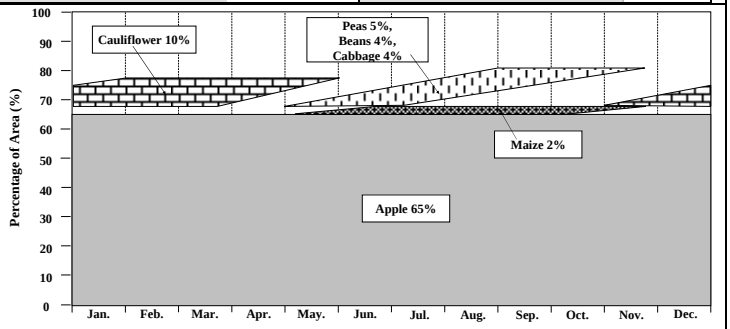
Project area
Existing Road
Proposed Road
Proposed Irrigation Canal / Pipeline

(5) Bagain

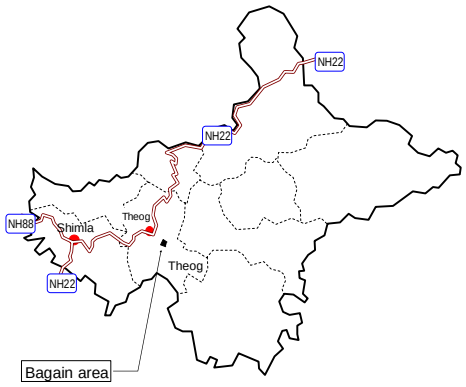
Present Condition

Socio-economic and Natural Conditions

District	Shimla	Category	I
Block	SH-59 Theog	Agro-ecological zone	Zone-3
Panchayat	Bagain	Annual rainfall (mm)	1,420
Village	Basa Bagain, Ulvi, Charail, Khahar, Bananal, Deothi, Dasana, Damyana, Bagri, Indkul, Bhuin & Rena	Average Temperature	No data
		Average Max. Temperature	No data
		Average Min. Temperature	No data
		Total area (ha)	580
Total Population	1,670	Cultivated area (ha)	245
No. of farm household	510		



Present Cropping Pattern



Shimla District

Location Map

Present Situation, Constraints and Measures

(1) Agriculture

In Bagain site, diversified farming including food grains, vegetables, and fruit cultivation are carried out in some extent. While vegetables and fruit cultivation are carried out for commercial purpose, food grains are cultivated mainly for self-consumption. The main vegetables cultivated in the area are peas, beans, cabbage, and cauliflower. The major constraints include: i) transport and marketing, ii) poor or no irrigation facilities, iii) pests and diseases and iv) damage by animals.

About 10% of the households purchase seeds for cereal crops from departmental outlet, and 90% use their own seeds. In case of vegetable seeds, 100% of the households purchase from retail shops outside the village. In case of fruit crops, 85% of the households purchase seedlings from certified nursery owners, and about 15% purchase from horticulture department.

The farmers are interested in crop diversification to grow vegetable crops such as cauliflower, cabbage, beans, pea and capsicum. The farmers are already cultivating vegetables and are interested to cultivate exotic vegetables

(2) Post-harvesting and Marketing

In Shimla District, there are six (6) market yards. Out of six market yards, four Market Yards except Rampur and Rahroo Sub-Market Yards are seasonal market yards. Theog Sub-Market Yard is nearby the Pre-F/S site in Theog. This Sub-Market Yard is old and not functional. Permanent staff is not deployed, therefore market price information is not available.

(3) Infrastructure

IPH Basa Bagain lift irrigation was constructed in 2002 to irrigate 32 ha of land, and is actually irrigating around 30 ha in these years. Many private irrigation systems are operated, which include mostly small tank systems taking water from spring and supplying water to their small farms by using hose. It was reported that five irrigation tanks are operated and some other tanks remain unutilized.

Most of villages have been connected except Banahar village with a population of 200. Panchayat constructed a part of the road between Banahar and Dak Bagain, however, it is only in poorly jeepable condition. The road route is entirely in the Protective Forest area. There are many narrow footpaths, which starts from the existing village road and ends in the crop fields.

Field Tank

Farm Road

Theog Market Yard

Theog Collection Depo

Proposed Project

(1) Agricultural Development Plan

Vegetable promotion and agricultural support for the Bagain site are planned as follows: i) In Bagain Area, about 55 ha is left as current fallow area, which can be converted for vegetable production with irrigation facilities., ii) By the implementation of irrigation project, full irrigation will be available for 51 ha area, and life-saving irrigation will be available for 25 ha area in kharif season. Using this irrigation, the area under strategic (peas, and cauliflower), and multiple (cabbage) vegetables shall be increased, iii) It is planned to introduce exotic vegetables in 15 ha area, iv) DOA should also conduct exotic vegetable promotion activities including demonstration trials, training camps, exposure visits and field days.

