Section 3
Zoning

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1. Objective

Agro-ecological condition of the study area is quite diverse and productive use of agricultural lands requires adoption of strategies compatible with their intricate topography and slope. Selection of high value commodities for promotion of agricultural commercialization too, should be based on considerations of ecological conditions and local situation. Accordingly, zoning of the study area has been carried out to identify areas with high prospects of agricultural commercialization by using various types of information. The main purpose of zoning is to identify different locations in study area suitable for commercialization by producing particular commodity through the utilization of both spatial and attribute data.

2. Trials and Errors of Zoning Exercise Conducted under SRCAMP

During the implementation period of SRCAMP, three attempts for zoning have been carried out.

“First” one was conducted during October to November 2011, based on land use, agro-ecological conditions, slope, road access, existence of production pockets, future strategic road network development plan, etc. and taking VDCs/municipalities as unit of analysis because it is the lowest political administrative unit of Nepal.

“Second” one was conducted during January to February 2012, in response to the request raised by counterparts saying although it is officially published, existing information of DADO/DLSO production pockets with both existing and future potential are unreliable and new data collection should be carried out regarding Wards as unit of analysis not VDCs.

“Third” one was conducted during July to September 2013, due to the consideration that despite two sets of zoning exercise conducted, the applicability of these zoning results were judged unsatisfactory for the master plan formulation. Therefore, in the third attempt, a drastic change of the approach was introduced based on the very fundamental condition for the agricultural commercialization, the accessibility. In the following, selected zoning results conducted under SRCAMP are briefly presented.

3. First Zoning Exercise

First zoning was carried out basically through utilization of Geographic Information System (GIS) using both spatial and attribute data. Table 1 below presents different data used for zoning exercise along with their data sources.

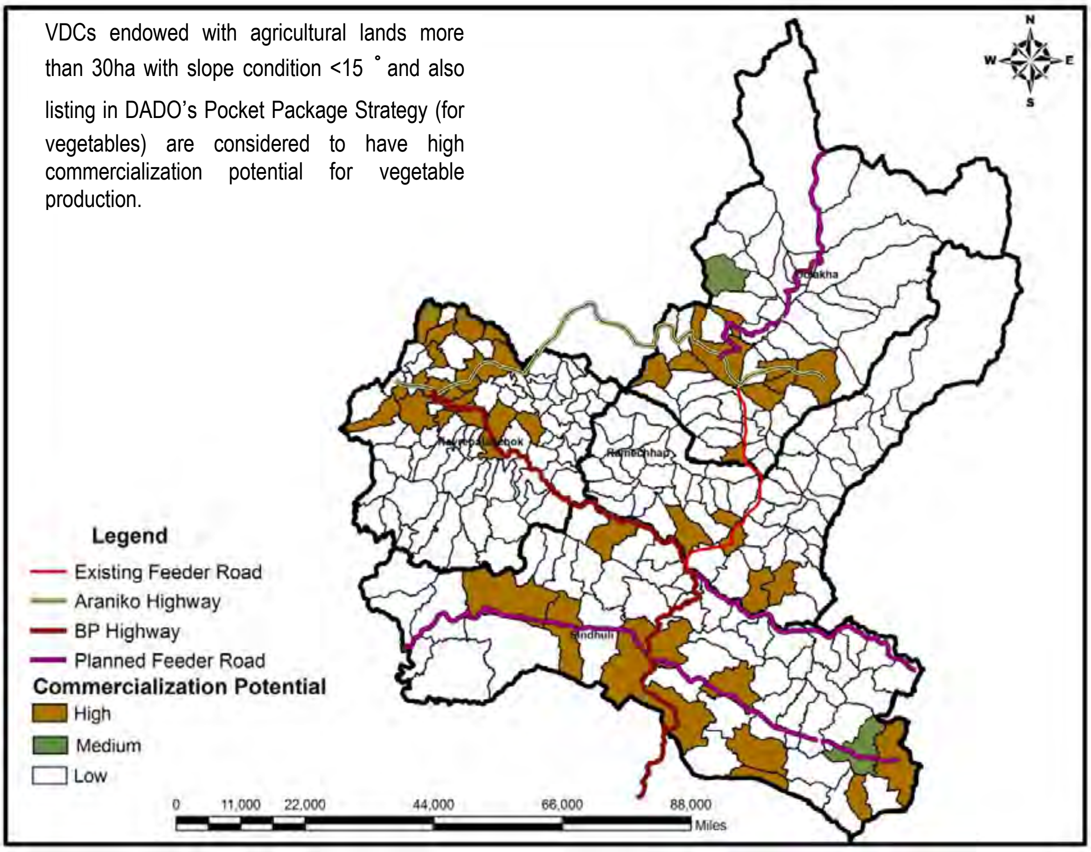
Table 1: Data Used for First Zoning Exercise and their Sources

Parameters	Year	Data Sources
A. Spatial data		
Land use	1996	Department of Survey
Slope	1996	Department of Survey
Bio-climatic zone	1996	Department of Survey
B. Attribute data		
Administrative boundary (District, VDC, Municipality)	1996	Department of Survey
Pocket area information (DADO, DLSO)	2011	DADO, DSLO Records
Road Access	2011	Consultative meetings
Strategic Road Network (Existing and Planned)	2010	Department of Roads

Query based sequential[1] analysis was performed to compose maps in GIS domain. However, farming system in Nepal is complex and same unit of land is used for multiple purposes and it is very difficult to identify areas suitable for single particular high value commodity or livestock. Hence, study first identified VDCs endowed with commercialization potential for vegetables and fruits separately (based mainly on slope condition, i.e. <15° for vegetables and 30>15° for fruits). Likewise, VDCs having commercialization prospects of livestock were identified (based mainly on vegetation cover, i.e. <20% for swine/poultry, 20<50% for dairy, and >50% for goat). Later on commercialization potential of vegetables, fruits and livestock maps were prepared.

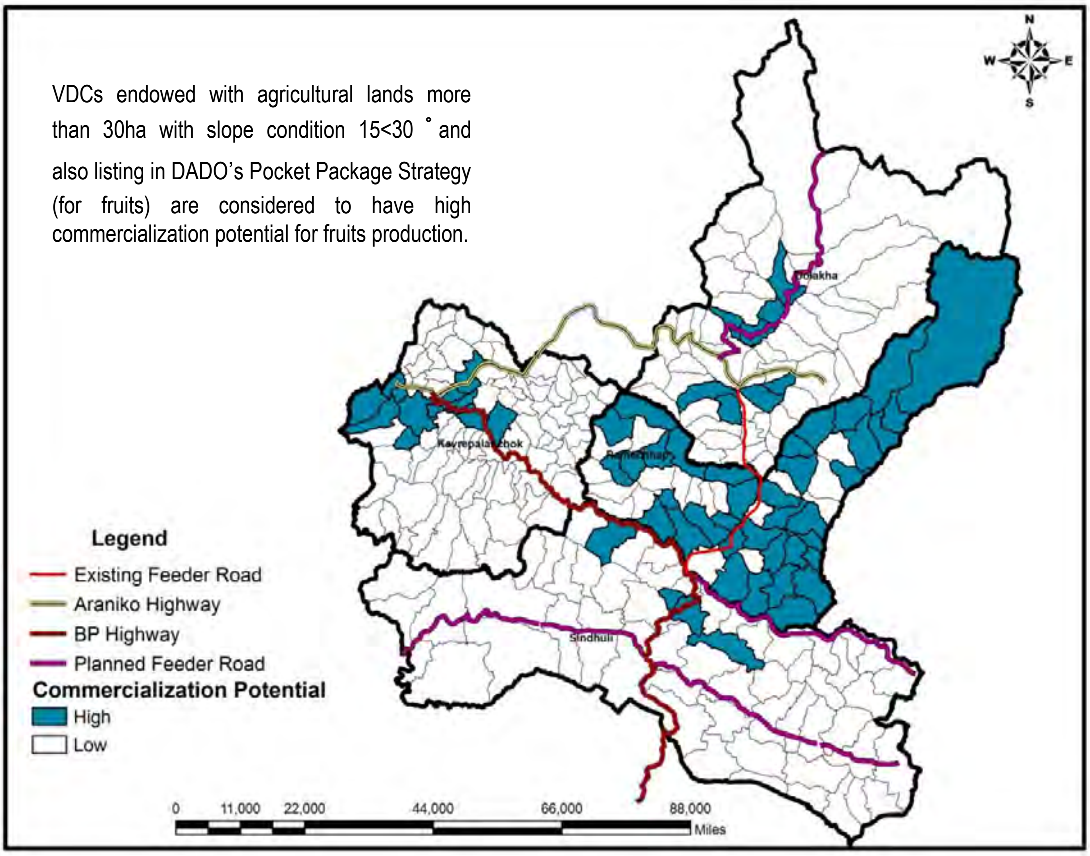
Maps 1 to 3 show the commercialization potential of vegetables, fruits and livestock products as the results of above process.

Map 1: Commercialization Potential Map of Vegetables by VDCs/Municipalities

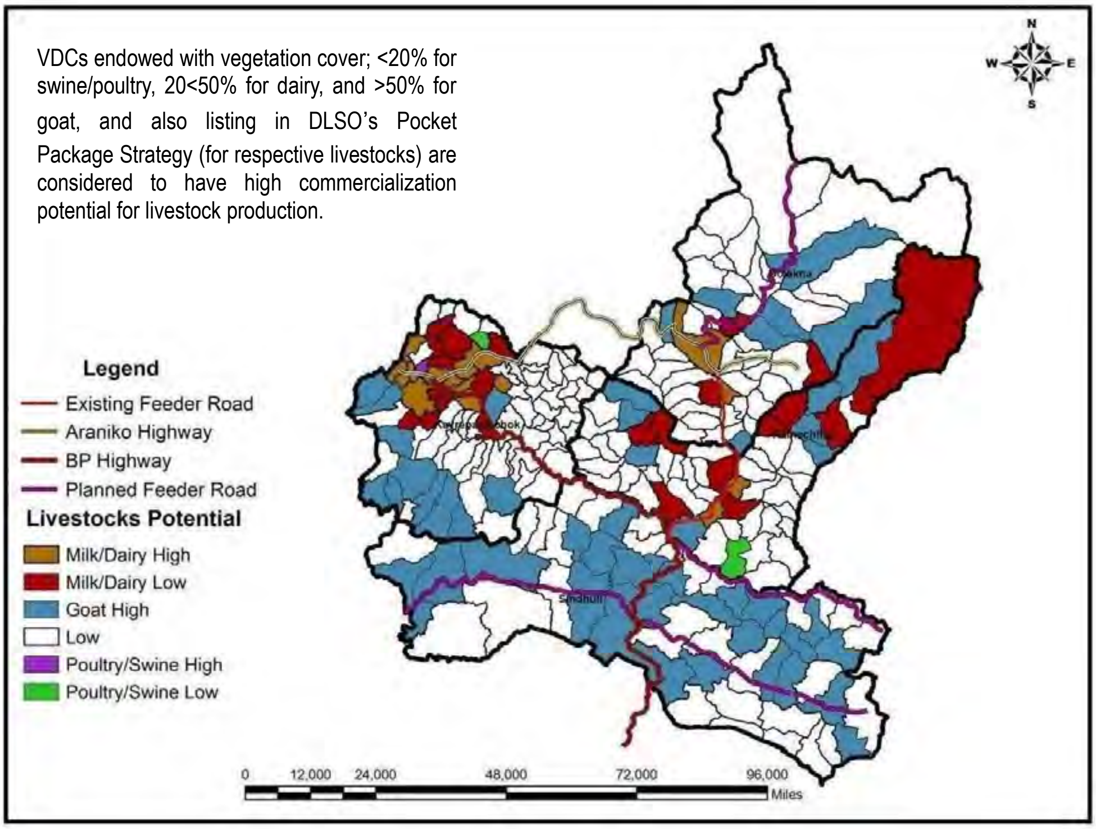


[1] This includes the analysis of data against specific indicators or questions, e.g. "show area above 30 ha" or "indentify area having both high agriculture commercialization prospects and pocket area of DADO/DLSO."

Map 2: Commercialization Potential Map of Fruits by VDCs/Municipalities



Map 3: VDCs/Municipalities Having Commercialization Potentials by Livestock Types



Second zoning exercise was carried out in response to the request made by counterparts, i.e. obtain new primary data for existing and future potential production pockets of HVCs because existing data are unreliable and in doing so, data should be based on Wards not VDCs.

Table 2 below presents different data used for second zoning along with the data sources.

Table 2: Data Used for Second Zoning and their Sources

Parameters	Year	Data Sources
A. Spatial		
Administrative boundary (Ward District, VDC, Municipality)	1996	Department of Survey
B. Attribute data		
Existing status of commercialization	2012	Consultative Workshop
Future status of commercialization	2012	Consultative Workshop
Availability of support services	2012	Consultative Workshop

The second zoning exercise was conducted relying mostly on data collected from consultative meetings with district stakeholders. A series of consultative meetings were carried out with the district stakeholders, especially that of government officials in all four study districts, to understand existing status of agricultural commercialization, future prospects together with availability of support services for agriculture commercialization, solely based on their knowledge and experiences.

Participants were first requested to identify wards in each VDCs/municipalities where HVCs are cultivated or livestock commodities are reared commercially. After identification of wards, they were further requested to predict future growth prospects for commercialization if support services such as irrigation, feeds, production inputs, road access, electricity etc. become available in near future.

Table 3 presents number of participants by districts. All the front line extension workers, especially JTs/JTAs working at service centers, participated in the meeting. They assigned scores based on their working knowledge and experiences particularly for this zoning purpose. Hence, scores made by them this time were more realistic and reliable as compared to the official existing and future production pockets data used for first zoning exercise in Oct. - Nov. 2011 that were disregarded by some important stakeholders as unreliable.

Table 3: Number of Participants to Consultative Workshop by Districts

#	Office	Kavre	Dolakha	Ramechhap	Sindhuli
1	District Agriculture Development office	14	6	13	13
2	District Livestock Service Office	21	19	14	14

Table.4. presents the proportion of wards with commercial cultivation of HVCs by studied districts. According to the workshops' participants, vegetable is grown commercially in more than 40.5 percent of wards in study districts, with highest in Kavre (63.9 percent) and lowest in Dolakha (18.0 percent). Likewise, fruits is grown commercially in 33.8 percent of wards while potato in 40.9 percent of wards. Commercial cultivation of all crops is relatively high in Kavre followed by Sindhuli while lowest in Ramechhap.

Table 4: Distribution of Wards based on Existing Status of Commercial HVC Cultivation

Districts	No. of wards	Proportion of wards with EXISTING commercial cultivation (%)		
		Vegetables	Fruits	Potato
Kavre	815	63.9	49.8	49.4
Dolakha	472	18.0	9.7	45.1
Ramechhap	495	18.6	24.2	27.5
Sindhuli	495	45.5	40.0	36.2
Total	**2,277**	**40.5**	**33.8**	**40.9**

In addition to existing situation, participants were further asked to identify future prospects for commercialization if availability of facilities such as irrigation, road access, electricity etc. were made available in near future. Existing status will affect commercialization prospects and vice versa. If the majority of wards in particular VDCs already have high extent of commercialization, future prospects will be less. In other words, it is likely that future prospects will be less if majority of wards of the VDCs are already commercialized.

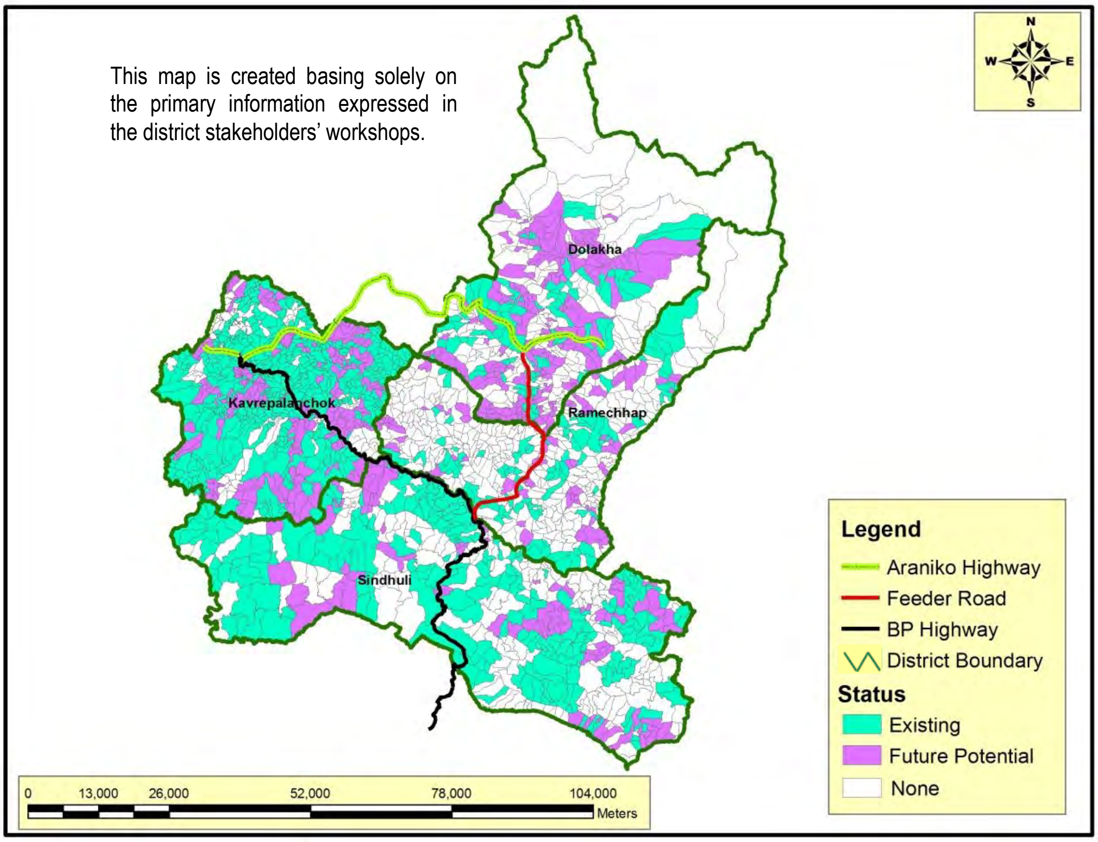
Table 5 shows the distribution of wards based on future prospects of commercialization. According to the workshops' participants, nearly one fourth of wards in the SRC districts have future growth prospects for commercialization, which remain almost similar among the commodities. There is a high prospect of promoting commercial cultivation of fruits and potato in Kavre while vegetables in Dolakha. Among the four SRC districts, Kavre and Dolakha have high future prospects of commercialization of HVCs compared to other districts.

Table 5: Distribution of Wards based on Future Growth Prospects of Commercial Cultivation in addition to Existing Commercialization Situation

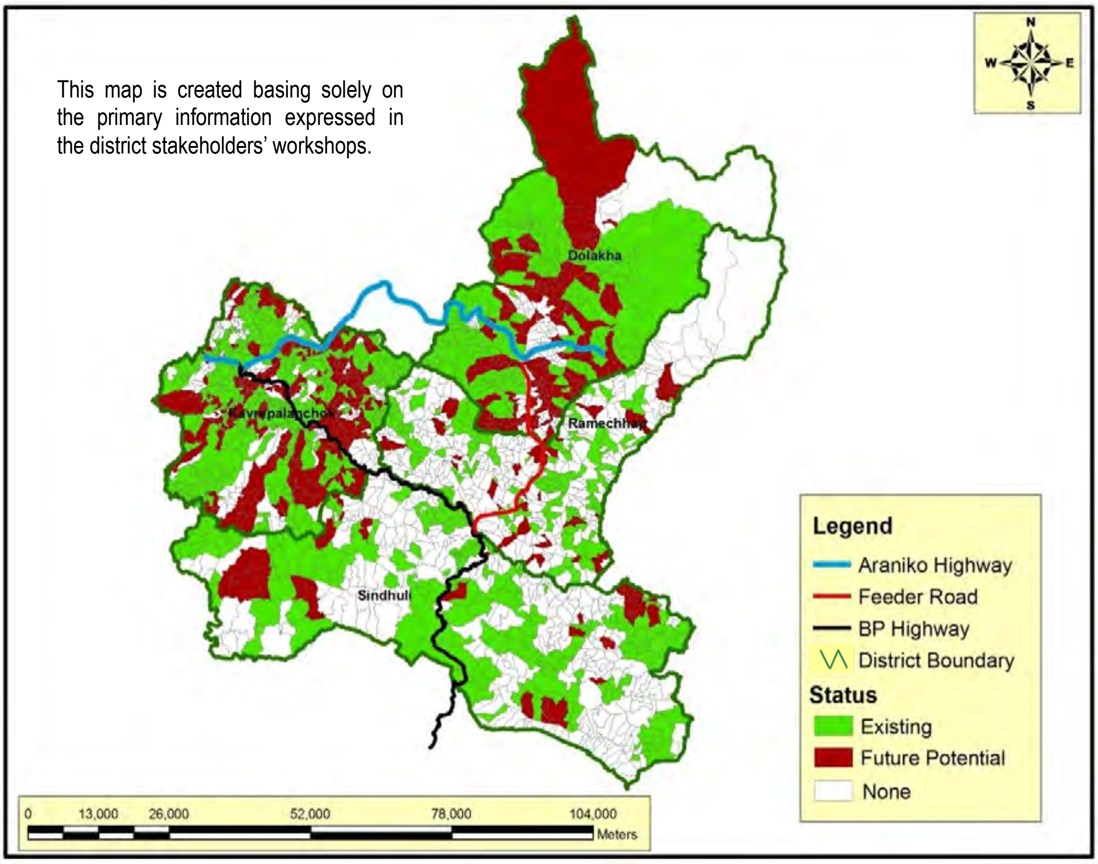
Districts	No. of wards	Proportion of wards with POTENTIAL commercial cultivation (%)		
		Vegetables	Fruits	Potato
Kavre	815	28.7	36.3	36.7
Dolakha	472	42.2	29.4	36.0
Ramechhap	495	12.3	7.7	6.9
Sindhuli	495	17.4	9.5	9.7
Total	**2,277**	**25.5**	**22.8**	**24.2**

Maps 4, 5, and 6 show wards where vegetables, fruits and potato are either grown commercially or have future prospects. Maps reveal that commercial cultivation is confined within the particular localities or wards in VDCs. This is considered mainly because of high climatic and altitudinal variations within the study districts.

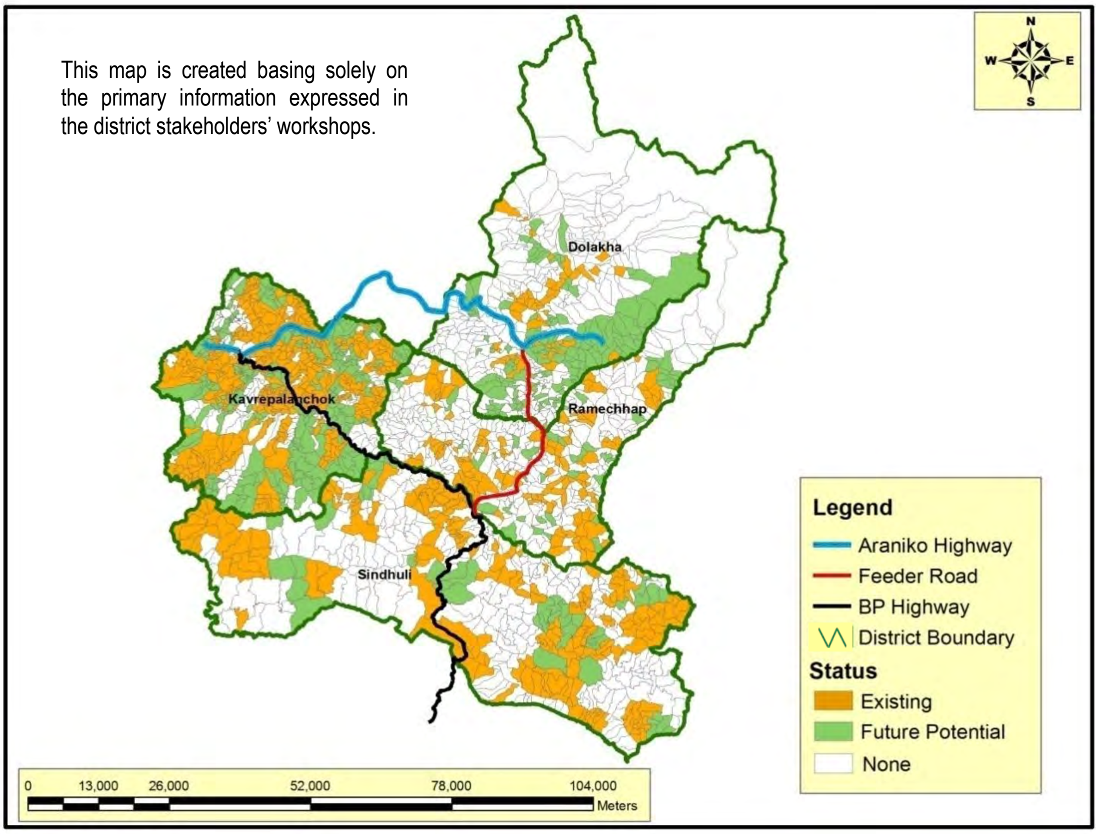
Map 4: Wards Where Vegetables Are Grown Commercially or Have Future Prospects



Map 5: Wards Where Fruits Are Grown Commercially or Have Future Prospects



Map 6: Wards Where Potato Are Grown Commercially or Have Future Prospects



As in the case for HVCs, the same process for livestock products were carried out and the results for dairy (milk) and goat (meat) will be presented below.

Table 6 and 7 present existing and future growth prospects for commercialization of dairy animals and goat rearing in study districts, respectively.

Table 6: Distribution of Wards based on Existing and Future Growth Prospects for Commercialization of DAIRY

Districts	No. of Wards	Existing Status		Future Prospects	
		No.	Percent (%)	No.	Percent (%)
Dolakha	472	104	22.0	63	13.3
Kavre	815	753	92.4	55	6.7
Ramechhap	495	70	14.1	77	15.6
Sindhuli	495	330	66.7	26	5.3
Grand Total	**2,277**	**1,257**	**55.2**	**221**	**9.7**

Dairy animal is reared commercially in more than half of the wards of SRC area varying from 92.4 percent in Kavre to 14.1 percent in Ramechhap. Likewise, nearly one tenth of wards in SRC have additional future growth prospects for commercialization of dairy varying from 15.6 percent in Ramechhap to 5.3 percent in Sindhuli.

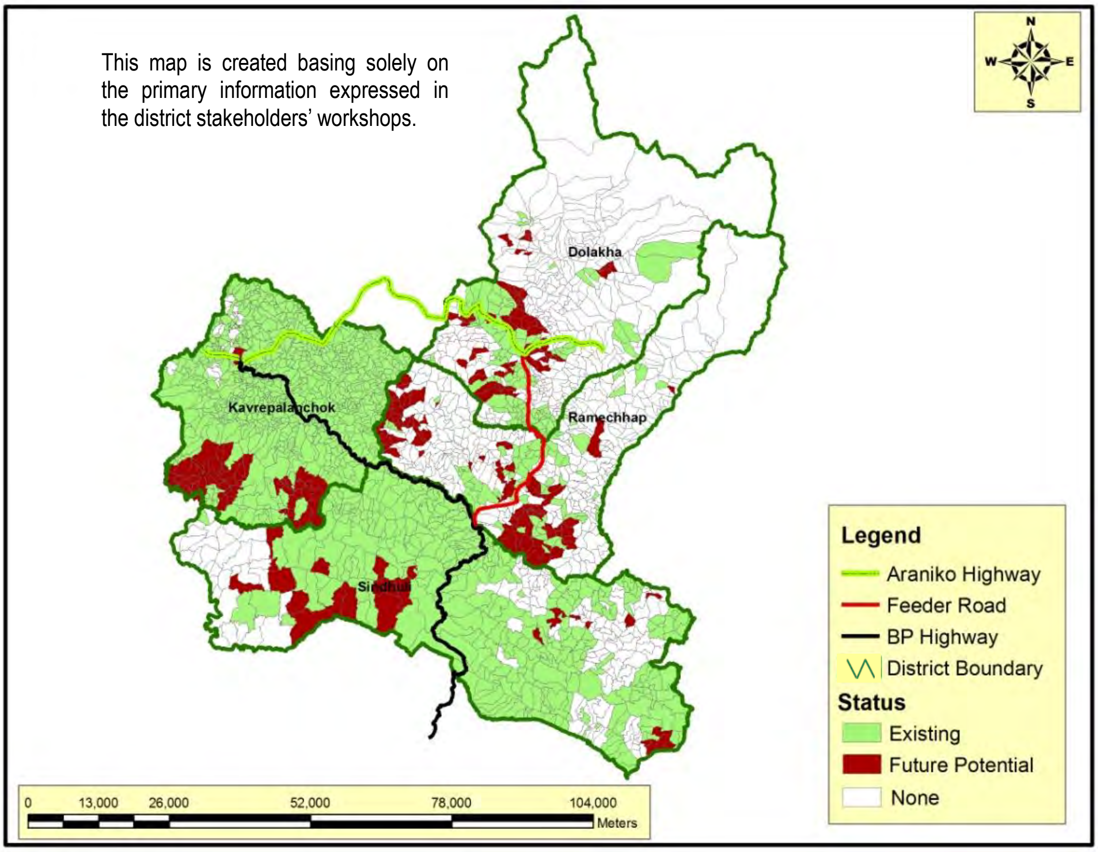
Table 7: Distribution of Wards based on Existing and Future Prospects of Commercialization of GOAT

Districts	No. of Wards	Existing Status		Future Prospects	
		No.	Percent (%)	No.	Percent (%)
Dolakha	472	323	68.4	29	6.1
Kavre	815	795	97.5	10	1.2
Ramechhap	495	119	24.0	65	13.1
Sindhuli	495	464	93.7	12	2.4
Grand Total	**2,277**	**1,701**	**74.7**	**116**	**5.1**

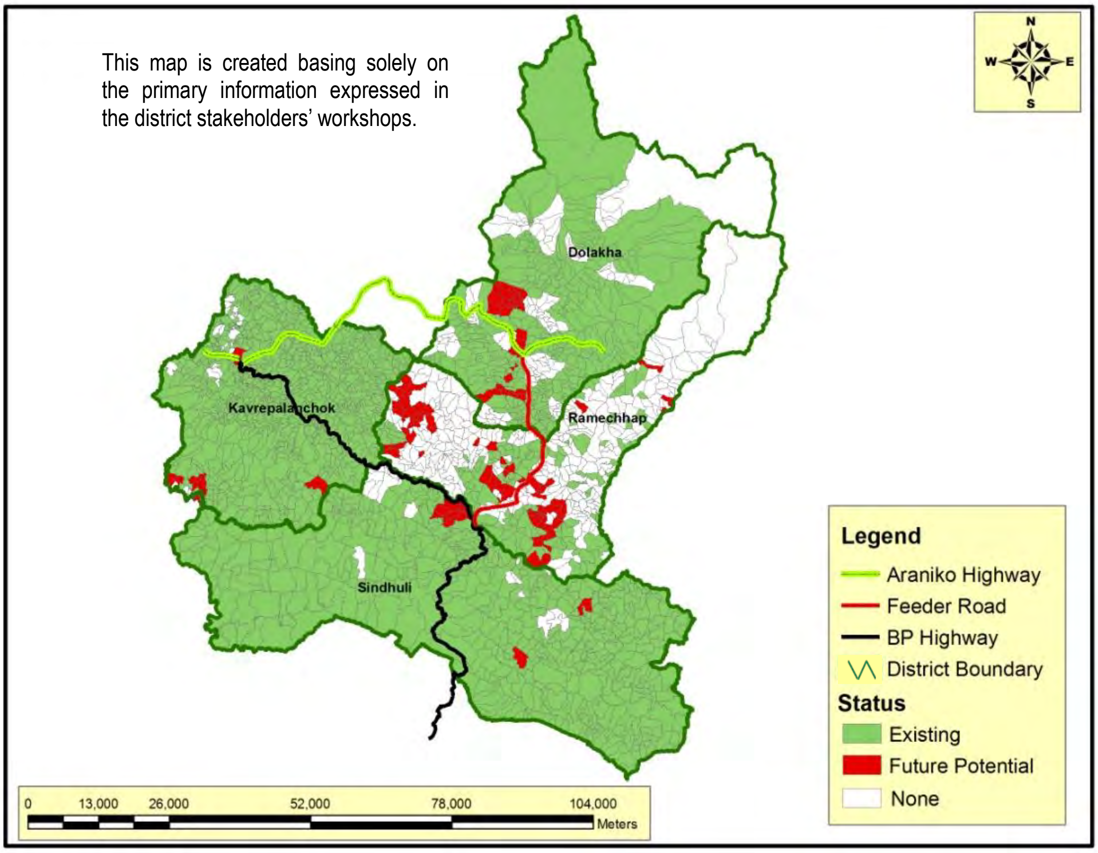
Goat is reared commercially in more than two thirds wards of SRC area varying from 97.5 percent in Kavre to 24.1 percent in Ramechhap. Very few of wards of SRC (5.1 percent) have additional future prospects of commercialization of goat rearing varying from 13.1 percent in Ramechhap to 1.2 percent in Kavre.

Maps 7 and 8 show the wards where dairy animals and goats are either reared commercially or have future prospects.

Map 7: Wards where Dairy Animals Are Reared Commercially or Have Future Growth Prospects



Map 8: Wards where Goats Are Reared Commercially or Have Future Prospects



The results of the second zoning exercise presented above are based solely on the primary information provided by the workshops' participants who are mainly the front line extension workers of both DADOs and DLSOs. Therefore, they can be regarded as reliable to some extent with the condition that they are all through the subjective observations and judgments probably mixed with the anticipations and wishes of the workshops' participants.

At this point of work, the study team decided to carry out another set of zoning exercise with drastically changing the approach. While the outputs produced by previous zoning exercises can be useful to consider the suitability of some HVCs in particular parts of the study area, their powers of conviction is still judged weak to be applied for the regional master planning. Therefore, the study team decided to treat the results of the first and second zoning exercises as the supporting data for the future development practitioners to refer in their practice.

4. Third Zoning Exercise

Unlike the first and second zoning exercises, the third round zoning adopted the accessibility aspect as the primary variable, combined with the agro-ecological aspect as secondary variable. The accessibility aspect has surfaced as the fundamental and necessary condition for the agricultural commercialization during the preparation stage of the Draft Basic Development Strategy (DBDS), while the agro-ecological aspect is judged useful in considering the seasonality of the productions in identified pockets.

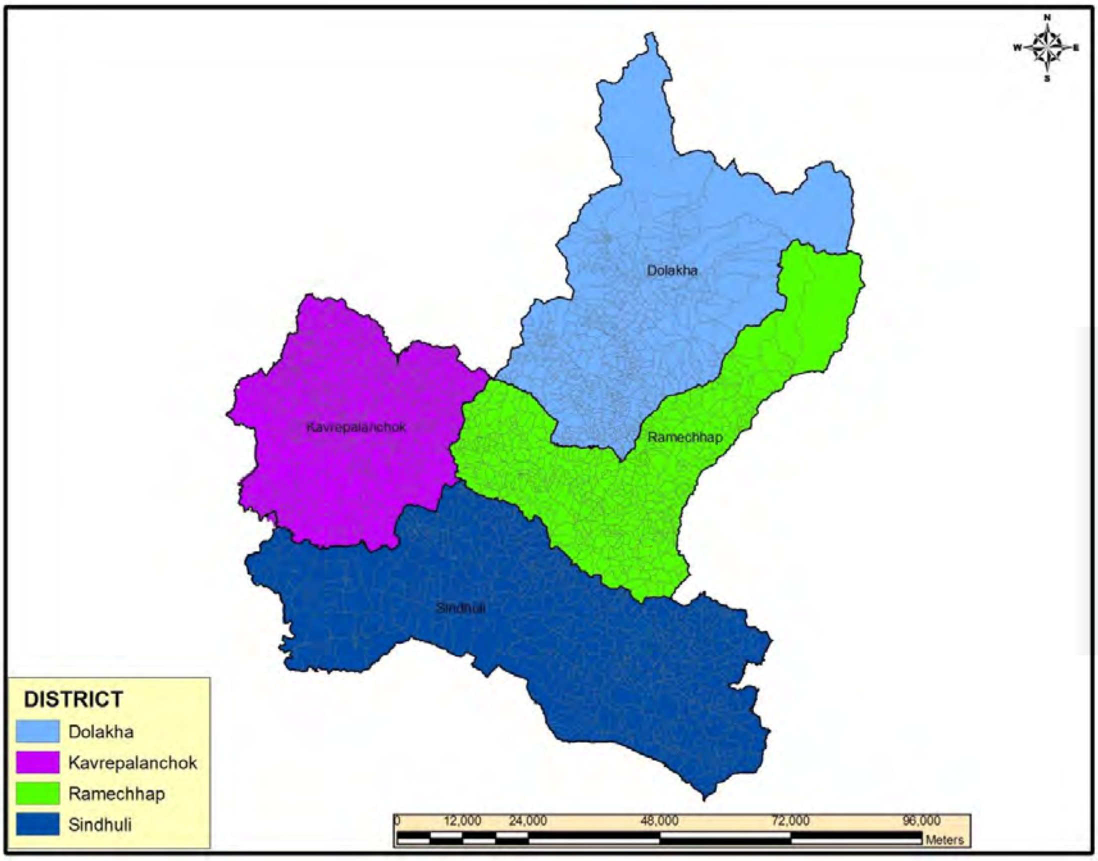
The third round zoning was conducted to identify agriculture pockets that are suitable for promoting different high value crops while considering accessibility situation (existing and future prospects), together with their basic agro-ecological characteristics such as climate, precipitation, altitude, soil texture, land capability etc. VDCs/municipalities and wards have been taken into analysis in order to better understand exiting status of agriculture commercialization in the intricate terrain of the study districts. GIS was applied for the third round zoning and Table 8 below presents the data used.

Table 8: Data used for Third Zoning

Parameters	Year	Data Sources
Administrative boundary with district, VDC/municipality & wards	1996	Department of Survey
Land use	1996	Department of Survey
Climatic region map	1996	Department of Survey (Computed based on altitude)
Precipitation map	2009	ICIMOD
Road network map (updated based on Google earth map & consultation with district stakeholders)	2012	Department of Road, District Development Committee (updated based on consultation with stakeholders)
River network map (Major rivers only)	1996	Department of Survey
Land capability classification	1986	Department of Survey
Land system map (Soil texture)	1986	Department of Survey

Spatial data was obtained from Department of Survey, District Development Committee and other stakeholders. Map 9 presents the administrative boundaries of the district.

Map 9: Administrative Border of the Study Districts



4.1 Methods Applied for the Third Zoning

Spatial and query based analysis was carried out for the third zoning. The study digitized the road network map (existing and future roads from the District Transport Master Plans - DTMPs of respective districts). Of the four districts, GIS-based digitized road network map was available only for Ramechhap while for other districts it was digitized based on geo-referencing. DTMP included the information of both existing and future roads as well as bridges.

Table 9: Key Features of DTMP

Districts	DTMP	Remark
Dolakha	• 1,009.04 km of roads network • Priority on improvement of road conditions • New construction of 91.8 km road • 50 VDCs (out of 51) and 1 municipality (out of 1) will have road access at the end of planning period • Total financial outlay of the plan is NRs 312.2 millions	Five years (2013-2017), updated on August, 2013
Kavre	• 1,723.7 km of roads network • Priority is on improvement of road conditions • New construction of 20.3 km road • 85 VDCs (out of 87) and 3 municipalities (out of 3) will have road access at the end of planning period • Total financial outlay of the plan is NRs 939.3 millions	Five years (2013-2017), updated on August, 2013
Ramechhap	• 1,187.6 km of roads network • Priority on improvement of road conditions • New construction of 69.5 km road • All 55 VDCs will have road access at the end of planning period • Total financial outlay of the plan is NRs 338.5 millions	Five years (2013-2017), updated on July, 2013
Sindhuli	• 1,123.9 km of roads network • Priority on improvement of road conditions • New construction of 160.2 km road • All 53 VDCs and 1 municipality will have road access at the end of planning period • Total financial outlay of the plan is NRs 197.0 millions	Five years (2013-2017), updated on July, 2013

The study first conducted the zoning of agriculture land considering land use, land capability and soil texture prior to the identification of the potential production pockets considering the accessibility situation.

Zoning of agriculture land: This aimed at identifying different agriculture production zones/pockets considering agro-ecological characteristics by VDCs/Wards. Different spatial data such as land use, climatic region, land capability and soil texture map were used. Following sequential steps were applied for the zoning of agriculture land.

Step I: Clip out of agriculture lands (Map 11) from land use map (Map 10).

Step II: Classify agriculture area into different climatic region (Map 13) by overlaying of agriculture lands map with climatic region map (Map 12).

Step III: Identify agriculture land suitable for cultivation based on land capability classes by overlaying Map 13 with land capability map (Map 14) and clipping out land capability class I, II & III to indentify agriculture area suitable for cultivation (Map 15 and 16).

Step IV: Identify the agriculture land suitable for cultivation based on soil texture by overlaying Map 16 with soil texture map (Map 17) and clipping out of agriculture lands having certain soil types suitable for cultivation (Map 18).

Step V: Overlay agriculture land map suitable for cultivation (Map 19) with administrative boundary (Map 9) and produce of new map (Map 20).

Identification of potential production pockets based on accessibility situation: This intends to identify the different production pockets for commercialization, based primarily on the accessibility situation.

***Step I*:** Buffering of 500 m on either side of existing and future road network development map (Map 22) based on existing and future road network development map (Map 21).

***Step II*:** Overlay of agriculture zone map (Map 20) with road network and buffer map (Map 22) and classify agricultural area considering accessibility situation (Map 23).

***Step III*:** Produce maps showing (a) accessible pockets (b) likely accessible pockets by district and climatic region (Map 25 to Map 34).

Limitations: Road network map was digitized based on geo-referencing technique from District Transport Master Plans (DTMPs). Therefore, few deviations might have occurred during digitization process. However, earlier road network map and validation with Google earth map was carried out to minimize such deviations as much as possible. Apart from this, 500 m buffer from either side of road was carried out to identify agriculture area based on accessibility situation. Hence, this will not affect much study findings.

4.2 Zoning of Agriculture Lands

Spatial analysis was conducted for zoning of agriculture lands. Spatial data was obtained from Department of Survey. Step wise methodology and outputs of each step are discussed in the following.

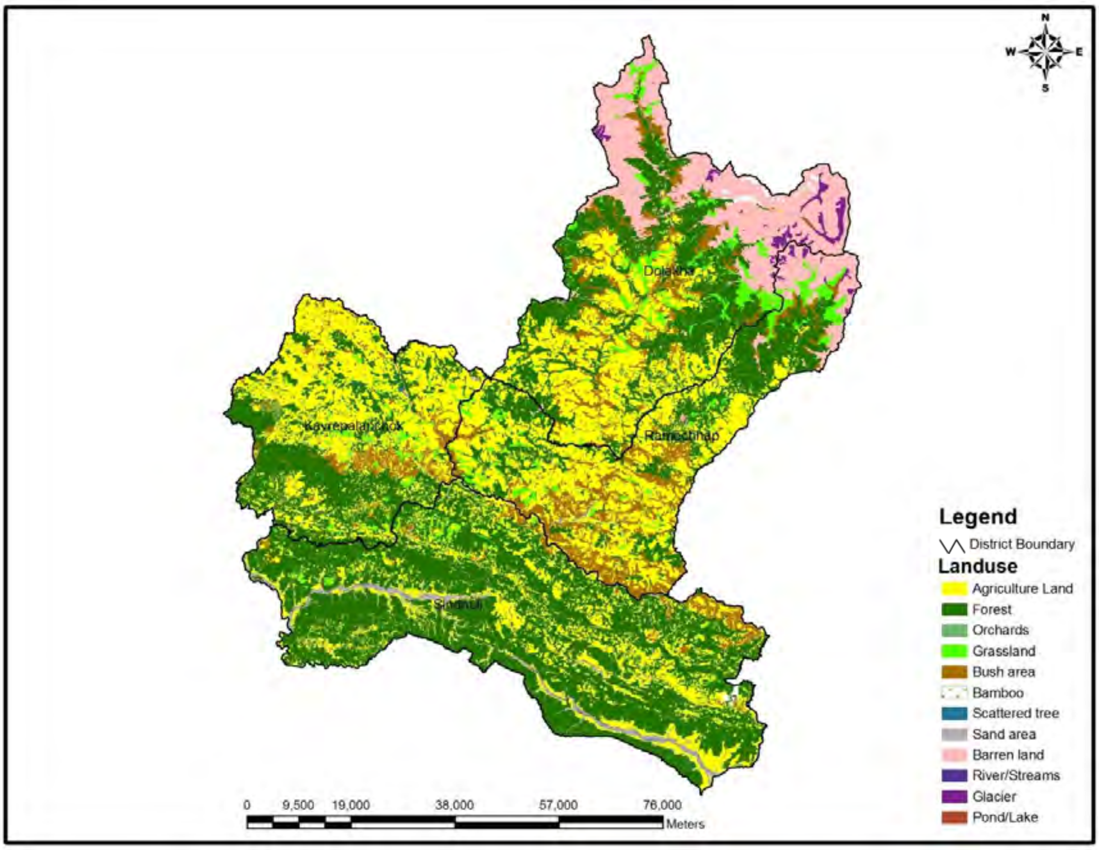
(1) Step I: Clipping Out of Agriculture Lands from Land Use Map

The land use map 1996 of Department of Survey (Map 10) is the only latest official land use map available in Nepal. With the help of GIS tools, agriculture area (cultivated area) of the study districts was clipped out for further analysis. Map 11 presents agriculture area. Total agriculture land of study districts is 234,688 ha, varying from 65,774 ha in Kavre to 51,716 ha in Dolakha. Table 10 presents the agriculture lands of the study districts (VDCs specific data on Annex 1).