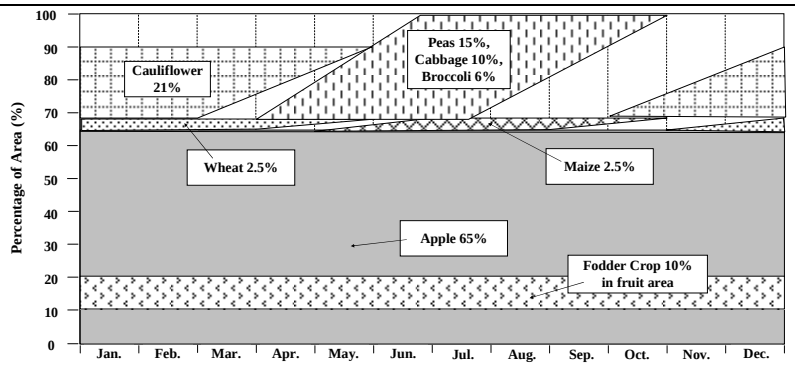
(2) Post Harvest Processing and Marketing Plan

Introduction or promotion of post-harvest activities, such as grading, sorting and packing etc., in accordance with the quality standard. Quality standard and post-harvest technologies should be disseminated by extension trainers by holding of the extension camps.

Farmers in Bagain area have sufficient experience for vegetable cultivation. However, they do not have any experience on group marketing. It is expected that they try to strengthen their ability for selling their produces by group, in order to improve quality of their vegetable produces, and strengthen their bargaining power.

(3) Facility Plan

Giri river is a perennial water source, and lift irrigation system is considered. However, due to the high construction cost and operation cost because of high pumping head more than 100 m, most of the plans are not economically feasible. Also, high pump output capacity will be beyond the capacity of farmers' operation and maintenance. Only one lift irrigation system is proposed to command relatively lower area, while high land are mostly covered with apple fruit. In addition, communal tank irrigation utilizing small stream or springs is proposed. For access farm road, one new road and improvement of three existing roads are proposed.



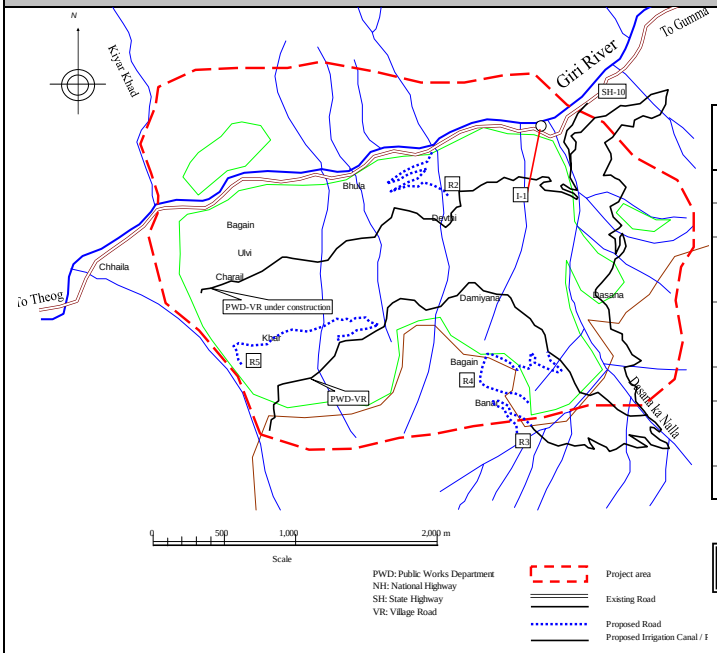
Proposed Cropping Pattern

Farmers' Support Program

Especially, the following support programs are required for improvement of the situation of the Pre-F/S site.

(1) Vegetable Promotion
- Improvement of productivity and quality control

(2) Market system improvement
- Promotion of improvement of quality control
- Improvement of market information system
- Promotion of farmers' groups



Salient Features and Estimated Cost of Infrastructure Development

Proposed works	Description	Cost (Rs.000)
Construction		
- New Lift irrigation, I-1	CCA=15 ha	3,677
- Rehabilitation of IPH Lift Irrigation		237
- Water Harvesting Facitlities		1,240
- New Road, R-2	L=2,262 m	12,515
- Improv. Exist. Road, 3nos	L=2,550	3,086
- Collection Center	240 m^2	3,120