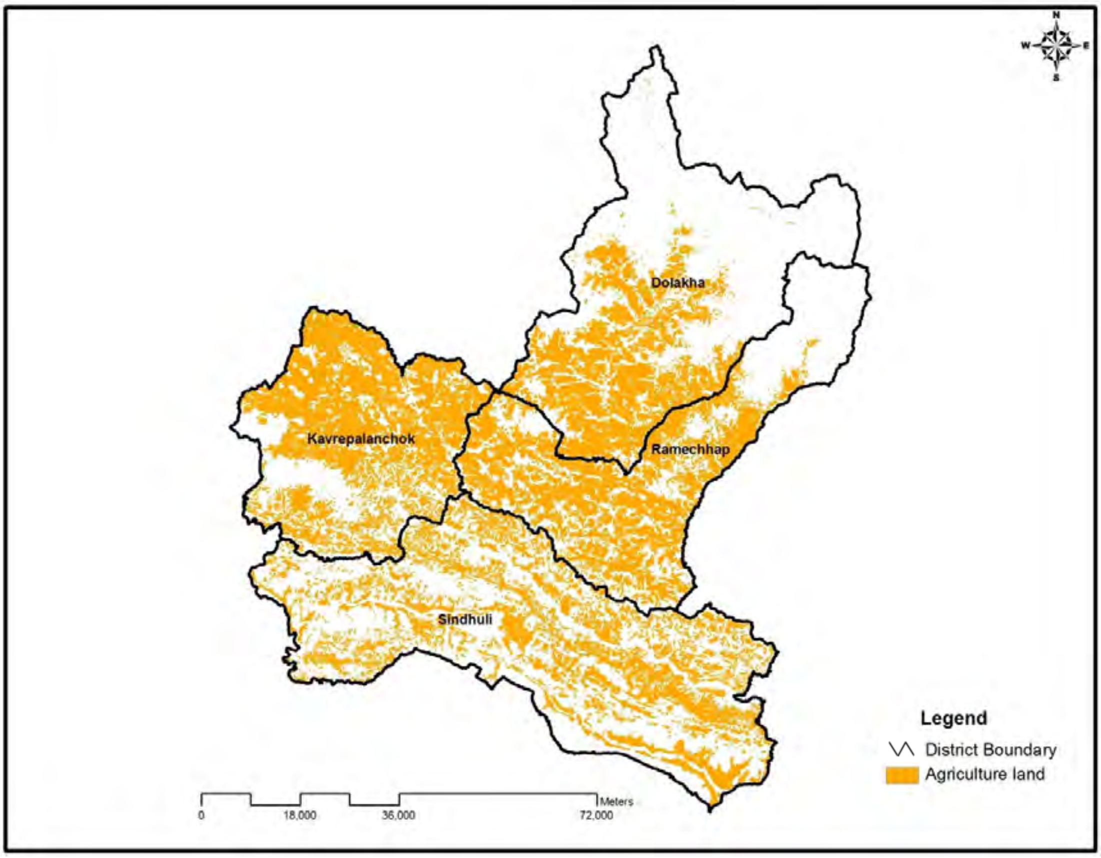
Table 10: Agricultural Land Area in SRC Districts

District	Total Area (ha)	Agricultural area (ha)	Ratio of Agriculture area to total area (%)
Kavre	139,012	65,774	47.3
Dolakha	214,698	51,716	24.1
Rammechap	156,510	58,857	37.6
Sindhuli	248,077	58,341	23.5
Total	**758,298**	**234,688**	**30.9**

Map 10: Land Use Map of the Study Districts



Map 11: Agriculture Lands in SRC Districts



(2) Step II: Classification of Agriculture Area by Climatic Regions

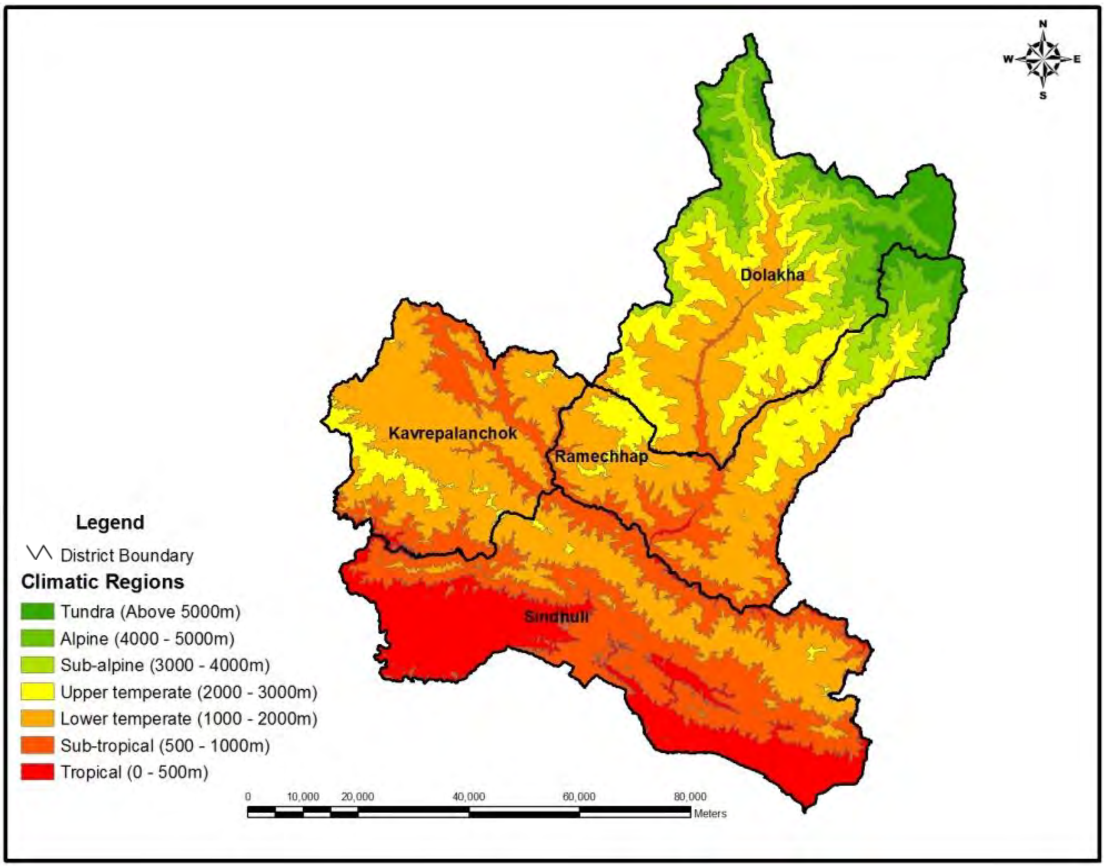
Wide altitudinal variations and diverse climatic conditions resulted into seven climatic regions in the study districts. Table 11 presents the definition of climatic region and zones whereas Map 12 shows the different climatic regions.

Table 11: Definition of Climatic Regions

Climatic region	Elevation (m)	Zone
Tundra	Above 5,000	High Himal
Alpine	4,000 – 5,000	High Mountains
Sub- Alpine	3,000 – 4,000	
Upper temperate	2,000 – 3,000	Upper Mid Hills
Lower temperate	1,000 – 2,000	Lower Mid hills
Subtropical	500 – 1,000	Low Lands
Tropical	Below 500	

Source: LRMP, 1986

Map 12: Climatic Regions in the Study Districts



Agriculture area map (Map 11) is overlaid with the climatic region map (Map 12) and spatial analysis was carried out in order to classify cultivation areas by different climatic regions. Of the total agriculture area in SRC districts, more than half of the agriculture area falls under lower temperate region (57.4%), followed by sub-tropical (21.1%) and upper temperate (12.1%). Map 13 presents the cultivation area by climatic region. Table 12 presents the cultivation area by districts (VDCs wise information in Annex 2).

Map 13: Agricultural Lands in SRC Districts by Climatic Regions

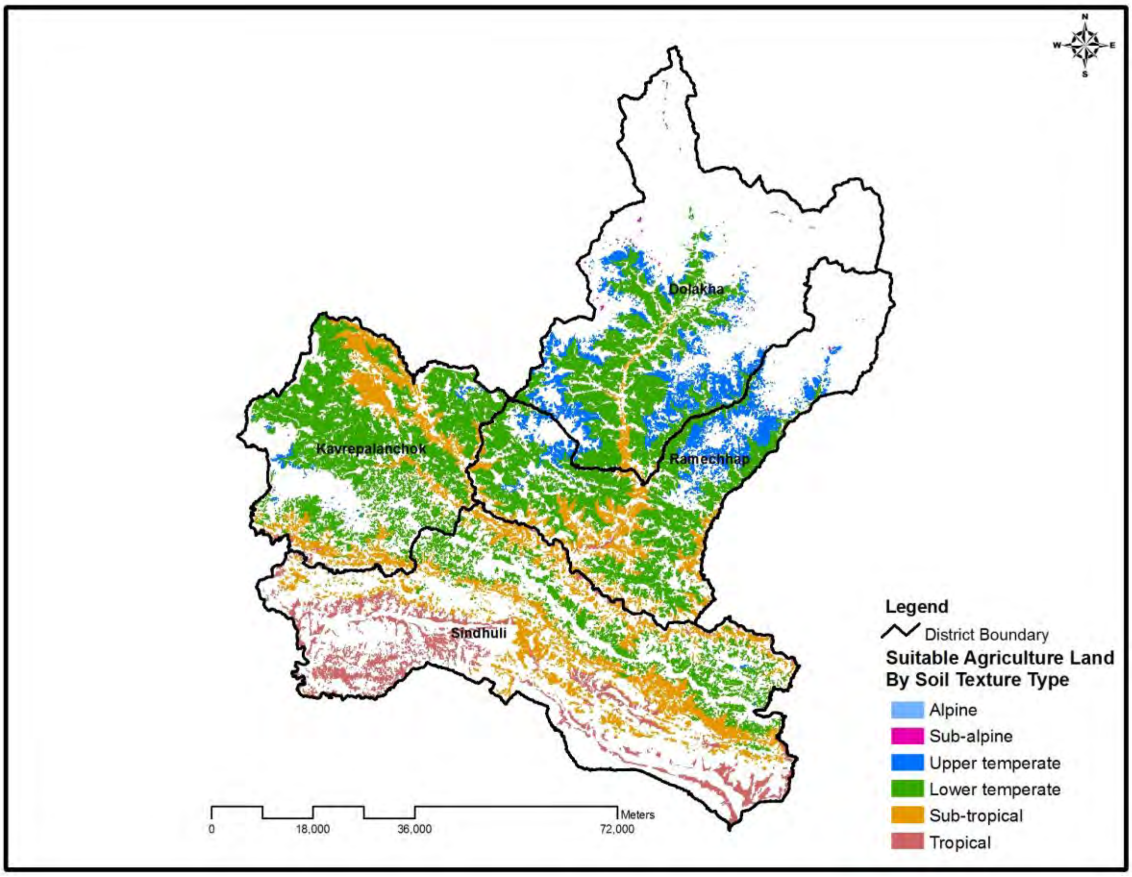


Table 12: Agriculture Lands in SRC Districts by Climatic Regions (ha)

Climatic region	Kavre	Dolakha	Ramechhap	Sindhuli	Total	% of Total
Alpine		31			31	0.01
Sub-alpine		172	40		212	0.09
Upper temperate	992	16,708	10,573	75	28,347	12.08
Lower temperate	49,302	33,292	37,505	14,700	134,799	57.44
Sub-tropical	15,087	1,513	10,358	22,616	49,575	21.12
Tropical	393		381	20,950	21,724	9.26
Total	**65,774**	**51,716**	**58,857**	**58,341**	**234,688**	**100.00**

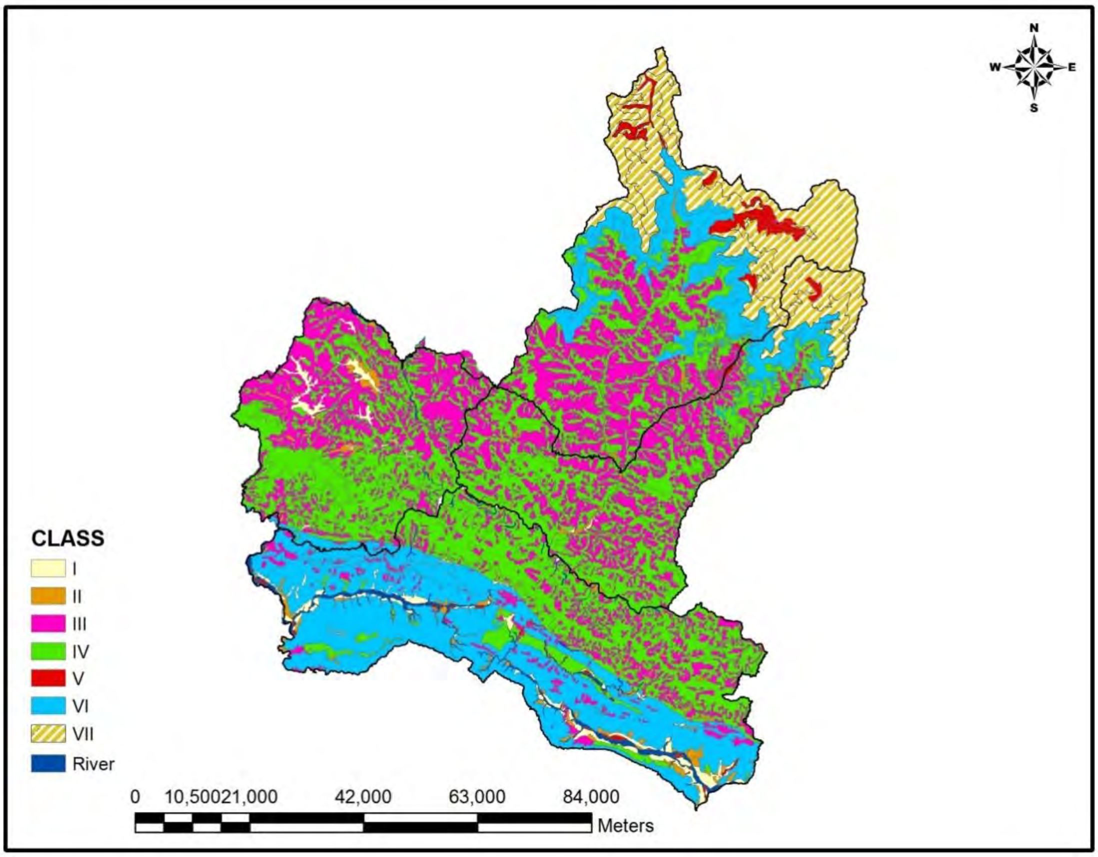
(3) Step III: Identify Agriculture Lands by Climatic Region Suitable for Cultivation based on Land Capability Condition

Land capability is defined as the inherent capacity of land to be productive under sustained use and specific management methods. Table 13 presents the descriptions of different land capability classes. According to the land capability classification, lands up to capability class III are suitable for agriculture cultivation with small improvements on land management practices while the rest is unsuitable for agricultural use. Map 14 presents land capability map of the study districts.

Table 13: Land Capability Classification of Study Area

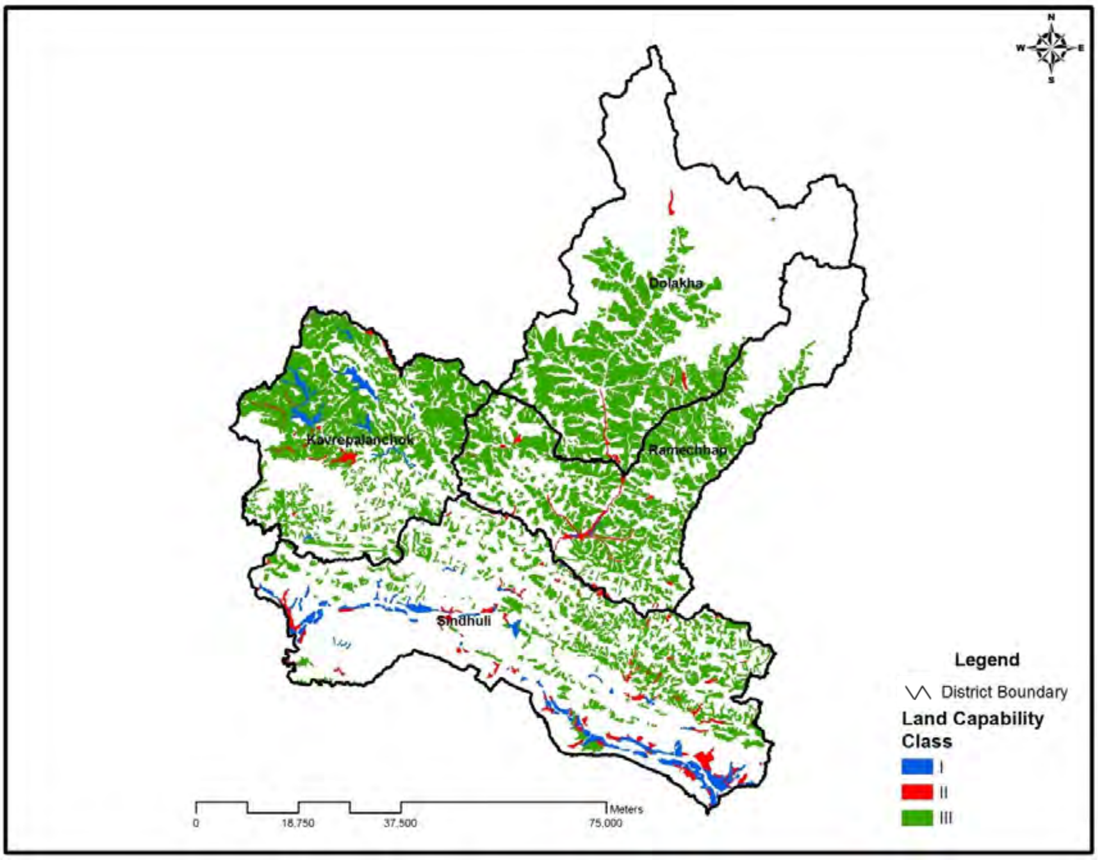
Capability Classes	Details	Area (Ha)	Percent
I	Lands are nearly level (slopes <1^{o}) and soils are deep. There are few limitations for arable agriculture or forestry.	13,649	1.8
II	Lands are gently sloping (slopes 1-5 ^{o}) and soils are deep and well drained. Terracing or contouring is necessary to control erosion when used for arable agriculture, and maintenance of ground cover is required for sustained forestry-related usage.	12,133	1.6
III	Lands are moderately to strongly sloping (slopes 5-30 ^{o}) and soils are 50 to 100 cm deep and well drained. There are few limitations to traditional forest use provided adequate ground cover is maintained. Terracing is mandatory to control erosion when used for arable agriculture. Under the existing agricultural system, a large portion of class III land is required for fodder production and grazing in order to maintain the productivity of the cultivated lands.	1,92,608	25.4
IV	Lands are either too steep to be terraced and cultivated (>30 ^{o} slope), or lie above the altitudinal limit of arable agriculture. Soils are more than 20 cm deep and well to imperfectly drain. These lands are suitable for fuel wood, fodder and timber production provided a good, permanent vegetative cover is maintained to minimize erosion.	2,72,229	35.9
V	Soils are more than 20 cm deep and slopes are less than 30 ^{o} and lands which are alpine (above tree line), or are river terraces that are frequently flooded. These lands will not support tree grown but have few limitations when used for fodder collection or grazing.	10,616	1.4
VI	This land includes areas with slopes of 40 to 50^{0}, or gentler slopes with soils less than 20cm deep. These lands are considered fragile because of extreme erosion hazard and/ or poor regeneration potential.	1,61,517	21.3
VII	This class consists of rock and ice.	82,654	10.9
River Area		12,891	1.7
Total		**758,298**	**100.0**

Map 14: Land Capbility Classes of Study Districts



Land capability classes up to III are considered suitable for cultivation. Hence the study clipped out land capability classes up to III from land capability Map (Map 14). Map 15 shows the area suitable for cultivation according to the land capability classes. This does not mean that all areas suitable for cultivation are cultivated. Different land use may exist within these land capability classes.

Map 15: Lands Suitable for Cultivation According to Land Capability Classes

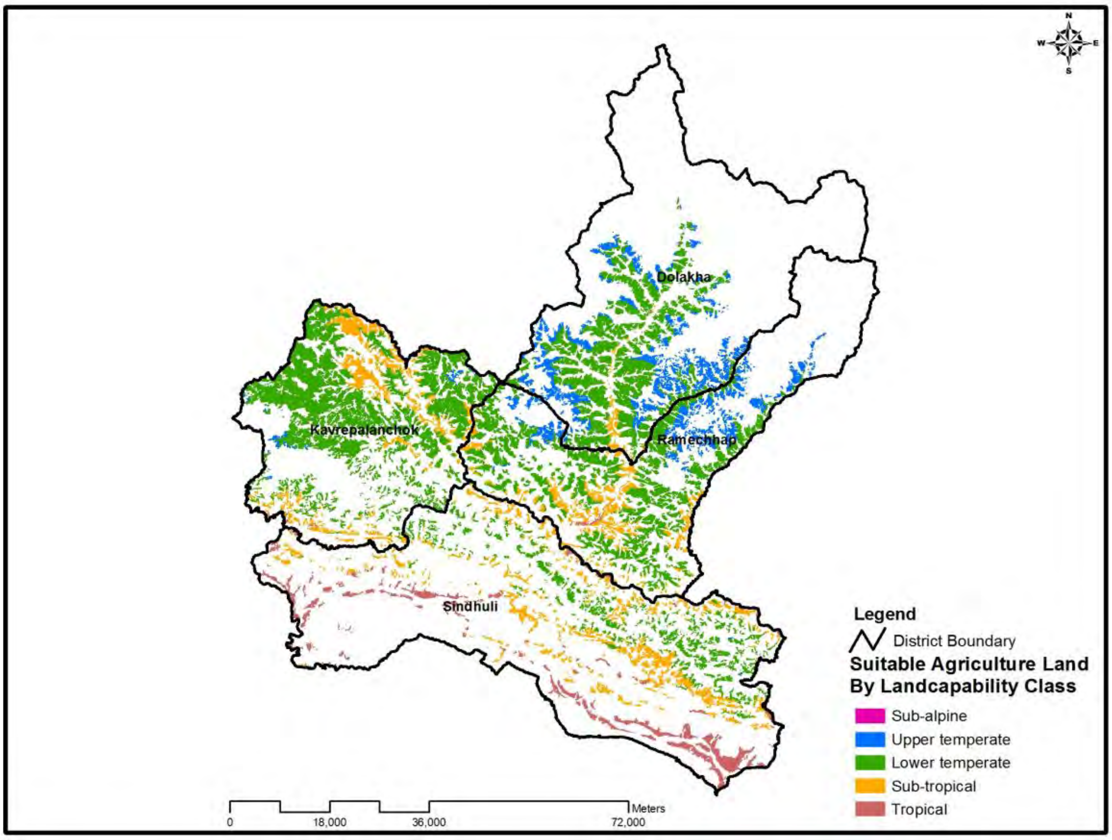


Agriculture map by climatic region (Map 13) was overlaid with area suitable for cultivation according to land capability condition (Map 15). Land capability up to class three was considered suitable for cultivation whereas the rests are considered unsuitable. Spatial analysis was carried out to clip out agriculture area suitable for cultivation according to land capability. Table 14 and Map 16 presents the agriculture area suitable for cultivation based on land capability for cultivation by districts (VDC wise information in Annex 3).

Table 14: Agriculture Lands Suitable for Cultivation based on Land Capability Classes

District	Agricultural area (ha)	Area suitable for cultivation (ha) based on land capability	Ratio of suitable area to total agricultural area (%)
Kavre	65,774	45,073	68.5
Dolakha	51,716	36,634	70.8
Ramechhap	58,857	36,772	62.5
Sindhuli	58,341	26,930	46.2
Total	**234,688**	**145,410**	**62.0**

Map 16: Lands Suitable for Cultivation based on Land Capability Class with Climatic Regions



(4) Step IV: Identify Agriculture Lands by Climatic Region Suitable for Cultivation based on Land Capability Condition and Soil Texture

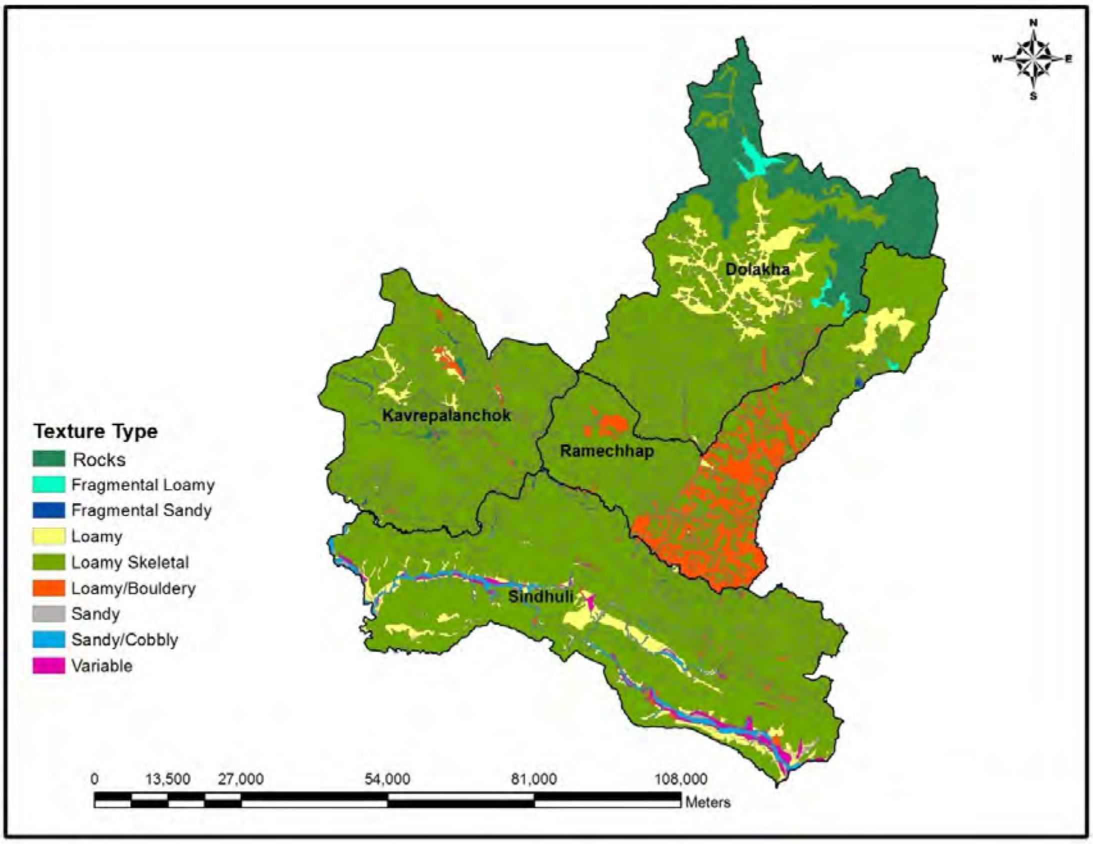
Soil texture indicates relative content of particles of various sizes, such as sand, silt and clay in the soil. Table 15 and Map 17 present the soil texture of the study districts. Loamy skeletal dominates soil texture on study districts followed by rocks, loamy and loamy boulder.

Table 15: Soil Texture Composition in the Study Area

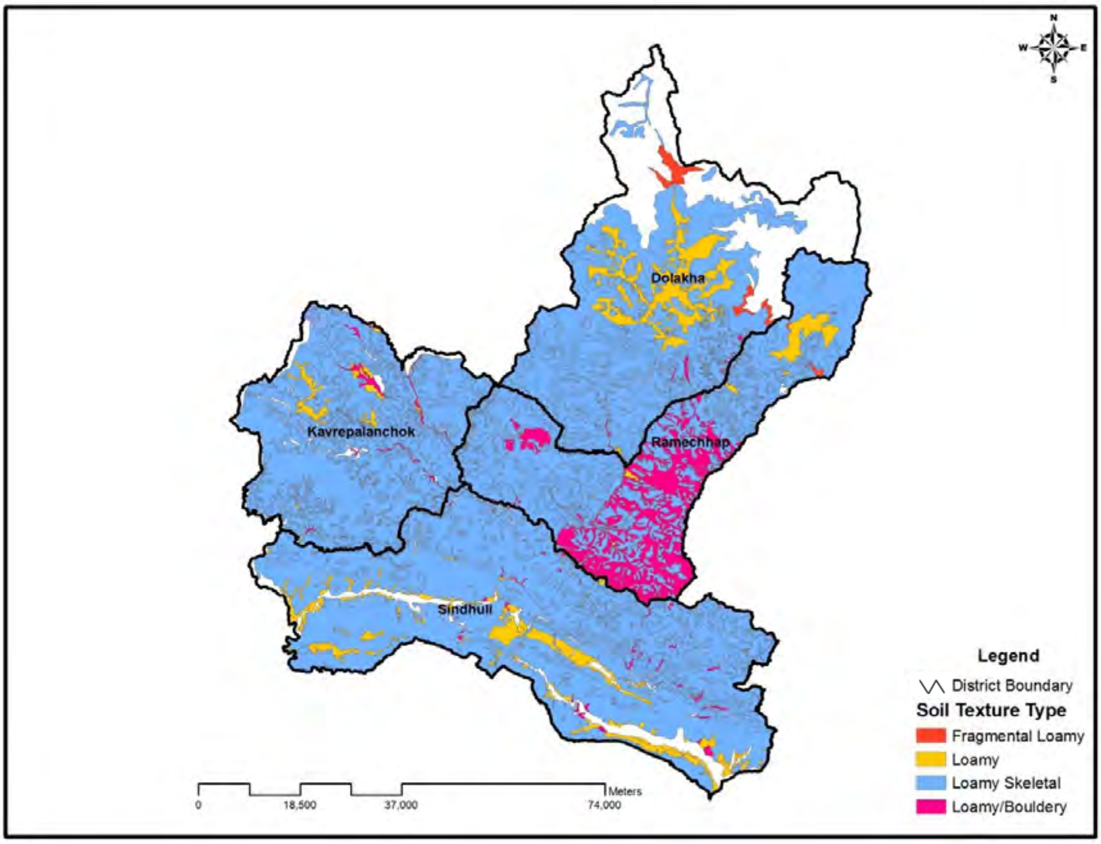
Soil texture	Area (ha)	Percent (%)	Suitability
Fragmental Loamy	3,791	0.5	Yes
Loamy	44,740	5.9	Yes
Loamy Skeletal	583,131	76.9	Yes
Loamy/Boulder	41,706	5.5	Yes
Fragmental Sandy	3,033	0.4	No
Sandy	1,517	0.2	No
Sandy/Cobbly	8,341	1.1	No
Variables	5,308	0.7	No
Rocks	66,730	8.8	No
Total	**758,298**	**100.0**	

Of the different soil texture, soil texture up to Fragmental Loamy, Fragmental Sandy, Loamy, Loamy Skeletal, and Loamy Boulder are considered suitable for cultivation of agricultural crops while the rest are considered as unsuitable. Hence the study clipped out soil texture from fragmental loamy to loamy boulder from soil texture map (Map 17). Map 18 shows the area suitable for cultivation, according to the soil texture.

Map 17: Soil Texture Map of the Study Area



Map 18: Lands Suitable for Cultivation According to the Soil Texture

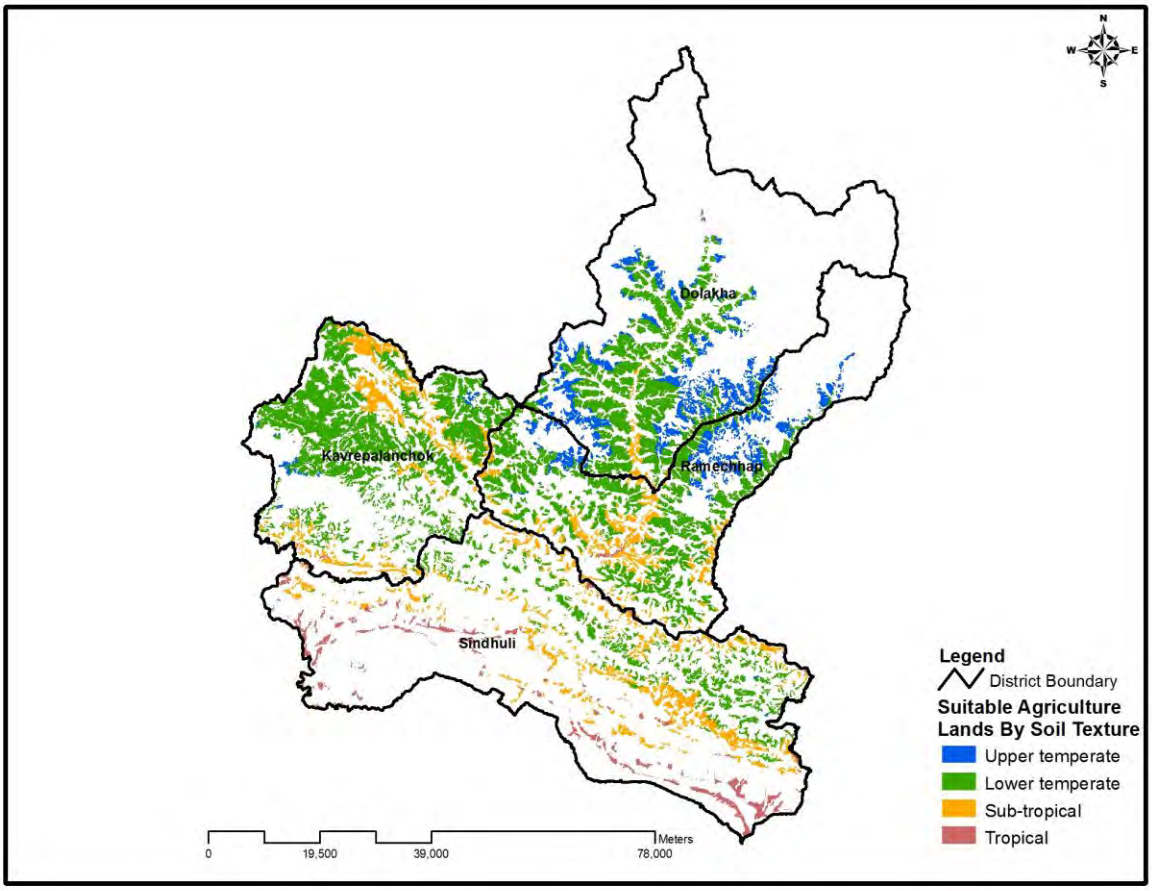


Agriculture area suitable for cultivation by land capability class (Map 16) was further overlaid with the lands suitable for cultivation according to the soil texture (Map 18). Spatial analysis was carried out to clip out agriculture area suitable for cultivation according to soil texture. Table 16 and Map 19 presents the agriculture lands suitable for cultivation based on land capability for cultivation and soil texture by districts (VDC wise information on Annex 4). As it can be seen in Table 16 and Map 19, the difference between before and after the clipping out of areas with unsuitable soil texture is insignificant.

Table 16: Agriculture Lands Suitable for Cultivation based on Land Capability Classes and Soil Texture

District	Area suitable for cultivation (ha) based on land capability	Area suitable for cultivation (ha) based on soil texture land capability	Ratio of suitable area to agricultural area (%) based on land capability
Dolakha	36,634	36,571	99.8
Kavre	45,073	42,211	93.7
Ramechhap	36,772	36,463	99.2
Sindhuli	26,930	23,395	86.9
Total	**145,410**	**138,640**	**95.3**

Map 19: Agriculture Lands Suitable for Cultivation based on Land Capability for Cultivation and Soil Texture



(5) Step V: Overlay Agriculture Zone Map (Map 19) with Administration Border Map

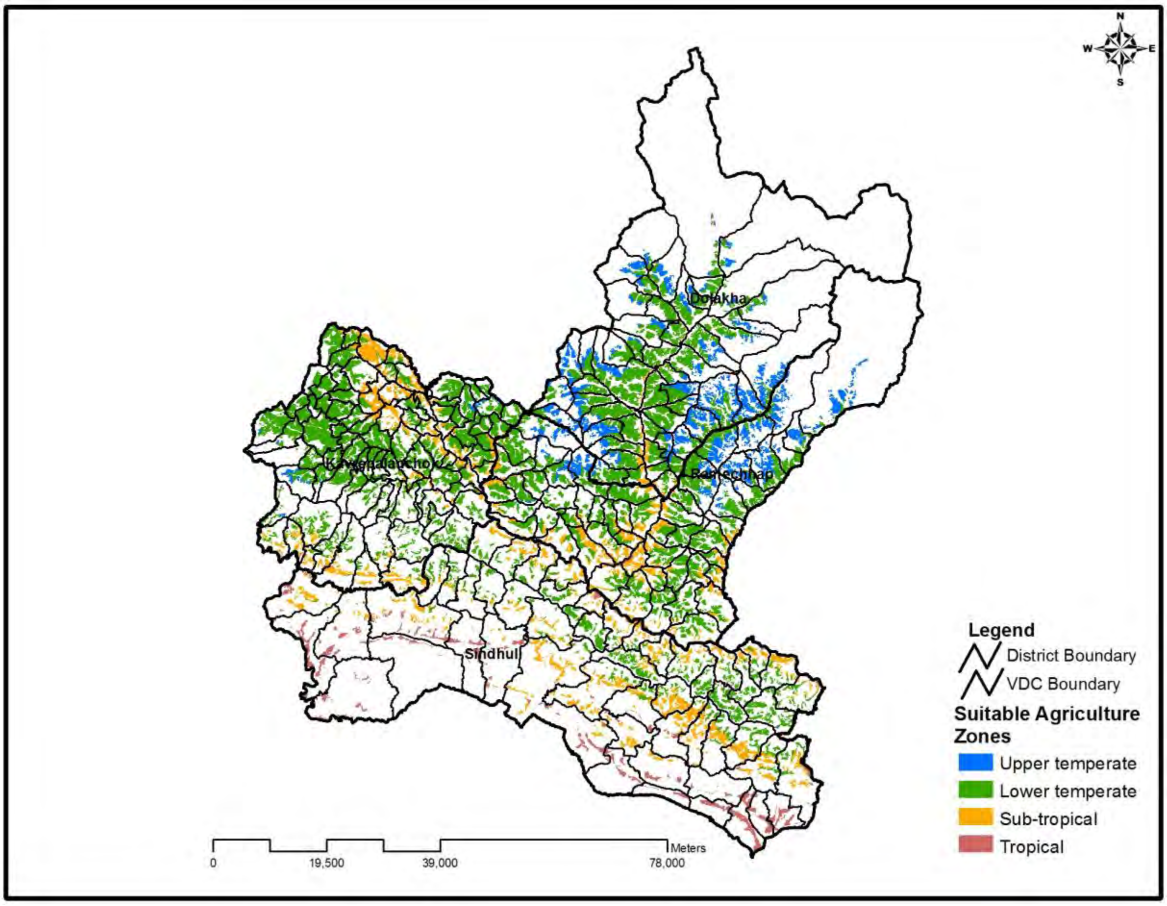
Map 10 was further overlaid with the administration border map (Map 1) to identify agriculture zones belonging to different climatic region by wards and VDCs.

Total agriculture land suitable for cultivation in the study area is 138,640 ha varying from 23,395 ha in Ramechhap to 42,211 ha in Kavre. Of the total agriculture lands suitable for cultivation based on land capability and climatic region, large proportion of agriculture lands falls under lower temperate region (65%), followed by sub-tropical (16.9%) and upper temperate (13.5%). Map 20 presents the agricultural lands suitable for cultivation by climatic region and administrative boundaries. Table 17 presents the cultivation area by districts (VDCs wise information in Annex 5).

Table 17: Agriculture Lands Suitable for Cultivation (ha) by Climatic Region

Climatic region	Kavre	Dolakha	Ramechhap	Sindhuli	Total	% of total land
Upper temperate	662	11,789	6,278	35	18,764	13.5
Lower temperate	33,720	24,038	24,304	8,082	90,145	65.0
Sub-tropical	7,758	744	5,601	9,373	23,475	16.9
Tropical	71	-	280	5,905	6,256	4.5
Total	**42,211**	**36,571**	**36,463**	**23,395**	**138,640**	**100.0**

Map 20: Agriculture Lands Suitable for Cultivation by Climatic Region and VDCs



4.3 Zoning for the Identification of Potential Production Pockets

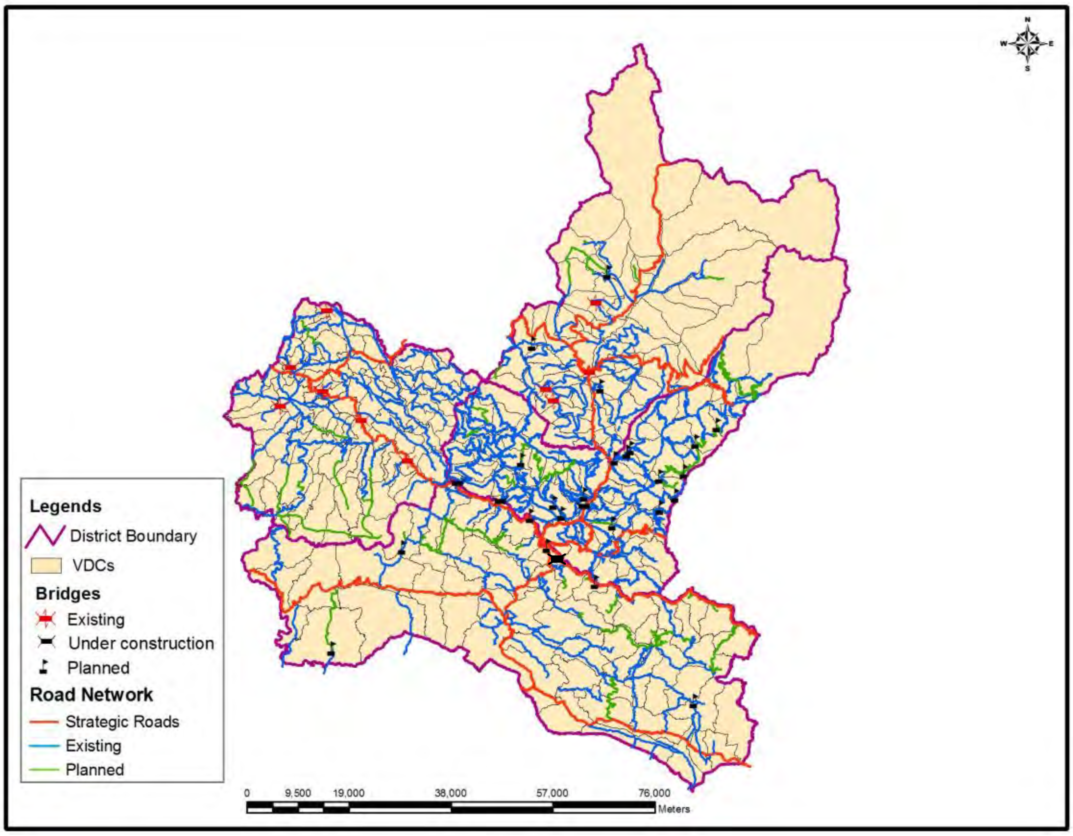
Spatial analysis was conducted for the identification of potential production pockets. Spatial data was obtained from Department of Survey and also digitized from DTMPs of respective districts. Step wise methodology and outcomes of each step are discussed in next section.

(1) Step I: Buffering of 500m on Either Side of Existing and Future Road Networks

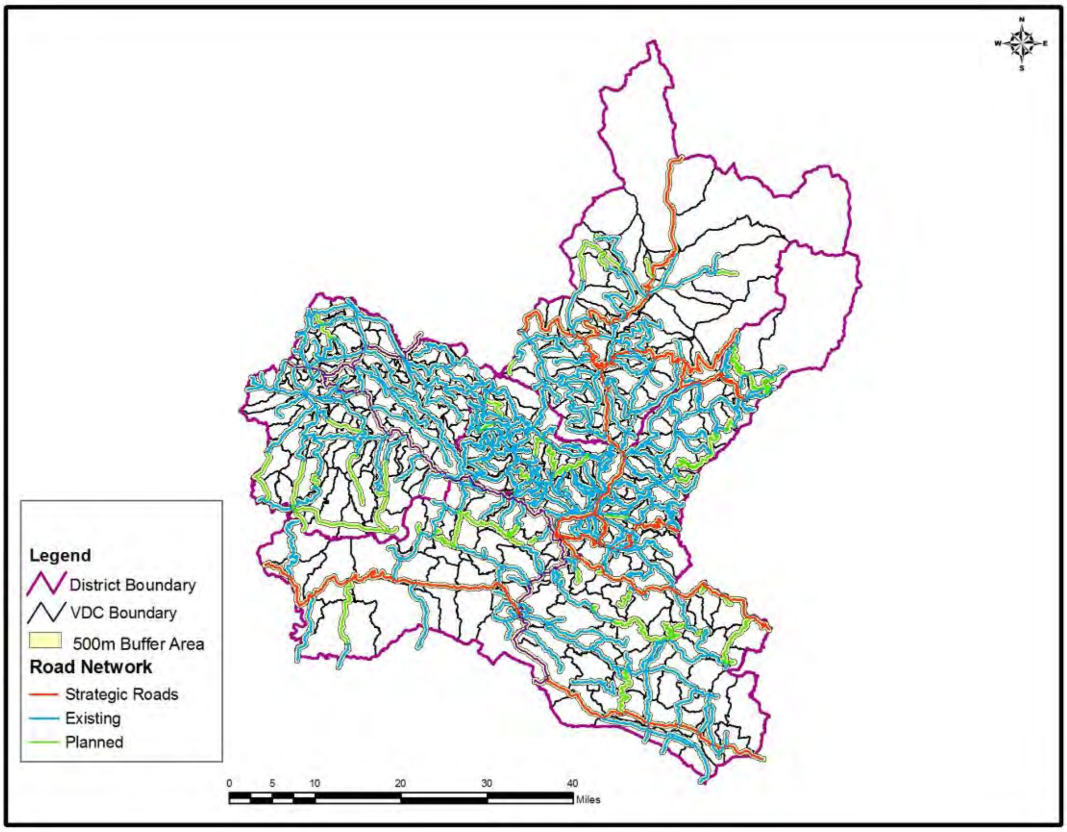
The latest road network maps (existing and future status) were digitized from DTMPs of each district. Map 21 presents the district road network map of the study districts. This map shows both existing strategic road and local road networks.

After the preparation of the road network map, buffering of 500m on either side of the roads was carried out, in order to indentify the impact zone of accessibility improvements for the agricultural commercialization. Map 22 presents the road network map with 500 m buffer area on either side of the roads.

Map 21: Existing and Future Road Network with Bridges



Map 22: Exiting and Future Road Network with 500m Buffer Area on Either Side of the Road



(2) Step II: Classify Agriculture Lands Considering the Accessibility Situation

The road network buffer map (Map 22) was overlaid with the agriculture production zone map (Map 20). The spatial analysis was carried out and agriculture land was further classified into three categories considering accessibility situation. The accessibility situation has taken into consideration of the bridges as well as roads which are being constructed along the Sindhuli road corridor.

- ***Accessible agriculture pockets:*** This includes those agriculture lands connected within 500m buffer from either side of the existing road. This excludes those agriculture lands lying beyond 500m buffer of road even if the area formed a contiguous cluster with accessible pockets.
- ***Likely accessible agriculture pockets:*** This includes those agriculture lands within 500m buffer from either side of planned road where there is no road connection at present but likelihoods of construction of road in near future. This excludes those agriculture lands lying beyond 500m buffer of road even if the area formed a contiguous cluster with likely accessible pockets.
- ***Inaccessible agriculture area:*** This includes those agriculture lands beyond 500m of buffer from either side of road. The study considered them as inaccessible pockets since there is no road or other means of accessibility at present. Likewise, these areas have no prospects of road construction within next five years according to District Transport Master Plans.