Economic Internal Rate of Return = 14.2 %

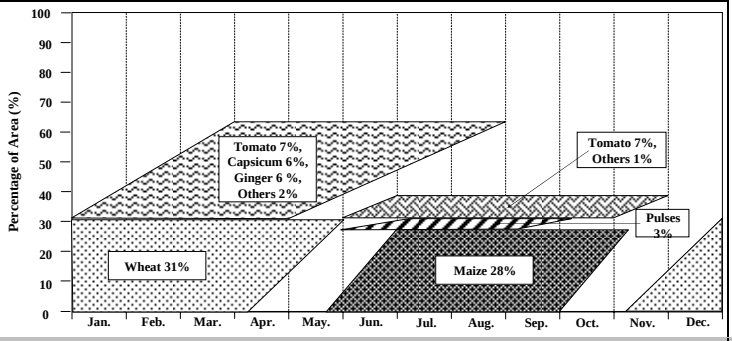
Note: Economic internal rate of return after cost allocation. For detail, refer to Annex-L section L-9.

(6) Chamo

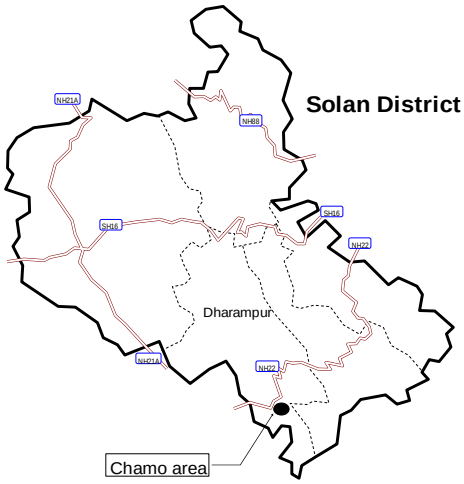
Present Condition

Socio-economic and Natural Conditions

District	Solan	Category	I (veritable oriented)
Block	Dharampur	Agro-ecological zone	Zone-2
Panchayat	Chamo	Annual rainfall (mm)	1,336
Village		Average Temperature	No data
Gadyar, Batoli Khurd, Batoli Kalan, Sanana, Nakaiyar, Chaamon, Dol, Chuancha, Karol, Oail, Shodon, Vayla Valau &		Average Max. Temperature	No data
		Average Min. Temperature	No data
		Total area (ha)	361
		Cultivated area (ha)	109



Present Cropping Pattern



Location Map

Present Situation, Constraints and Measures

(1) Agriculture

The food grains are mostly cultivated under rainfed condition, and are used mostly for self-consumption. The major vegetables grown in the area are tomato, capsicum, ginger, cucumber, peas and garlic. The major constraints include: i) irrigation, ii) labor required for vegetable farming, iii) pests and diseases, and iv) damage by animals (monkeys).

90% of the households purchase seeds for cereal crops from departmental outlet and 10% use their own seeds. On the other hand, only 30% of the households purchase seeds for the vegetable crops from departmental outlet, whereas 70% purchase from retail shops outside the village.

With counter measures against the constraints, the farmers are interested to convert at least 95% of the food grains area to vegetables. The major preferred crops are tomato, capsicum, cucumber and ginger. Since the vegetables are sold at relatively higher prices compared to processing of vegetables, the farmers informed that they have almost no interest in processing of vegetables. They informed that they have enough technical support from the Department of Agriculture and are satisfied with on-going programs of the department.

(2) Post-harvesting and Marketing

Since Solan District is close to big consuming area and comparatively flat areas, many agro-processing facilities exists including Governmental or semi-governmental sector and private sector. In Solan District, almost all vegetables, which are locally produced, are shipped out to other states. Meanwhile, vegetables during the winter season are supplied from other districts, while off-season vegetables are supplied locally.

Chakki Ka Mour Sub-Market Yard is nearby the Pre-F/S site in Chamo. This Sub-Market Yard does not function well now. Originally farmers brought their produces by themselves to this sub-market yard, however, they bring most of their produces to other markets which they can get higher prices. Because road network was improved outside of the Site, and farmers are able to take their produces to other market easily

(3) Infrastructure

There is no irrigation system developed by the government, while small scale communal and private irrigation systems are operated utilizing local water source like spring and small streams. Major constraints are lack of perennial water source and steep geographic conditions, therefore limited water should be efficiently utilized. Some new lift irrigation systems to be constructed on the small tributaries and tank irrigation system including rehabilitation/improvement are required. Training for improvement of irrigation system and proper management are necessary.

Accessibility within the site is poor and farmers expect improvement of transport measures, with new construction of access farm roads.