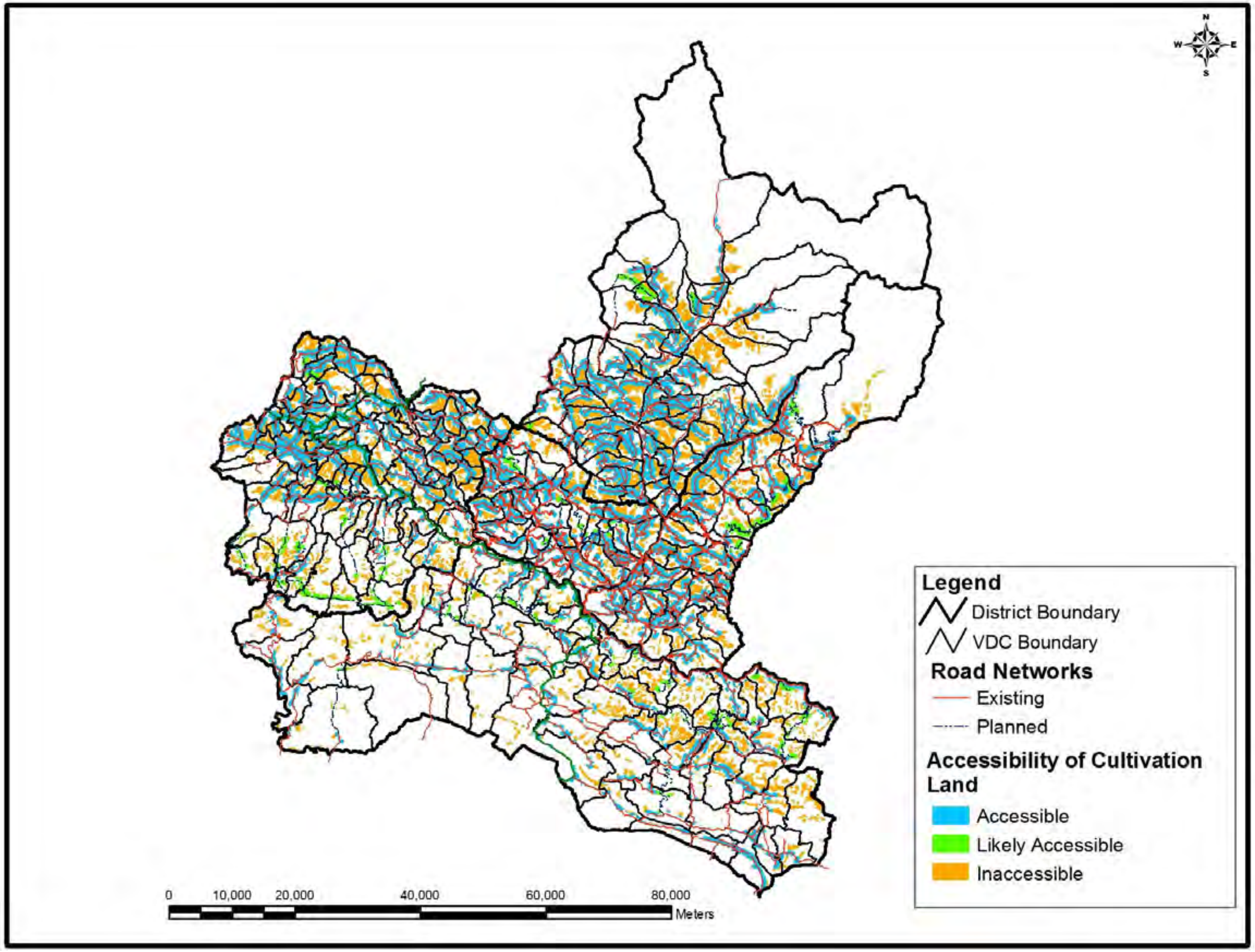
Map 23 and Table 18 below show accessibility of agriculture lands suitable for cultivation. Of the total agricultural lands suitable for cultivation in the study districts, 75,371ha (54.4 %) are accessible, 4,677ha (3.4%) are likely accessible and 58,592ha (42.3%) are inaccessible. Nearly half of the cultivation land is accessible in all the districts varying from 40.8% in Sindhuli to 66.1% in Ramechhap. Inaccessible area is relatively high in Sindhuli followed by Kavre and Dolakha. Annex 6 presents accessible situation by VDCs.

Table 18: Accessibility Situation of Agriculture Lands in the Study Districts

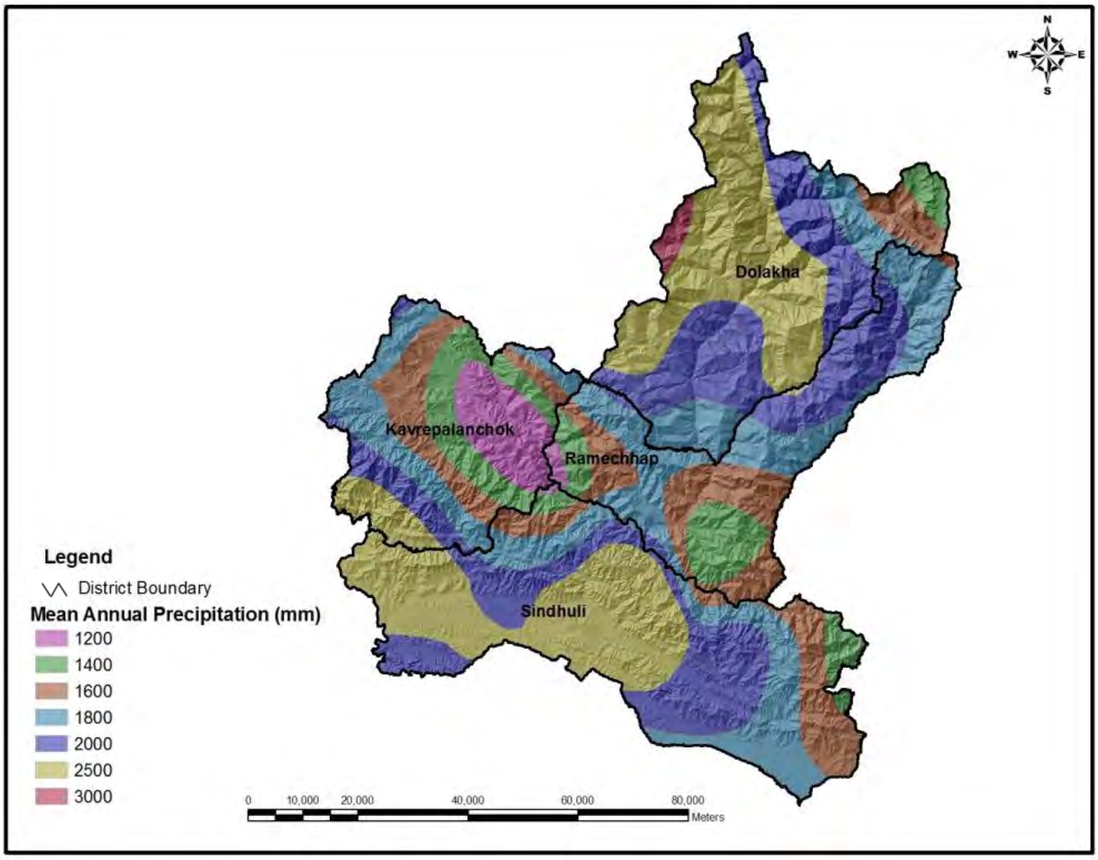
District	Accessible agriculture area		Likely accessible agriculture area		Inaccessible agriculture area		Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Kavre	21,906	51.9	1,433	3.4	18,872	44.7	**42,211**	100.0
Dolakha	19,835	54.2	668	1.8	16,068	43.9	**36,571**	100.0
Ramechhap	24,095	66.1	1,398	3.8	10,970	30.1	**36,463**	100.0
Sindhuli	9,535	40.8	1,178	5.0	12,682	54.2	**23,395**	100.0
Total	**75,371**	**54.4**	**4,677**	**3.4**	**58,592**	**42.3**	**138,640**	**100.0**

Map 24 presents the precipitation distribution of the study districts. This is the only available data for precipitation but its accuracy is considered low. Therefore, this map should be regarded just as referential data. Water availability rely very much on the existence of perennial water sources and their volumes, thus this aspect needs to be checked on the ground for each pockets.

Map 23: Accessibility Situation of Agricultural Lands Suitable for Cultivation



Map 24: Precipitation Distribution of the Study Districts



(3) Step III: Classification of Accessibility by Climatic Regions

The map obtained from step II (Map 23) was further classified based on climatic regions. Table 19 presents accessible and likely accessible cultivation area by climatic regions. Majority of the accessible pockets fall under lower temperate region (50,221 ha) followed by sub-tropical (12,225 ha) and upper temperate region (9,008 ha).

Table 19: Accessibility Situation of Agricultural Area by Climatic Region

		Accessible agriculture area		Likely accessible agriculture area		Inaccessible agriculture area		Total	
		Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Upper temperate (2,000 – 3,000m)	Area (ha)	9,008	48	543	2.9	9,213	49.1	**18,764**	**100**
	%	12		11.6		15.7		**13.6**	
Lower temperate (1,000 – 2,000m)	Area (ha)	50,221	55.7	3,172	3.5	36,751	40.8	**90,145**	**100**
	%	66.6		67.8		62.7		**65**	
Sub-tropical (500 – 1,000m)	Area (ha)	12,225	52.1	887	3.8	10,363	44.1	**23,475**	**100**
	%	16.2		19		17.7		**16.9**	
Tropical (0 - 500m)	Area (ha)	3,917	62.6	74	1.2	2,265	36.2	**6,256**	**100**
	%	5.2		1.6		3.9		**4.5**	
Total	Area (ha)	**75,371**	**54.4**	**4,677**	**3.4**	**58,592**	**42.2**	**138,640**	**100**
	%	**100**		**100**		**100**		**100**	

Table 20 presents district specific situation by accessible agricultural lands and climatic region whereas Annex 7 presents VDC level information by accessible and likely accessible area by climatic region. Map 25 and Map 26 presents accessible and likely accessible agricultural lands suitable for cultivation by climatic regions and districts.

Table 20: Accessible and Likely Accessible Agriculture Lands by Climatic Regions

District	Climatic region	Accessible agriculture area, ha	Likely accessible agriculture area, ha
Dolakha	Upper temperate*(2,000 – 3,000m)*	5,720	355
	Lower temperate *(1,000 – 2,000m)*	13,662	313
	Sub-tropical *(500 – 1,000m)*	454	-
	Tropical *(0 - 500m)*	-	-
	Sub-total	**19,835**	**668**
Kavre	Upper temperate*(2,000 – 3,000m)*	369	5
	Lower temperate *(1,000 – 2,000m)*	17,617	795
	Sub-tropical *(500 – 1,000m)*	3,893	607
	Tropical *(0 - 500m)*	26	27
	Sub-total	**21,906**	**1,433**
Ramechhap	Upper temperate*(2,000 – 3,000m)*	2,901	183
	Lower temperate *(1,000 – 2,000m)*	16,949	1,207
	Sub-tropical *(500 – 1,000m)*	3,981	7
	Tropical *(0 - 500m)*	265	-
	Sub-total	**24,095**	**1,398**
Sindhuli	Upper temperate*(2,000 – 3,000m)*	18	0
	Lower temperate *(1,000 – 2,000m)*	1,994	857
	Sub-tropical *(500 – 1,000m)*	3,897	273
	Tropical *(0 - 500m)*	3,626	48
	Sub-total	**9,535**	**1,178**
Total		**75,371**	**4,677**

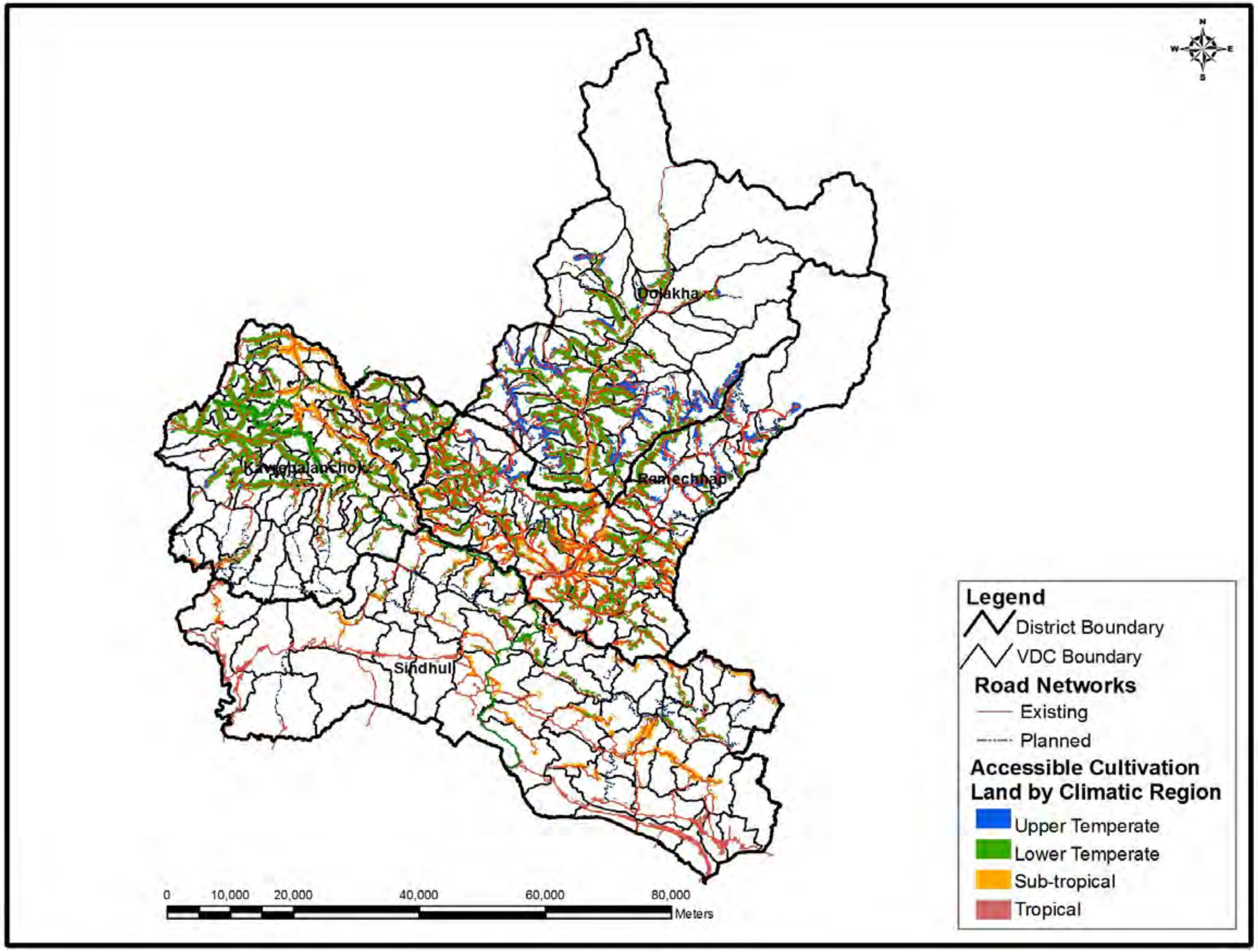
Likewise, following map shows accessible agriculture lands by study districts and VDCs and climatic region.

- Map 27: Accessible agricultural land suitable for cultivation in Kavre district by climatic region
- Map 28: Accessible agricultural land suitable for cultivation in Dolakha district by climatic region
- Map 29: Accessible agricultural land suitable for cultivation in Ramechhap district by climatic region
- Map 30: Accessible agricultural land suitable for cultivation in Sindhuli district by climatic region

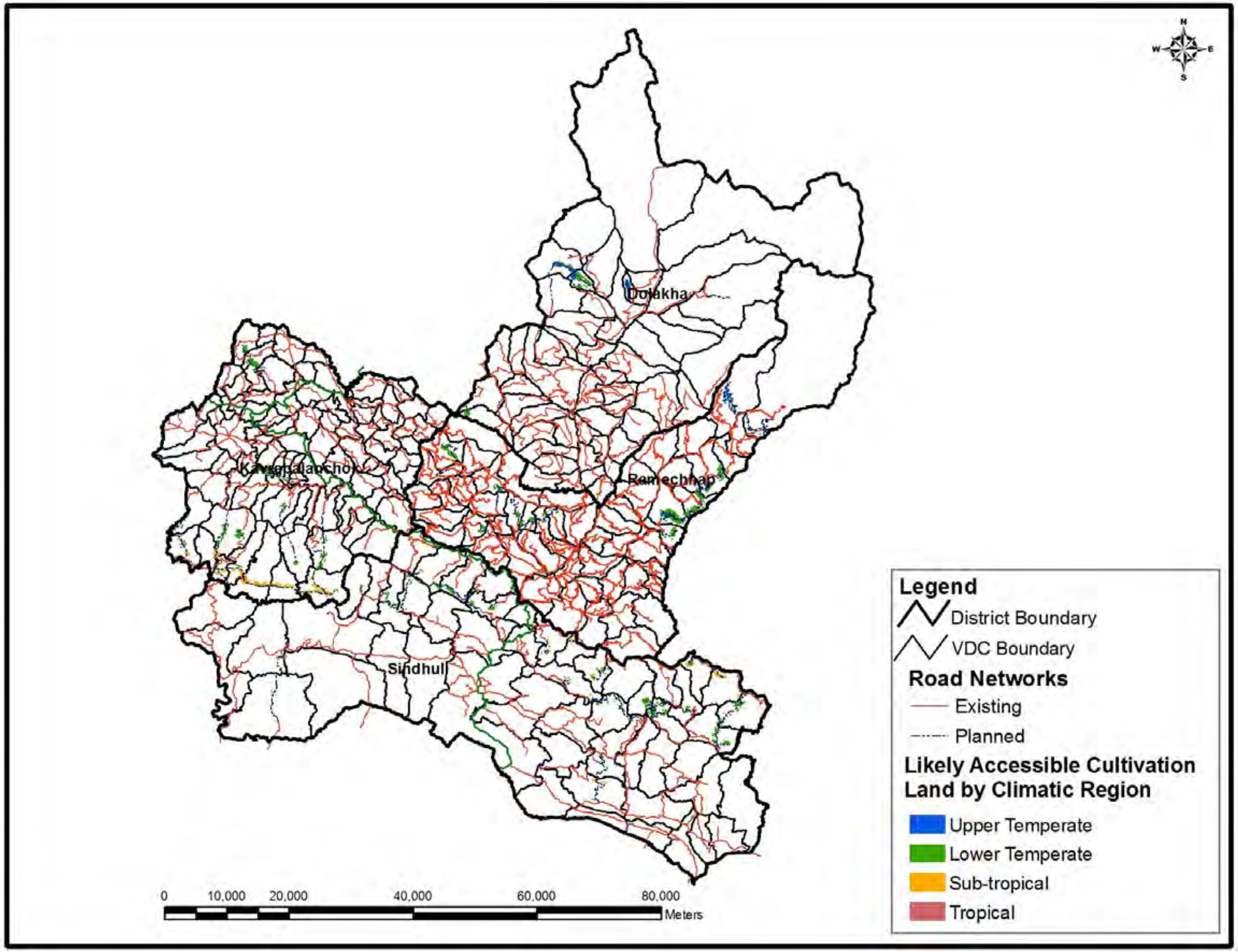
Following map shows likely accessible agriculture area by study districts and VDCs and climatic region.

- Map 31: Likely accessible agricultural land suitable for cultivation in Kavre district by climatic region
- Map 32: Likely accessible agricultural land suitable for cultivation in Dolakha district by climatic region
- Map 33: Likely accessible agricultural land suitable for cultivation in Ramechhap district by climatic region
- Map 34: Likely accessible agricultural land suitable for cultivation in Sindhuli district by climatic region

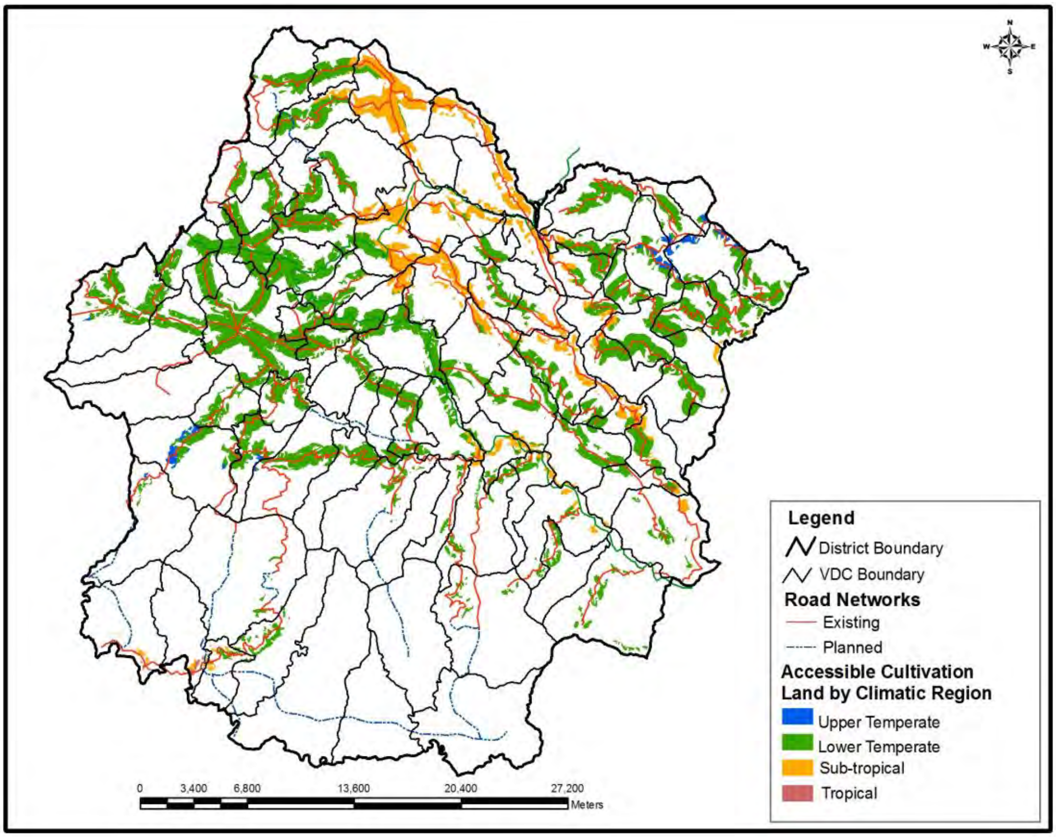
Map 25: Accessible Agricultural Lands Suitable for Cultivation by Climatic Regions



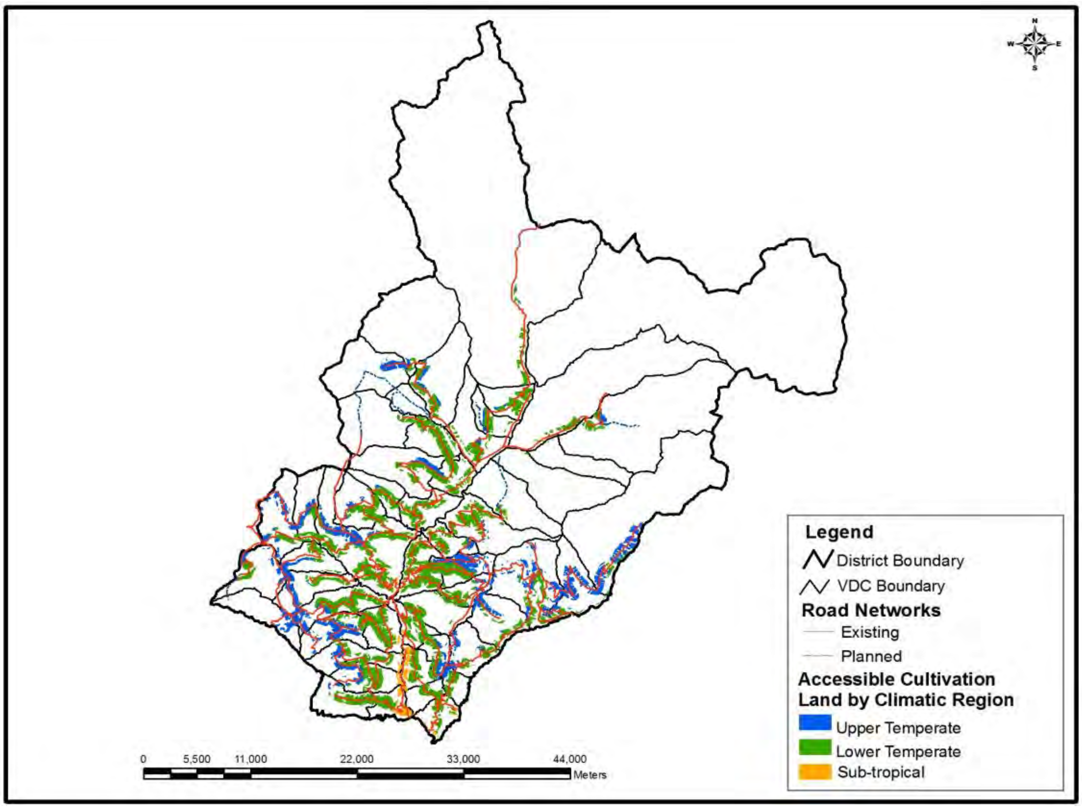
Map 26: Likely Accessible Agricultural Lands Suitable for Cultivation by Climatic Regions



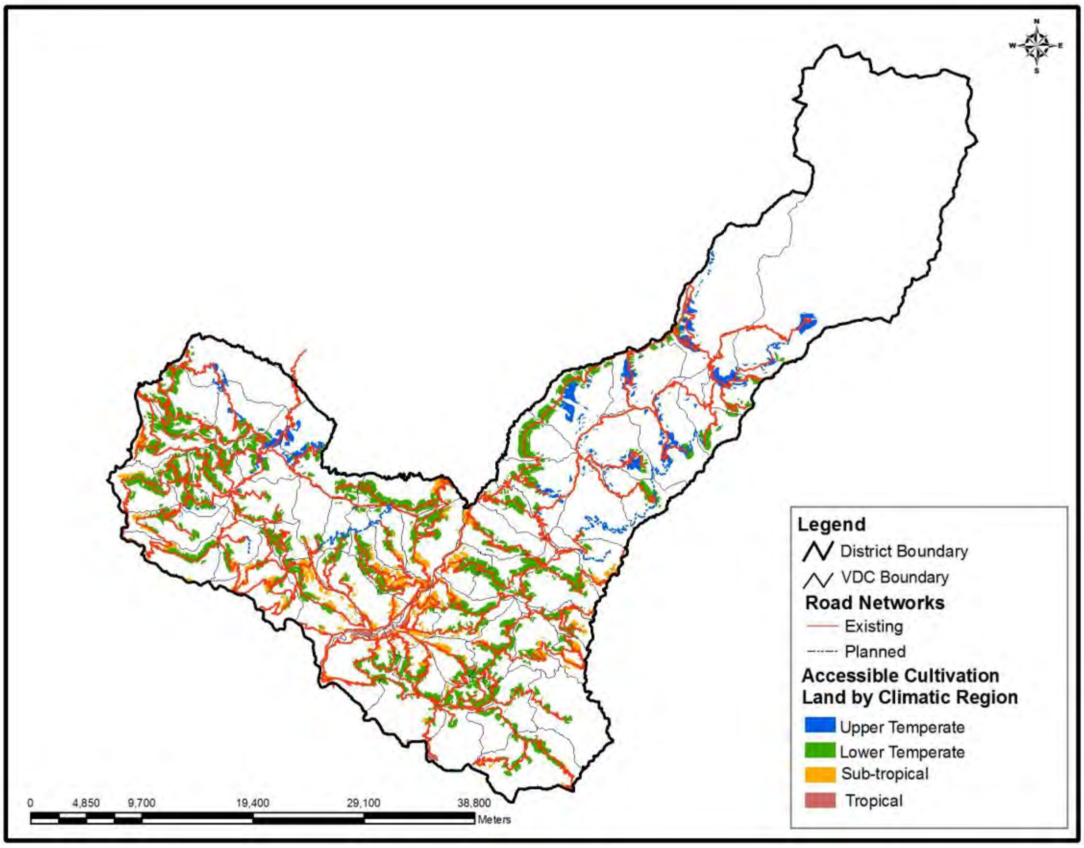
Map 27: Accessible Cultivation Area in Kavre District



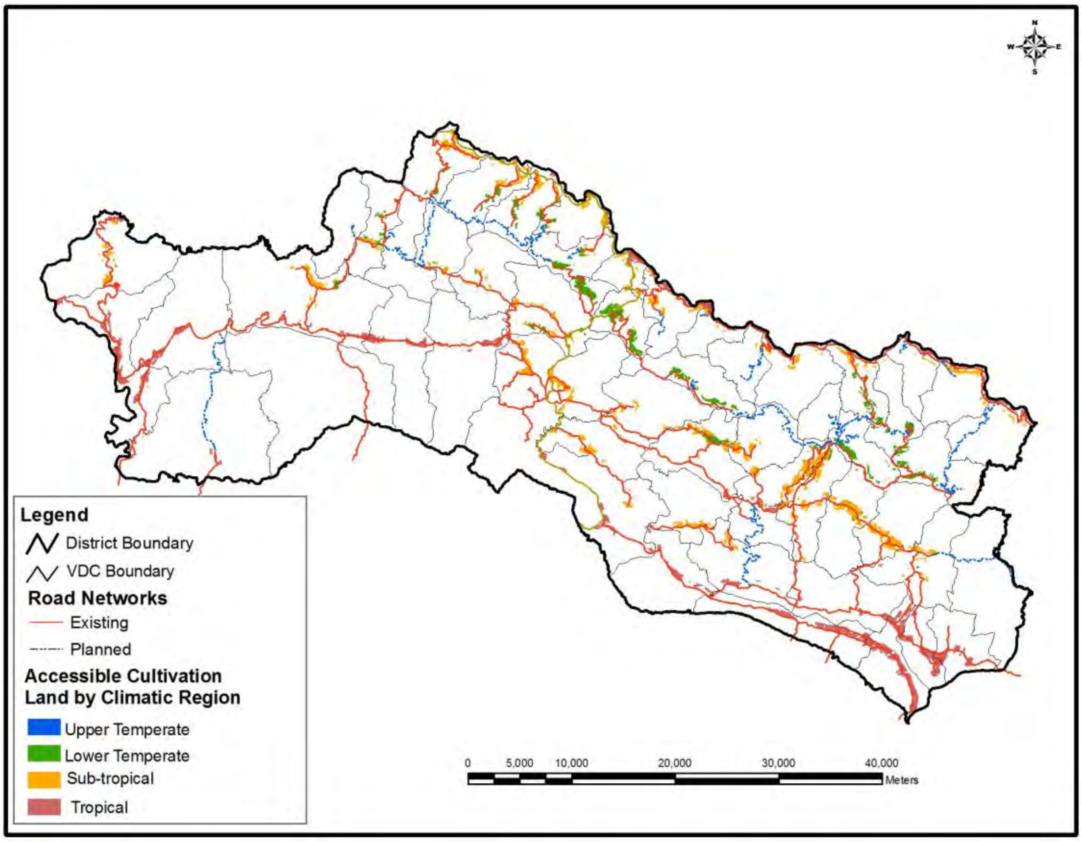
Map 28: Accessible Cultivation Area in Dolakha District



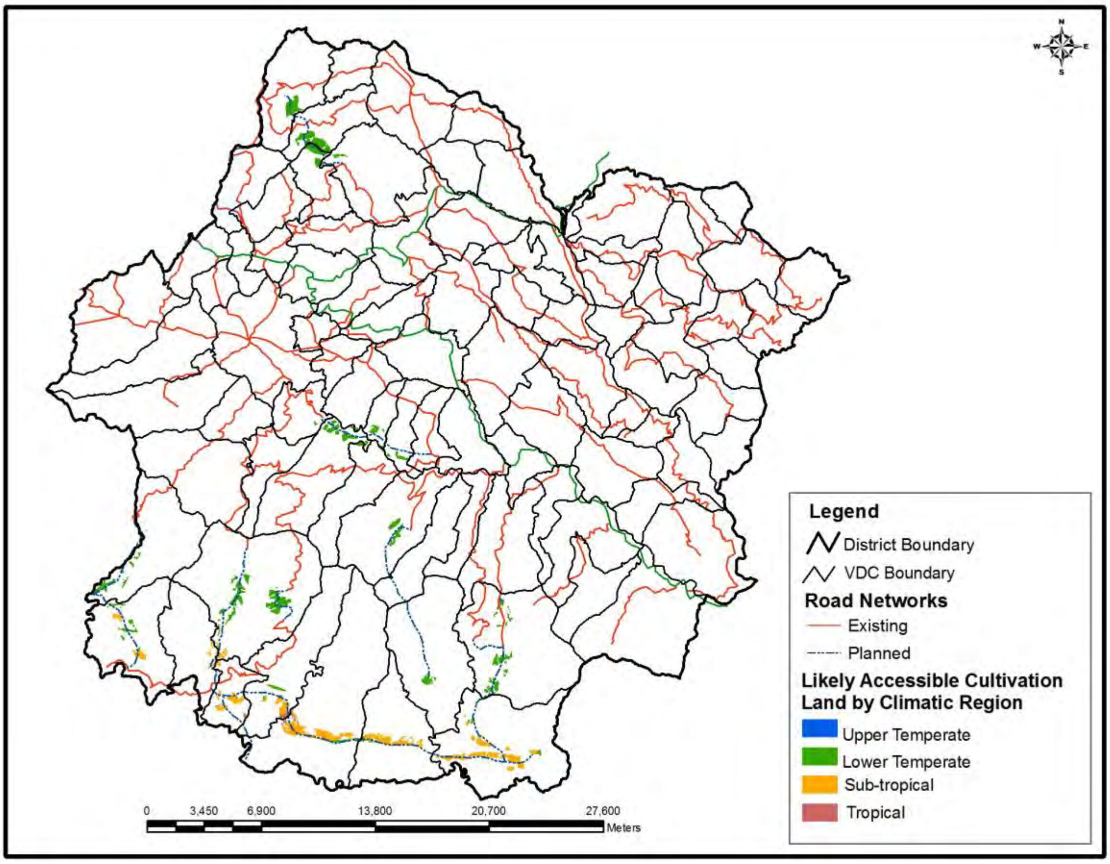
Map 29: Accessible Cultivation Area in Ramechhap District



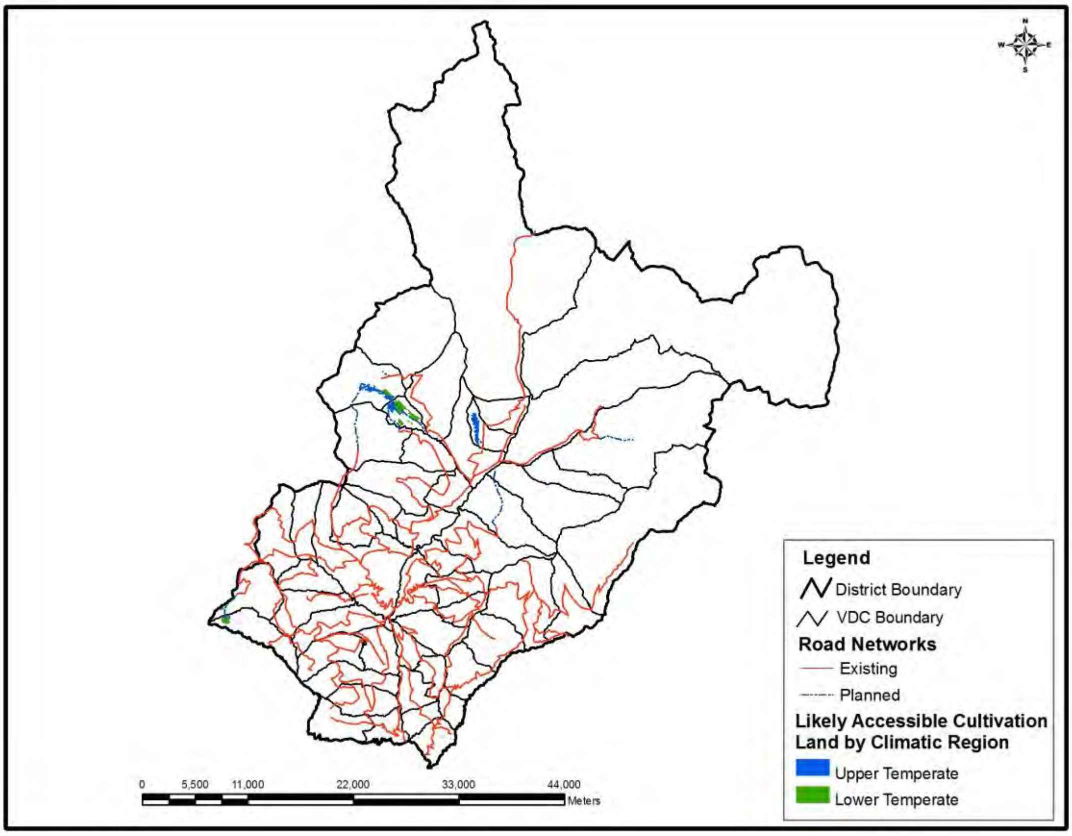
Map 30: Accessible Cultivation Area in Sindhuli District



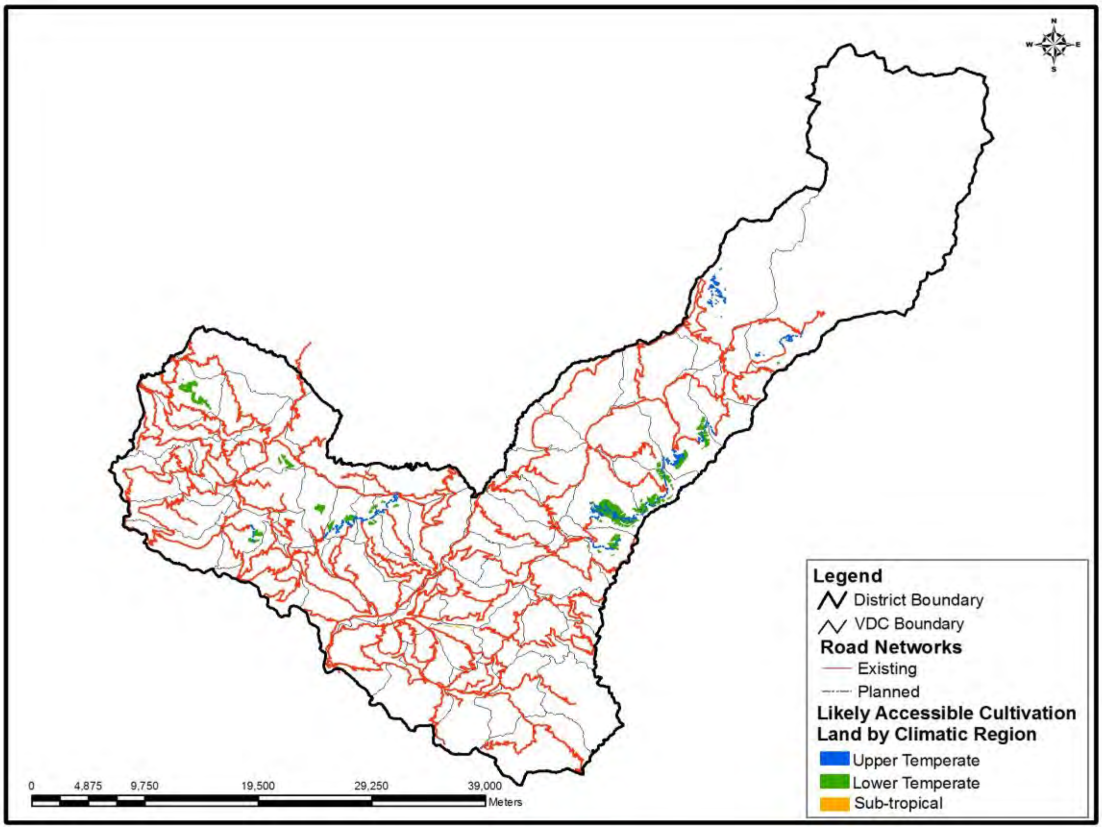
Map 31: Likely Accessible Cultivation Area in Kavre District



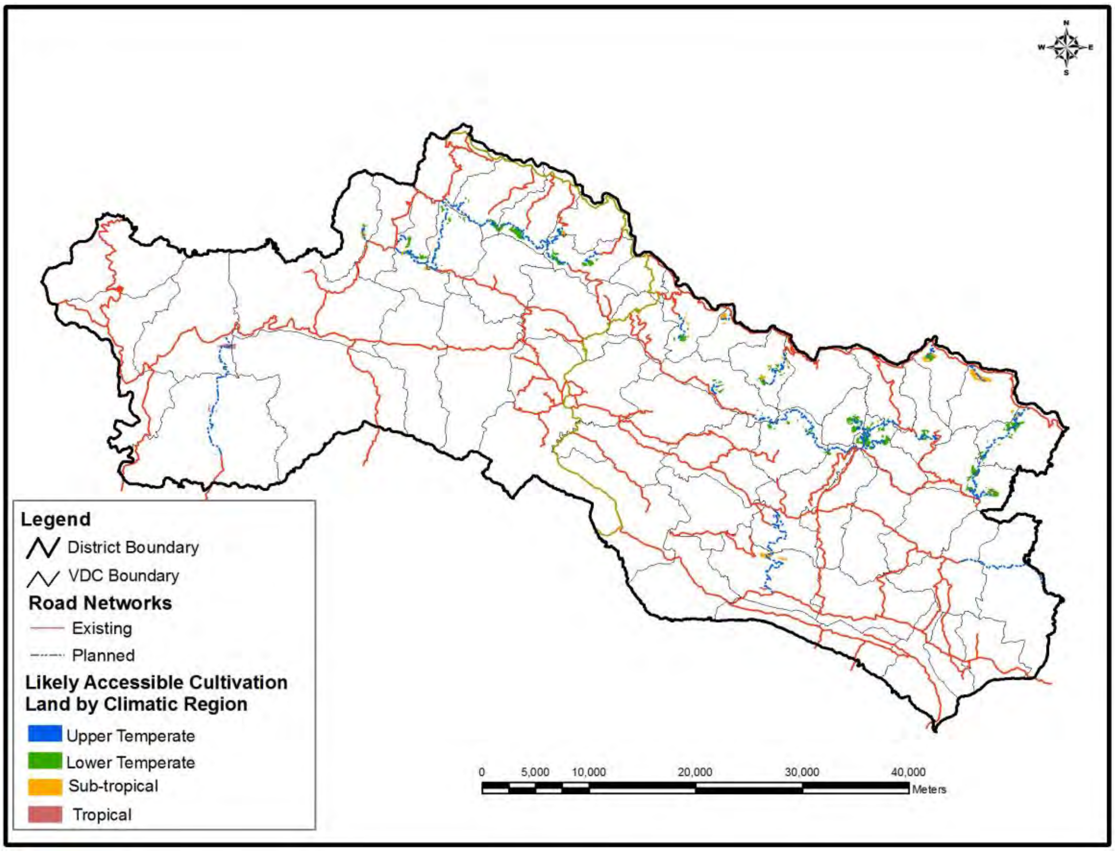
Map 32: Likely Accessible Cultivation Area in Dolakha District



Map 33: Likely Accessible Cultivation Area in Ramechhap District



Map 34: Likely Accessible Cultivation Area in Sindhuli District



5. Commercialization Potentials Along the Different Routes within the Study Area

Based on the analyses carried out in previous sections, a further attempt to compile a set of referential data was conducted for the initial activities in next stage.

The data compiled are:

District-wise maps of the existing and planned road network with unique codes given to each routes, taken after DTMPs.