Tomato Cultivation

Chakkikamor Sub-Market

Solan Market yard

Sorting Tomato at Field

Proposed Project

(1) Agricultural Development Plan

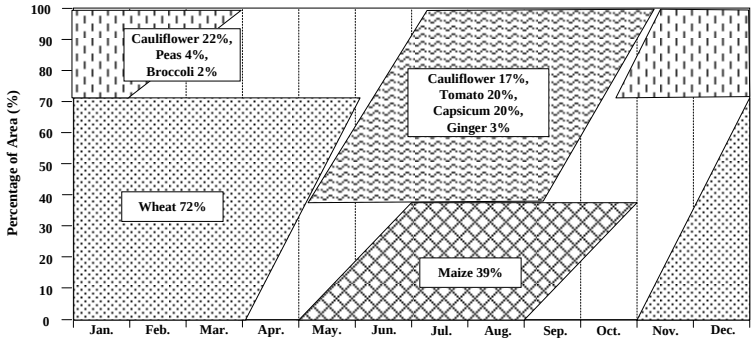
Vegetable promotion and agricultural support for the Chamo site are planned as follows: i) about 80 ha is left as current fallow area, of which a part can be converted for vegetable production with irrigation facilities, ii) By the implementation of irrigation project, full irrigation will be available for 15 ha area, and supplementary irrigation will be available for about 50 ha area in kharif season. Using this irrigation, the area under strategic (peas, and cauliflower), and multiple (capsicum and ginger) vegetables shall be increased, and exotic vegetables is planed to introduce in 3 ha area. iii) DOA should also conduct exotic vegetable promotion activities including demonstration trials, training camps, exposure visits and field days

(2) Post-Harvest Processing and Marketing Plan

Farmers in Chamo area have sufficient experience for vegetable cultivation. However, they do not have any experience on group marketing. It is expected that they try to strengthen their ability for selling their produces by group, in order to improve quality of their vegetable produces, and strengthen their bargaining power.

(3) Infrastructure Development Plan

In this site, perennial water source is quite limited. Also, due to the high pumping head, most of the plans are not economically feasible. One lift irrigation system of which CCA is 15 ha is proposed. For access farm road, two roads and one footpath are proposed including provision of cross drainage culvert, causeway, and bridges, and slope protection. The proposed new access farm road will connect 40 ha of remote area with total length of about 6 km.



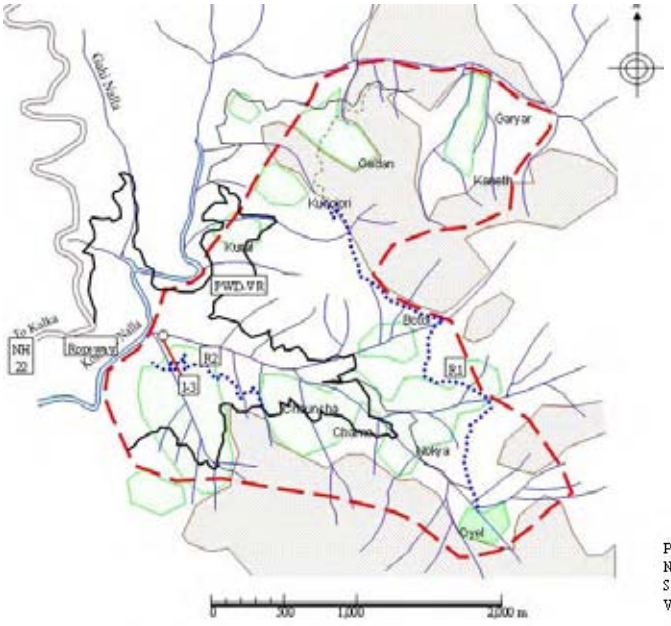
Proposed Cropping Pattern

Farmers' Support Program

Especially, the following support programs are required for improvement of the situation of the Pre-F/S site.

(1) Vegetable Promotion
- Promotion of exotic vegetables
- Improvement of quality control

(2) Market system improvement
- Promotion of improvement of quality control
- Improvement of market information system
- Promotion of farmers' groups



PWD: Public Works Department
NH: National Highway
SH: State Highway
VR: Village Road

Scale
- Project area
- Existing Road
- Proposed Road
- Proposed Irrigation Canal / Pipeline

Salient Features and Estimated Cost of Infrastructure Development

Proposed works	Description	Cost (Rs.000)
Construction		
- Lift irrigation, I-3	CCA = 15ha	3,752
- Water harvesting facilities		1,860
- Access Farm Road, R-1	L=3,900 m	10,769
- Access Farm Road, R-2	L=2,398 m	10,983
- Collection Center	240 m^2	3,120

Economic Internal Rate of Return = 14.1 %

Note: Economic internal rate of return after cost allocation. For detail, refer to Annex-L section L-9.