District-wise tables that include the data of;

(1) Road (route) codes

(2) Road (route) names

(3) Road length (km)

(4) Climatic zones (i.e. temperate, etc.) and accessibility (accessible or likely accessible) conditions of these routes

(5) Number of agriculture production pockets existing along the routes, classified by climatic zones and accessibility conditions

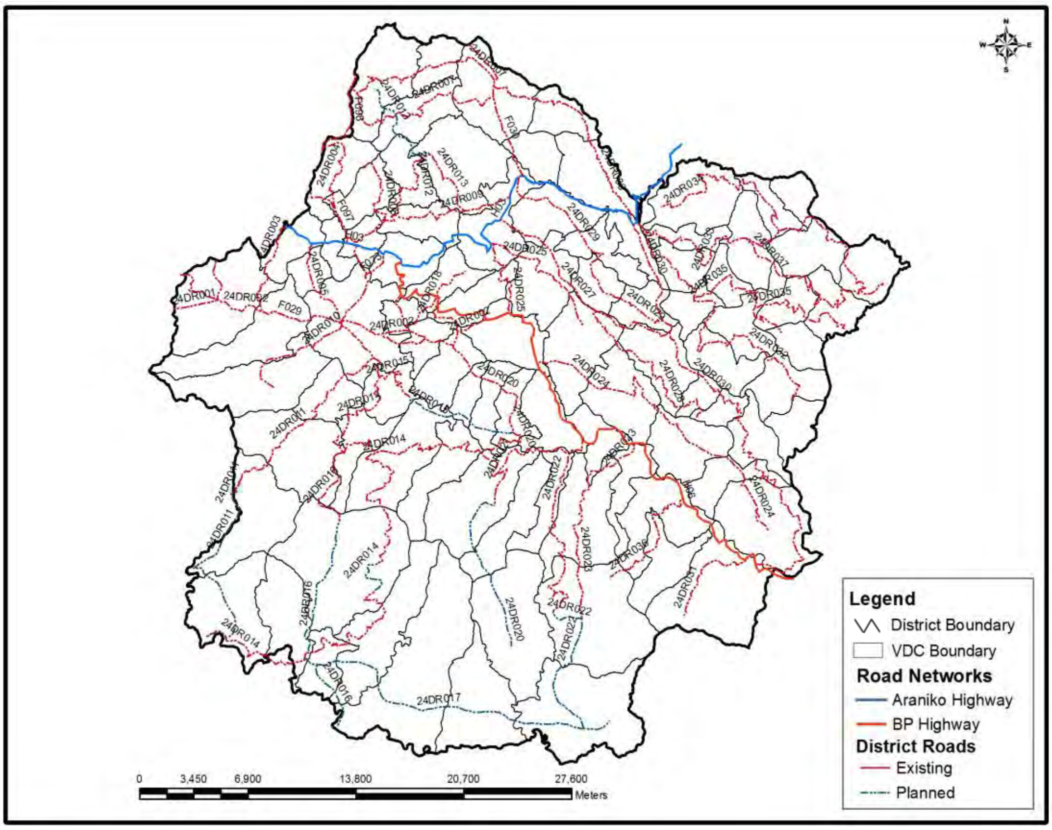
(6) Total size of agriculture lands existing within 500m buffer zones each side along the routes, classified by climatic zones and accessibility conditions

The purpose of compiling this data is, **"in the initial stage of next step which is the actual selection of particular routes the project interventions will be carried out, this data can be utilized as one of the referential materials to support estimating the commercialization potentials among them."**

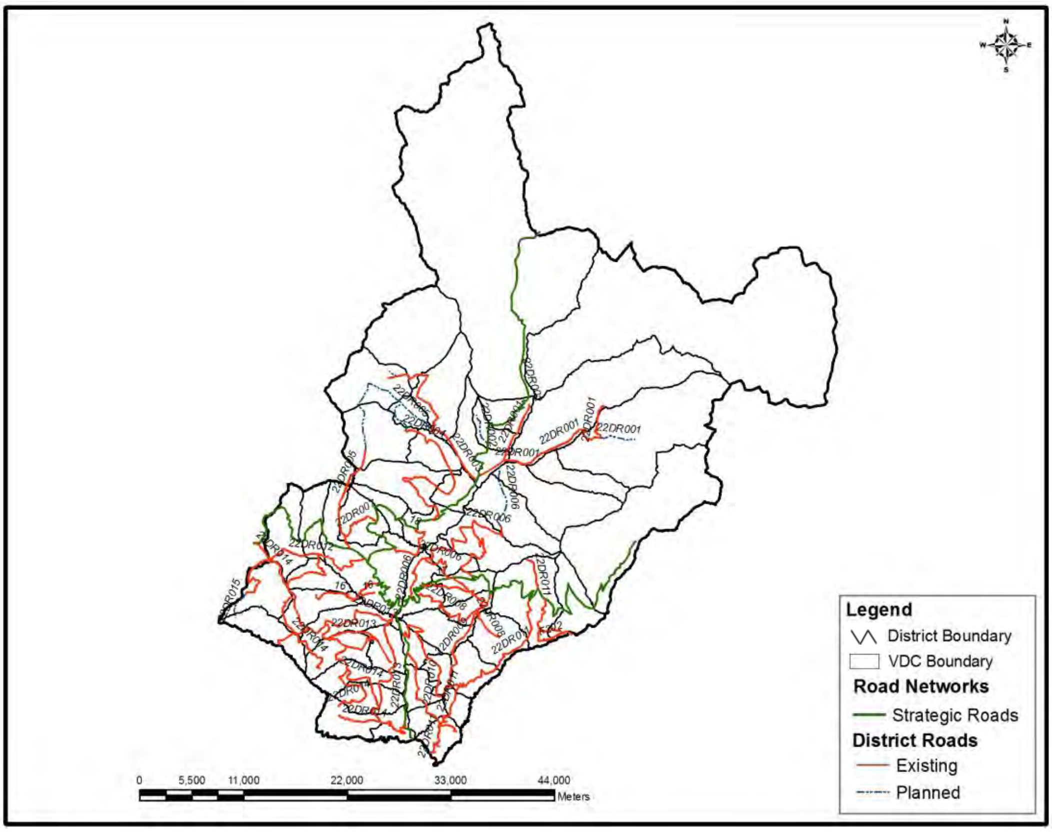
The Maps 35 to 38[2] presented in the following are the district-wise maps of the road networks with road (route) codes, whereas Annex 8 presents the tables that include attribute data for each road (route) described above.

[2] These maps are taken from District Transport Master Plan (DTMP) 2014-2018 of each district. DR = District Road, VR = Village Road, F = Feeder Road.

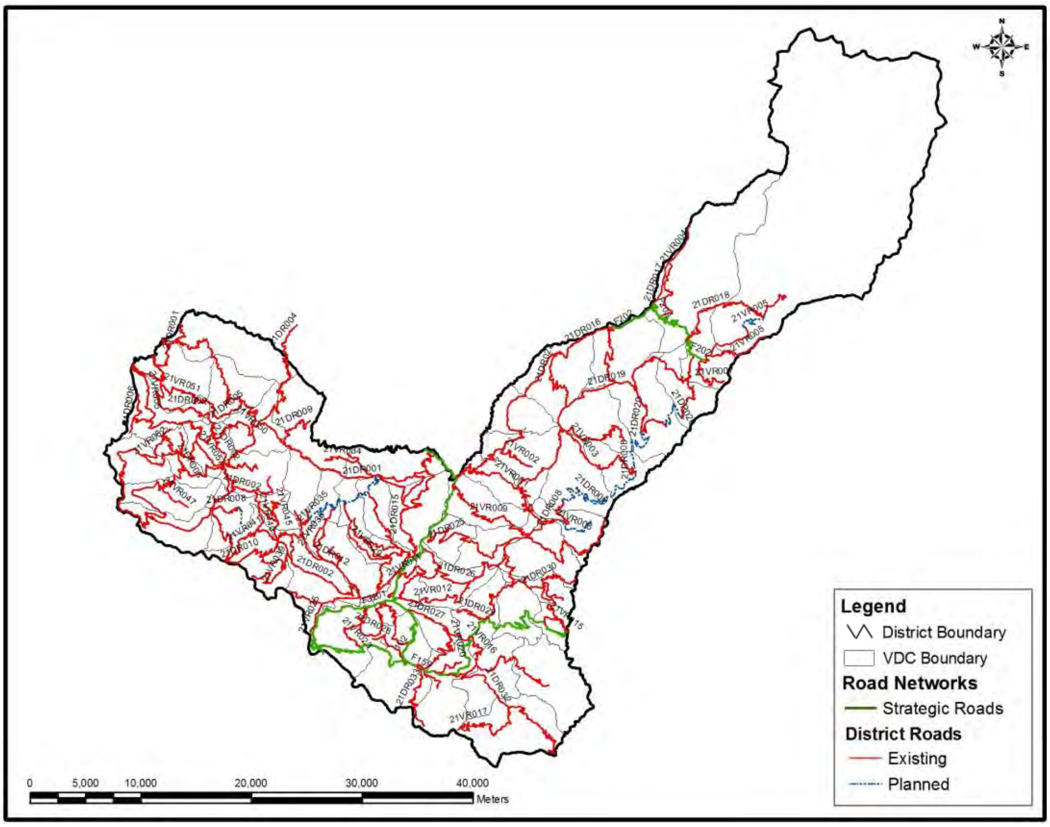
Map 35: Road Network with Identification Codes – Kavre District



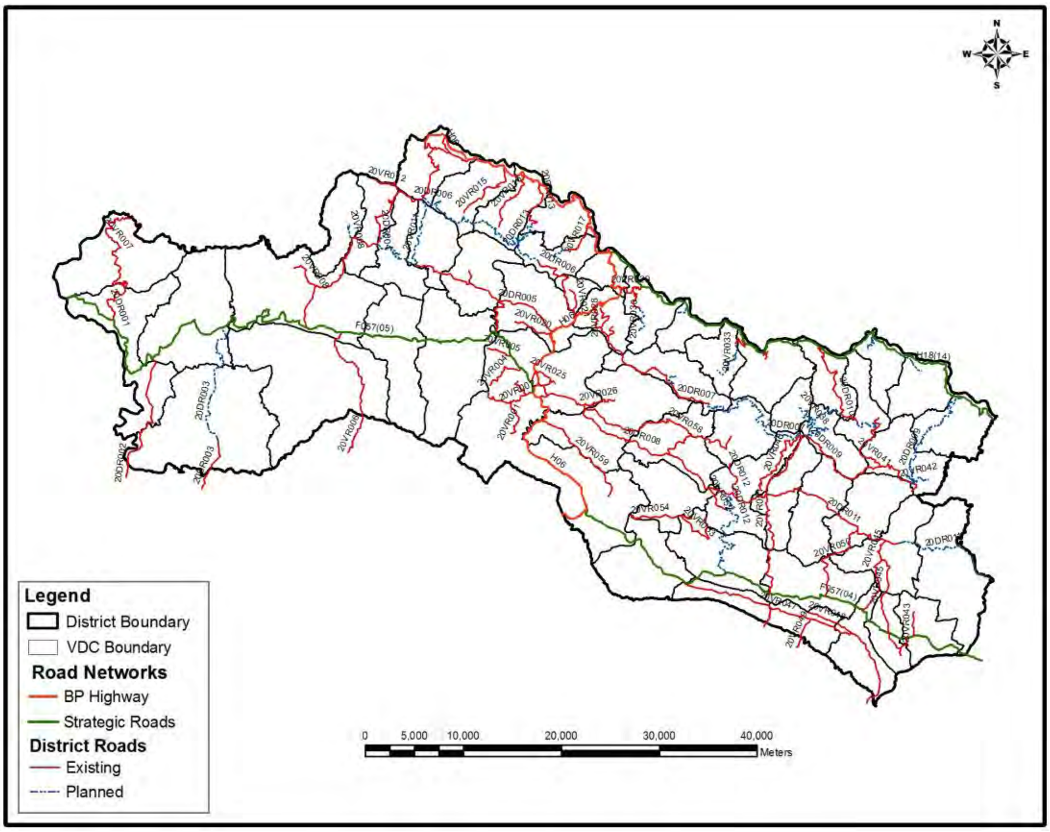
Map 36: Road Network with Identification Codes – Dolakha District



Map 37: Road Network with Identification Codes – Ramechhap District



Map 38: Road Network with Identification Codes – Sindhuli District



Annex1: Agriculture Land Area

1. Kavre

VDC	Total Land Area (ha)	Agriculture Land Area (ha)	% of agriculture land
ANEKOT	2,469.4	1,356.1	54.9
BALTHALI	952.6	528.2	55.4
BANAKHU	3,684.7	1,108.6	30.1
BANEPA MUNICIPALITY	555.8	429.2	77.2
BEKHSIMLE	588.1	423.4	72.0
BHIMKHORI	3,448.8	949.9	27.5
BHUGDEU MAHANKAL	2,402.5	830.0	34.5
BHUMLUTAR	798.1	442.3	55.4
BIRTADEURALI	1,212.7	733.4	60.5
BOLDE PHEDICHE	478.4	395.8	82.7
BUDHAKHANI	3,983.4	805.1	20.2
CHALAL GANESHTHAN	1,260.8	801.1	63.5
CHANDENI MANDAN	944.5	707.1	74.9
CHAPAKHORI	994.3	548.4	55.2
CHAUBAS	1,316.9	765.2	58.1
CHAURI POKHARI	735.2	633.5	86.2
CHHATREBANJH	852.5	603.3	70.8
CHYAMRANGBESI	2,269.5	269.2	11.9
CHYASING KHARKA	959.7	453.1	47.2
DANDAGAUN	2,762.7	1,012.0	36.6
DARAUNE POKHARI	864.3	569.9	65.9
DEUBHUMI BALUWA	1,781.0	1,049.0	58.9
DEVITAR	1,005.7	625.9	62.2
DHULIKHEL MUNICIPALITY	1,207.9	925.3	76.6
DHUNGKHARKA	2,872.1	833.9	29.0
DHUSENI SIWALAYA	815.3	611.7	75.0
DOLALGHAT	740.7	350.5	47.3
GAIRI BISAUNA DEUPUR	776.7	578.3	74.5
GHARTICHHAP	2,539.3	646.8	25.5
GOKULE	5,081.5	1,250.5	24.6
GOTHPANI	1,325.4	957.2	72.2
HOKSE BAZAR	1,244.9	838.4	67.3
JAISITHOK	824.8	664.5	80.6
JYAMDI	1,620.4	1,026.9	63.4
KABHRE NITTYA CHANDESHWARI	944.6	662.0	70.1
KANPUR KALAPANI	1,875.8	1,030.9	55.0
KATTIKE DEURALI	1,279.2	840.7	65.7
KATUNJE BESI	848.7	397.9	46.9
KHAHARE PANGU	1,532.8	675.9	44.1
KHANALTHOK	1,281.7	757.0	59.1
KHARELTHOK	819.5	556.7	67.9
KHARPACHOK	918.9	320.7	34.9
KOLANTI	715.4	333.5	46.6
KOLANTI BHUMEDANDA	2,579.8	60.4	2.3
KOSHIDEKHA	863.8	439.1	50.8
KUSHADEVI	2,277.7	908.4	39.9
MADAN KUNDARI	861.7	417.6	48.5
MAHADEVSTHAN	2,205.9	1,707.1	77.4
MAHADEVTAR	1,549.2	361.9	23.4
MAHENDRA JYOTI BANSDOL	549.6	400.2	72.8

VDC	Total Land Area (ha)	Agriculture Land Area (ha)	% of agriculture land
MAJHIPHEDA	1,094.7	760.7	69.5
MANGALTAR	1,974.9	559.9	28.4
MATHURAPATI PHULBARI	1,498.5	1,109.7	74.1
MECHCHHE	2,677.6	1,163.0	43.4
METHINKOT	2,140.2	1,035.8	48.4
MILCHE	2,245.1	486.9	21.7
NALDUNG BALUWAPATI	2,029.2	1,722.0	84.9
NANGRE GAGARCHE	1,182.9	717.8	60.7
NASIKASTHAN SANGA	906.5	660.9	72.9
NAYAGAUN	1,278.3	988.1	77.3
PANAUTI MUNICIPALITY	3,174.0	2,322.5	73.2
PANCHKHAL	1,914.4	1,265.2	66.1
PATLEKHET	1,011.9	757.6	74.9
PHALAMETAR	5,032.1	1,477.6	29.4
PHALANTE	862.4	433.0	50.2
PHOKSINGTAR	3,311.3	568.5	17.2
POKHARI NARAYANSTHAN	1,663.9	929.4	55.9
PURANOGAUN	507.9	365.3	71.9
RABI OPI	1,032.0	741.5	71.9
RYALE	2,830.9	1,112.3	39.3
SALDHARA	1,677.2	454.9	27.1
SALLE	605.3	502.1	83.0
SALME	1,127.8	424.3	37.6
SANKHUPATI CHAUR	669.9	448.0	66.9
SANU WANGTHALI	1,267.6	646.2	51.0
SAPING	1,953.9	1,264.6	64.7
SARADA BATASE	469.2	331.9	70.7
SARMATHALI	454.3	332.2	73.1
SARSUNKHARKA	1,583.7	1,084.0	68.4
SATHIGHAR BHAGAWATI	1,200.1	673.3	56.1
SHIKHAR AMBOTE	2,685.4	992.7	37.0
SIMTHALI	699.5	386.8	55.3
SIPALI CHILAUNE	2,419.5	613.8	25.4
SISAKHANI	929.9	294.8	31.7
SYAMPATI SIMALCHAUR	1,215.8	873.7	71.9
THULO PARSEL	1,032.6	587.9	56.9
TUKUCHA NALA	1,227.3	706.7	57.6
UGRACHANDI NALA	1,054.8	655.8	62.2
UGRATARA JANAGAL	576.2	362.4	62.9
WALTING	1,319.3	366.6	27.8
KAVRE Total	**139,012.5**	**65,774.3**	**47.3**

2. Dolakha

VDC	Total Land Area (ha)	Agriculture Land Area (ha)	% of agriculture land
ALAMPU	6,672.5	362.7	5.4
BABARE	1,667.1	891.8	53.5
BHEDPU	1,839.4	1,278.1	69.5
BHIMESHWAR MUNICIPALITY	6,506.7	3,395.5	52.2
BHIRKOT	1,047.8	583.9	55.7
BHUSAPHEDI	2,403.5	1,033.4	43.0
BIGU	3,708.6	879.7	23.7
BOCH	1,789.9	662.7	37.0
BULUNG	1,205.7	682.2	56.6
CHANGKHU	2,178.4	480.8	22.1
CHHETRAPA	1,209.6	549.0	45.4
CHILANGKHA	3,880.7	1,172.1	30.2
CHYAMA	826.4	564.9	68.4
DANDAKHARKA	1,950.7	1,389.3	71.2
GAIRIMUDI	2,025.0	1,343.9	66.4
GAURISHANKAR	32,394.0	514.6	1.6
GHYANGSUKATHOR	2,048.2	1,206.9	58.9
HAWA	1,905.1	902.6	47.4
JAPHE	1,270.4	902.4	71.0
JHULE	935.5	567.1	60.6
JHYAKU	3,591.2	1,512.5	42.1
JIRI	4,885.6	2,276.9	46.6
JUGU	3,385.2	1,055.5	31.2
KABRE	1,609.7	1,167.9	72.6
KALINCHOK	3,816.3	818.5	21.4
KATAKUTI	2,179.0	1,126.9	51.7
KHARE	10,443.4	757.2	7.3
KHOPACHAGU	999.2	645.1	64.6
LADUK	2,688.2	992.2	36.9
LAKURI DANDA	2,756.2	1,042.5	37.8
LAMABAGAR	40,563.6	512.7	1.3
LAMIDANDA	1,375.6	751.6	54.6
LAPILANG	3,331.9	1,118.9	33.6
MAGAPAUWA	1,567.5	934.8	59.6
MALI	2,627.3	1,457.8	55.5
MALU	881.0	531.4	60.3
MARBU	11,401.5	689.5	6.0
MELUNG	1,118.5	782.6	70.0
MIRGE	1,110.1	613.9	55.3
NAMDU	2,095.6	1,266.2	60.4
ORANG	1,511.1	617.3	40.9
PHASKU	2,428.9	1,740.6	71.7
POWATI	1,695.7	1,088.8	64.2
SAILUNGESHWAR	2,125.6	1,227.5	57.7
SHAHARE	1,349.6	530.4	39.3
SUNDRAWATI	1,238.9	574.6	46.4
SUNKHANI	1,815.0	929.5	51.2
SURI	4,702.3	1,059.2	22.5
SUSPA CHHAMABATI	2,177.6	728.2	33.4
SYAMA	11,160.5	1,459.8	13.1
TAMCHET DUDHPOKHARI	2,147.6	946.3	44.1
THULOPATAL	2,453.4	1,395.5	56.9
DOLAKHA Total	**214,698.0**	**51,715.6**	**24.1**

3. Ramechhap

VDC	Total Land Area (ha)	Agriculture Land Area (ha)	% of agriculture land
BAMTI BHANDAR	2,026.8	1,300.8	64.2
BETALI	1,729.8	1,038.8	60.1
BETHAN	1,804.4	1,044.8	57.9
BHALUWAJOR	3,159.4	988.3	31.3
BHATAULI	2,548.2	927.9	36.4
BHIRPANI	2,683.4	920.9	34.3
BHUJI	1,845.1	876.0	47.5
BIJULIKOT	2,619.1	1,585.3	60.5
CHANKHU	1,316.4	851.8	64.7
CHISAPANI	1,001.5	626.4	62.5
CHUCHURE	7,761.1	1,179.4	15.2
DADHUWA	2,900.2	1,503.2	51.8
DEURALI	1,714.3	965.2	56.3
DIMIPOKHARI	1,648.5	980.5	59.5
DORAMBA	2,039.5	1,022.2	50.1
DURAGAUN	2,994.0	1,081.7	36.1
GAGAL BHADAURE	1,563.2	735.7	47.1
GELU	2,617.5	1,481.9	56.6
GOSHWARA	3,671.2	1,059.8	28.9
GOTHGAUN	1,039.7	632.4	60.8
GUMDEL	33,296.6	1,630.4	4.9
GUNSI	2,184.6	1,106.4	50.6
GUPTESHWAR	2,429.6	898.1	37.0
HILEDEVI	1,464.3	918.5	62.7
HIMGANGA	3,488.2	1,296.5	37.2
KATHJOR	2,304.3	1,196.3	51.9
KHANDADEVI	2,133.9	806.3	37.8
KHANIYAPANI	2,097.2	1,072.0	51.1
KHIMTI	2,196.0	966.1	44.0
KUNBHUKASTHALI	1,956.8	1,292.6	66.1
LAKHANPUR	2,649.5	1,691.8	63.9
MAJUWA	1,716.7	685.0	39.9
MAKADUM	810.5	551.8	68.1
MANTHALI	1,454.0	631.1	43.4
NAGDAHA	1,716.5	1,029.4	60.0
NAMADI	2,799.1	1,197.7	42.8
OKHRENI	2,568.6	1,036.1	40.3
PAKARBAS	3,114.5	1,440.0	46.2
PHARPU	1,409.1	604.2	42.9
PHULAS	2,324.6	1,536.5	66.1
PINGKHURI	968.5	622.3	64.3
PRITI	3,618.7	2,041.5	56.4
PURANAGAUN	1,171.7	835.1	71.3
RAKATHUM	2,056.4	914.7	44.5
RAMECHHAP	3,849.6	1,595.4	41.4
RAMPUR	3,784.8	1,530.8	40.4
RASANALU	3,224.8	1,893.0	58.7
SAIPU	1,652.4	662.0	40.1
SALU	1,985.7	1,124.1	56.6
SANGHUTAR	903.0	480.3	53.2
SUKAJOR	2,884.5	1,305.8	45.3
SUNARPANI	1,293.8	648.7	50.1
THOKARPUR	2,136.1	741.1	34.7
THOSE	2,915.5	1,175.0	40.3
TILPUNG	1,267.0	897.6	70.8
RAMECHHAP Total	**156,510.1**	**58,857.2**	**37.6**

4. Sindhuli

VDC	Total Land Area (ha)	Agriculture Land Area (ha)	% of agriculture land
AMALE	4,096.0	666.2	16.3
ARUN THAKUR	4,816.2	1,442.9	30.0
BAHUN TILPUNG	2,022.3	709.0	35.1
BALAJOR	3,417.3	1,316.2	38.5
BASESHWAR	2,763.7	604.0	21.9
BASTIPUR	3,006.8	709.9	23.6
BELGHARI	3,912.2	874.8	22.4
BHADRAKALI	5,048.3	1,077.3	21.3
BHIMESHWAR	1,507.2	373.6	24.8
BHIMSTHAN	4,621.2	1,549.0	33.5
BHUWANESHWARI GWALTAR	1,660.7	418.1	25.2
BITIJOR BAGAINCHA	2,494.6	684.9	27.5
DANDIGURANSE	8,264.9	820.0	9.9
DUDHAULI	2,251.4	1,074.4	47.7
DUDHBHANJYANG	4,003.1	742.0	18.5
HARIHARPUR GADHI	6,365.3	883.3	13.9
HARSAHI	2,335.7	470.5	20.1
HATPATE	5,282.4	1,199.6	22.7
JALKANYA (CHAPAULI)	904.6	357.5	39.5
JARAYOTAR	4,856.3	1,700.0	35.0
JHANGAJHOLI RATMATA	3,560.8	1,137.9	32.0
JINAKHU	4,181.2	1,715.0	41.0
KAKUR THAKUR	6,744.9	1,610.5	23.9
KALPABRIKSHA	12,917.1	2,282.3	17.7
KAMALAMAI MUNICIPALITY	20,796.2	4,562.5	21.9
KAPILAKOT	10,730.0	2,123.9	19.8
KHANGSANG	2,144.3	658.6	30.7
KHOLAGAUN	2,978.9	751.7	25.2
KUSHESHWAR (DUMJA)	3,534.4	1,035.9	29.3
KYANESHWAR	12,332.0	2,280.8	18.5
LAMPANTAR	3,353.4	1,202.5	35.9
MAHADEVDANDA	3,882.3	947.0	24.4
MAHADEVSTHAN	6,075.9	1,139.6	18.8
MAHENDRA LADABHIR	3,000.8	1,027.4	34.2
MAHENDRAJHYADI	8,246.0	1,099.4	13.3
MAJHUWA	2,528.5	548.4	21.7
NETRAKALI	2,851.6	732.3	25.7
NIPANE	1,896.0	269.7	14.2
PIPALMADI	7,064.6	1,278.1	18.1
PURANO JHANGAJHOLI	3,226.7	1,049.6	32.5
RANIBAS	5,077.8	522.1	10.3
RANICHAURI	8,147.4	2,440.1	29.9
RATANCHURA	2,430.8	876.7	36.1
RATNAWATI	3,800.3	743.6	19.6
SANTESHWARI RAMPUR	3,170.8	540.3	17.0
SIRTHAULI	4,807.1	1,034.7	21.5
SITALPATI	2,617.8	785.4	30.0
SUNAM POKHARI	2,664.4	545.7	20.5
SWALPATHANA	3,101.6	748.1	24.1
TAMAJOR	3,551.5	654.5	18.4
TANDI	3,636.6	1,260.7	34.7
TINKANYA	3,552.2	1,250.6	35.2
TOSAMKHOLA	1,622.9	458.0	28.2
TRIBHUWAN AMBOTE	4,220.0	1,354.2	32.1
SINDHULI Total	**248,077.1**	**58,341.0**	**23.5**
Grand Total	**758,297.7**	**234,688.1**	**30.9**

Annex2: Agriculture Area by Climatic Zones

1. Kavre

VDC	Alpine	Lower temperate	Sub-alpine	Sub-tropical	Tropical	Upper temperate	Grand Total
ANEKOT		903.7		452.4			1,356.1
BALTHALI		528.2					528.2
BANAKHU		222.9		885.0	0.6	0.0	1,108.6
BANEPA MUNICIPALITY		429.2					429.2
BEKHSIMLE		407.3				16.1	423.4
BHIMKHORI		804.2		141.0		4.7	949.9
BHUGDEU MAHANKAL		816.3				13.7	830.0
BHUMLUTAR		330.2		111.7		0.4	442.3
BIRTADEURALI		452.9		280.5			733.4
BOLDE PHEDICHE		225.3		170.5			395.8
BUDHAKHANI		716.2		73.0		15.9	805.1
CHALAL GANESHTHAN		736.3				64.7	801.1
CHANDENI MANDAN		268.7		438.4			707.1
CHAPAKHORI		475.9		72.5			548.4
CHAUBAS		676.1				89.1	765.2
CHAURI POKHARI		481.3		152.2			633.5
CHHATREBANJH		603.3					603.3
CHYAMRANGBESI		220.9		7.7		40.5	269.2
CHYASING KHARKA		421.6				31.5	453.1
DANDAGAUN		660.4		278.8	60.2	12.7	1,012.0
DARAUNE POKHARI		569.9					569.9
DEUBHUMI BALUWA		119.0		930.0			1,049.0
DEVITAR		625.2		0.7			625.9
DHULIKHEL MUNICIPALITY		925.2		0.1			925.3
DHUNGKHARKA		501.6				332.3	833.9
DHUSENI SIWALAYA		611.7					611.7
DOLALGHAT		99.6		250.9			350.5
GAIRI BISAUNA DEUPUR		332.9		245.4			578.3
GHARTICHHAP		180.5		464.1	2.1		646.8
GOKULE		621.0		524.7	94.4	10.4	1,250.5
GOTHPANI		903.0		42.7		11.5	957.2
HOKSE BAZAR		76.0		762.4			838.4
JAISITHOK		381.9		282.6			664.5
JYAMDI		449.5		577.4			1,026.9
KABHRE NITTYA CHANDESHWARI		620.0		42.0			662.0
KANPUR KALAPANI		984.6		46.3			1,030.9
KATTIKE DEURALI		608.2		232.5			840.7
KATUNJE BESI		252.2		145.7			397.9
KHAHARE PANGU		675.9					675.9
KHANALTHOK		677.3		79.7			757.0
KHARELTHOK		378.6		178.1			556.7
KHARPACHOK		225.1		95.6			320.7
KOLANTI		210.0		123.4			333.5
KOLANTI BHUMEDANDA		57.7				2.7	60.4
KOSHIDEKHA		168.4		270.7			439.1
KUSHADEVI		860.3				48.1	908.4
MADAN KUNDARI		281.2		136.3			417.6
MAHADEVSTHAN		223.4		1,483.7			1,707.1
MAHADEVTAR		359.9		0.5		1.5	361.9
MAHENDRA JYOTI BANSDOL		400.2					400.2

VDC	Alpine	Lower temperate	Sub-alpine	Sub-tropical	Tropical	Upper temperate	Grand Total
MAJHIPHEDA		723.5		37.3			760.7
MANGALTAR		349.4		210.5			559.9
MATHURAPATI PHULBARI		1,107.6		2.1			1,109.7
MECHCHHE		763.8		399.2			1,163.0
METHINKOT		804.6		231.2			1,035.8
MILCHE		136.1		229.1	115.6	6.0	486.9
NALDUNG BALUWAPATI		1,622.7		97.5		1.8	1,722.0
NANGRE GAGARCHE		717.4				0.3	717.8
NASIKASTHAN SANGA		660.9					660.9
NAYAGAUN		781.4		206.7			988.1
PANAUTI MUNICIPALITY		2,322.5					2,322.5
PANCHKHAL		219.6		1,045.6			1,265.2
PATLEKHET		589.2		168.5			757.6
PHALAMETAR		1,195.7		265.5		16.5	1,477.6
PHALANTE		358.6		74.4			433.0
PHOKSINGTAR		361.7		181.3		25.5	568.5
POKHARI NARAYANSTHAN		855.9		73.5			929.4
PURANOGAUN		365.3					365.3
RABI OPI		656.1		85.4			741.5
RYALE		1,051.8				60.5	1,112.3
SALDHARA		189.8		228.7	36.4		454.9
SALLE		501.5		0.6			502.1
SALME		80.5		259.9	83.9		424.3
SANKHUPATI CHAUR		448.0					448.0
SANU WANGTHALI		496.3				149.9	646.2
SAPING		1,054.7		210.0			1,264.6
SARADA BATASE		331.9					331.9
SARMATHALI		193.7		138.5			332.2
SARSUNKHARKA		654.1		429.9			1,084.0
SATHIGHAR BHAGAWATI		468.6		204.6			673.3
SHIKHAR AMBOTE		956.7		34.9		1.2	992.7
SIMTHALI		372.8		4.2		9.8	386.8
SIPALI CHILAUNE		584.6		25.9		3.3	613.8
SISAKHANI		241.7		53.1			294.8
SYAMPATI SIMALCHAUR		873.7					873.7
THULO PARSEL		382.3		205.7			587.9
TUKUCHA NALA		690.9				15.8	706.7
UGRACHANDI NALA		651.7				4.2	655.8
UGRATARA JANAGAL		362.4					362.4
WALTING		360.9		4.3		1.5	366.6
KAVRE Total	**-**	**49,301.6**	**-**	**15,087.4**	**393.1**	**992.1**	**65,774.3**

2. Dolakha

VDC	Alpine	Lower temperate	Sub-alpine	Sub-tropical	Tropical	Upper temperate	Grand Total
ALAMPU		156.0	35.1			171.5	362.7
BABARE		858.1				33.7	891.8
BHEDPU		911.9		141.9		224.3	1,278.1
BHIMESHWAR MUNICIPALITY		2,738.6		105.6		551.3	3,395.5
BHIRKOT		514.6		35.9		33.4	583.9
BHUSAPHEDI		669.5				363.9	1,033.4
BIGU		191.4	19.4			668.9	879.7
BOCH		469.8				192.9	662.7
BULUNG		454.0				228.2	682.2
CHANGKHU		224.0	3.3			253.6	480.8
CHHETRAPA		448.6		10.3		90.1	549.0
CHILANGKHA		492.4	15.8			663.9	1,172.1
CHYAMA		467.9		2.5		94.5	564.9
DANDAKHARKA		1,184.5				204.8	1,389.3
GAIRIMUDI		1,216.7		4.5		122.7	1,343.9
GAURISHANKAR	30.5	200.2	26.2			257.7	514.6
GHYANGSUKATHOR		822.1		122.5		262.3	1,206.9
HAWA		466.7				435.9	902.6
JAPHE		651.5		229.6		21.2	902.4
JHULE		299.9				267.2	567.1
JHYAKU		919.8	2.4	9.9		580.4	1,512.5
JIRI		745.5				1,531.4	2,276.9
JUGU		859.6		15.5		180.4	1,055.5
KABRE		659.7				508.3	1,167.9
KALINCHOK		411.9	16.5			390.1	818.5
KATAKUTI		685.3				441.6	1,126.9
KHARE		584.0	2.1			171.0	757.2
KHOPACHAGU		522.8				122.3	645.1
LADUK		779.2		8.4		204.6	992.2
LAKURI DANDA		347.7				694.8	1,042.5
LAMABAGAR	0.3	418.2	36.2			58.0	512.7
LAMIDANDA		678.5		39.9		33.2	751.6
LAPILANG		827.0	9.1			282.8	1,118.9
MAGAPAUWA		708.0				226.8	934.8
MALI		262.5	-			1,195.3	1,457.8
MALU		429.0		81.1		21.3	531.4
MARBU		373.5	5.7			310.2	689.5
MELUNG		467.5		315.0			782.6
MIRGE		486.4				127.5	613.9
NAMDU		1,250.1		16.1			1,266.2
ORANG		524.4				92.9	617.3
PHASKU		1,252.0		56.8		431.8	1,740.6
POWATI		994.7		94.1			1,088.8
SAILUNGESHWAR		471.2				756.2	1,227.5
SHAHARE		349.9		180.5			530.4
SUNDRAWATI		451.0				123.6	574.6
SUNKHANI		872.7		39.4		17.4	929.5
SURI		869.1		3.7		186.4	1,059.2
SUSPA CHHAMABATI		599.7				128.5	728.2
SYAMA		315.9	0.0			1,143.9	1,459.8
TAMCHET DUDHPOKHARI		297.5				648.7	946.3
THULOPATAL		439.2				956.3	1,395.5
DOLAKHA Total	**30.7**	**33,292.1**	**171.8**	**1,513.4**	**-**	**16,707.6**	**51,715.6**

3. Ramechhap

VDC	Alpine	Lower temperate	Sub-alpine	Sub-tropical	Tropical	Upper temperate	Grand Total
BAMTI BHANDAR		351.9	8.6			940.3	1,300.8
BETALI		803.0		0.0		235.8	1,038.8
BETHAN		712.4		332.4			1,044.8
BHALUWAJOR		599.6		331.4	57.3		988.3
BHATAULI		468.7		443.4	15.9		927.9
BHIRPANI		470.1		449.3	1.5		920.9
BHUJI		728.1		1.9		146.0	876.0
BIJULIKOT		1,401.8		181.3		2.2	1,585.3
CHANKHU		635.3		216.5			851.8
CHISAPANI		250.3		362.7	13.3		626.4
CHUCHURE		244.2	3.5			931.7	1,179.4
DADHUWA		726.9				776.3	1,503.2
DEURALI		762.0		203.3			965.2
DIMIPOKHARI		945.4				35.1	980.5
DORAMBA		701.9				320.3	1,022.2
DURAGAUN		787.6		10.3		283.8	1,081.7
GAGAL BHADAURE		546.3		173.1		16.3	735.7
GELU		852.9		626.0	2.9		1,481.9
GOSHWARA		543.7		1.0		515.1	1,059.8
GOTHGAUN		338.5		293.9			632.4
GUMDEL		326.3	27.5			1,276.6	1,630.4
GUNSI		873.0		233.4			1,106.4
GUPTESHWAR		196.4				701.7	898.1
HILEDEVI		797.6		46.3		74.7	918.5
HIMGANGA		589.2		670.5	36.8		1,296.5
KATHJOR		795.8		400.3	0.2		1,196.3
KHANDADEVI		796.3		0.1		9.8	806.3
KHANIYAPANI		891.0		114.7		66.4	1,072.0
KHIMTI		737.1		216.1		12.8	966.1
KUNBHUKASTHALI		676.1				616.5	1,292.6
LAKHANPUR		1,613.1		36.7		42.0	1,691.8
MAJUWA		593.7		89.5		1.9	685.0
MAKADUM		417.5		134.3			551.8
MANTHALI		37.0		512.5	81.6		631.1
NAGDAHA		1,025.3		2.3		1.8	1,029.4
NAMADI		832.7		0.6		364.4	1,197.7
OKHRENI		985.4		50.7			1,036.1
PAKARBAS		535.0		822.5	82.5		1,440.0
PHARPU		554.2		28.3		21.8	604.2
PHULAS		1,247.1		289.4			1,536.5
PINGKHURI		562.7		54.1		5.5	622.3
PRITI		1,059.4				982.0	2,041.5
PURANAGAUN		679.4		148.7		6.9	835.1
RAKATHUM		590.4		324.3			914.7
RAMECHHAP		1,128.8		449.2	17.4		1,595.4
RAMPUR		1,054.3		448.6	27.8		1,530.8
RASANALU		854.6	0.6			1,037.9	1,893.0
SAIPU		375.3		271.6		15.1	662.0
SALU		1,051.7		71.4		1.0	1,124.1
SANGHUTAR		194.3		286.0			480.3
SUKAJOR		1,029.5		232.9	43.5		1,305.8
SUNARPANI		279.7		369.0			648.7
THOKARPUR		501.1				240.0	741.1
THOSE		283.8				891.3	1,175.0
TILPUNG		470.1		427.4	0.1		897.6
RAMECHHAP Total		**37,505.4**	**40.2**	**10,358.0**	**380.8**	**10,572.9**	**58,857.2**

4. Sindhuli

VDC	Alpine	Lower temperate	Sub-alpine	Sub-tropical	Tropical	Upper temperate	Grand Total
AMALE		281.6		384.6			666.2
ARUN THAKUR		444.5		874.0	124.4		1,442.9
BAHUN TILPUNG		702.5		6.5			709.0
BALAJOR		304.4		1,011.8			1,316.2
BASESHWAR		118.5		343.4	142.1		604.0
BASTIPUR		493.0		213.1		3.8	709.9
BELGHARI		1.5		517.3	356.0		874.8
BHADRAKALI		349.8		693.0	34.5		1,077.3
BHIMESHWAR		15.9		256.9	100.9		373.6
BHIMSTHAN		311.2		536.3	701.5		1,549.0
BHUWANESHWARI GWALTAR		141.6		175.8	100.8		418.1
BITIJOR BAGAINCHA		165.0		486.3	33.7		684.9
DANDIGURANSE		30.1		158.6	631.2		820.0
DUDHAULI					1,074.4		1,074.4
DUDHBHANJYANG		354.2		321.4	66.5		742.0
HARIHARPUR GADHI		28.2		467.2	388.0		883.3
HARSAHI					470.5		470.5
HATPATE		20.4		290.8	888.4		1,199.6
JALKANYA (CHAPAULI)		321.0		36.5			357.5
JARAYOTAR		63.3		1,219.4	417.3		1,700.0
JHANGAJHOLI RATMATA		355.4		723.0	59.4		1,137.9
JINAKHU		685.9		989.2	40.0		1,715.0
KAKUR THAKUR		399.9		652.8	557.8		1,610.5
KALPABRIKSHA				3.4	2,278.8		2,282.3
KAMALAMAI MUNICIPALITY		211.2		3,361.5	989.8		4,562.5
KAPILAKOT		119.4		818.6	1,185.9		2,123.9
KHANGSANG		290.9		270.4	97.2		658.6
KHOLAGAUN		593.6		142.2	3.8	12.1	751.7
KUSHESHWAR (DUMJA)		460.5		575.4			1,035.9
KYANESHWAR				135.6	2,145.2		2,280.8
LAMPANTAR		182.6		1,017.4	2.5		1,202.5
MAHADEVDANDA		881.5		27.0		38.5	947.0
MAHADEVSTHAN		1.3		95.8	1,042.4		1,139.6
MAHENDRA LADABHIR					1,027.4		1,027.4
MAHENDRAJHYADI		19.2		166.4	913.8		1,099.4
MAJHUWA		379.1		169.4			548.4
NETRAKALI		509.9		220.8		1.7	732.3
NIPANE					269.7		269.7
PIPALMADI		0.0		46.3	1,231.8		1,278.1
PURANO JHANGAJHOLI		445.0		515.6	89.0		1,049.6
RANIBAS				1.8	520.3		522.1
RANICHAURI		366.5		1,716.1	357.5		2,440.1
RATANCHURA		771.3		105.4			876.7
RATNAWATI		408.4		249.7	85.0	0.5	743.6
SANTESHWARI RAMPUR		347.3		191.8		1.3	540.3
SIRTHAULI				11.4	1,023.3		1,034.7
SITALPATI		191.7		509.2	84.6		785.4
SUNAM POKHARI		266.9		225.2	53.5		545.7
SWALPATHANA		243.8		411.5	76.0	16.8	748.1
TAMAJOR		554.5		100.1		0.0	654.5
TANDI					1,260.7		1,260.7
TINKANYA		890.6		360.0			1,250.6
TOSAMKHOLA		445.6		12.5			458.0
TRIBHUWAN AMBOTE		531.3		798.3	24.6		1,354.2
SINDHULI Total		**14,699.8**	**-**	**22,616.1**	**20,950.4**	**74.7**	**58,341.0**
Grand Total	**30.7**	**134,798.9**	**212.0**	**49,574.9**	**21,724.3**	**28,347.3**	**234,688.1**

Annex3: Agriculture Area Suitable for Cultivation based on Land Capability

1. Kavre

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability (ha)	Percent
ANEKOT	1,356.1	653.9	48.2
BALTHALI	528.2	376.7	71.3
BANAKHU	1,108.6	456.7	41.2
BANEPA MUNICIPALITY	429.2	422.6	98.5
BEKHSIMLE	423.4	369.0	87.2
BHIMKHORI	949.9	473.0	49.8
BHUGDEU MAHANKAL	830.0	672.1	81.0
BHUMLUTAR	442.3	290.7	65.7
BIRTADEURALI	733.4	563.4	76.8
BOLDE PHEDICHE	395.8	260.1	65.7
BUDHAKHANI	805.1	277.7	34.5
CHALAL GANESHTHAN	801.1	602.5	75.2
CHANDENI MANDAN	707.1	476.7	67.4
CHAPAKHORI	548.4	314.2	57.3
CHAUBAS	765.2	622.6	81.4
CHAURI POKHARI	633.5	603.2	95.2
CHHATREBANJH	603.3	386.3	64.0
CHYAMRANGBESI	269.2	173.9	64.6
CHYASING KHARKA	453.1	370.1	81.7
DANDAGAUN	1,012.0	404.7	40.0
DARAUNE POKHARI	569.9	386.8	67.9
DEUBHUMI BALUWA	1,049.0	465.0	44.3
DEVITAR	625.9	453.3	72.4
DHULIKHEL MUNICIPALITY	925.3	783.1	84.6
DHUNGKHARKA	833.9	745.7	89.4
DHUSENI SIWALAYA	611.7	463.8	75.8
DOLALGHAT	350.5	194.7	55.5
GAIRI BISAUNA DEUPUR	578.3	436.0	75.4
GHARTICHHAP	646.8	292.3	45.2
GOKULE	1,250.5	466.3	37.3
GOTHPANI	957.2	862.1	90.1
HOKSE BAZAR	838.4	425.5	50.8
JAISITHOK	664.5	355.4	53.5
JYAMDI	1,026.9	620.4	60.4
KABHRE NITTYA CHANDESHWARI	662.0	476.9	72.0
KANPUR KALAPANI	1,030.9	767.1	74.4
KATTIKE DEURALI	840.7	676.2	80.4
KATUNJE BESI	397.9	241.1	60.6
KHAHARE PANGU	675.9	526.1	77.8
KHANALTHOK	757.0	529.1	69.9
KHARELTHOK	556.7	362.9	65.2
KHARPACHOK	320.7	162.0	50.5
KOLANTI	333.5	229.8	68.9
KOLANTI BHUMEDANDA	60.4	55.8	92.4
KOSHIDEKHA	439.1	198.6	45.2
KUSHADEVI	908.4	770.1	84.8
MADAN KUNDARI	417.6	316.5	75.8
MAHADEVSTHAN	1,707.1	1,385.9	81.2
MAHADEVTAR	361.9	110.5	30.5
MAHENDRA JYOTI BANSDOL	400.2	391.0	97.7

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability (ha)	Percent
MAJHIPHEDA	760.7	635.3	83.5
MANGALTAR	559.9	210.0	37.5
MATHURAPATI PHULBARI	1,109.7	935.3	84.3
MECHCHHE	1,163.0	320.6	27.6
METHINKOT	1,035.8	689.4	66.6
MILCHE	486.9	214.9	44.1
NALDUNG BALUWAPATI	1,722.0	1,395.4	81.0
NANGRE GAGARCHE	717.8	411.4	57.3
NASIKASTHAN SANGA	660.9	614.0	92.9
NAYAGAUN	988.1	832.2	84.2
PANAUTI MUNICIPALITY	2,322.5	2,239.5	96.4
PANCHKHAL	1,265.2	922.0	72.9
PATLEKHET	757.6	667.5	88.1
PHALAMETAR	1,477.6	682.5	46.2
PHALANTE	433.0	362.6	83.8
PHOKSINGTAR	568.5	158.3	27.8
POKHARI NARAYANSTHAN	929.4	651.4	70.1
PURANOGAUN	365.3	245.0	67.1
RABI OPI	741.5	592.2	79.9
RYALE	1,112.3	1,236.5	111.2
SALDHARA	454.9	269.8	59.3
SALLE	502.1	402.2	80.1
SALME	424.3	211.1	49.8
SANKHUPATI CHAUR	448.0	322.1	71.9
SANU WANGTHALI	646.2	464.6	71.9
SAPING	1,264.6	995.4	78.7
SARADA BATASE	331.9	311.0	93.7
SARMATHALI	332.2	163.6	49.3
SARSUNKHARKA	1,084.0	633.9	58.5
SATHIGHAR BHAGAWATI	673.3	471.0	70.0
SHIKHAR AMBOTE	992.7	523.1	52.7
SIMTHALI	386.8	298.5	77.2
SIPALI CHILAUNE	613.8	228.1	37.2
SISAKHANI	294.8	81.1	27.5
SYAMPATI SIMALCHAUR	873.7	569.9	65.2
THULO PARSEL	587.9	354.1	60.2
TUKUCHA NALA	706.7	655.9	92.8
UGRACHANDI NALA	655.8	631.2	96.2
UGRATARA JANAGAL	362.4	349.5	96.4
WALTING	366.6	200.8	54.8
KAVRE Total	**65,774.3**	45,073.3	68.5

2. Dolakha

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability (ha)	Percent
ALAMPU	362.7	178.4	49.2
BABARE	891.8	694.7	77.9
BHEDPU	1,278.1	966.5	75.6
BHIMESHWAR MUNICIPALITY	3,395.5	2,728.9	80.4
BHIRKOT	583.9	447.5	76.6
BHUSAPHEDI	1,033.4	515.7	49.9
BIGU	879.7	533.4	60.6
BOCH	662.7	554.2	83.6
BULUNG	682.2	534.3	78.3
CHANGKHU	480.8	316.9	65.9
CHHETRAPA	549.0	395.6	72.1
CHILANGKHA	1,172.1	836.8	71.4
CHYAMA	564.9	449.6	79.6
DANDAKHARKA	1,389.3	814.4	58.6
GAIRIMUDI	1,343.9	1,004.2	74.7
GAURISHANKAR	514.6	326.3	63.4
GHYANGSUKATHOR	1,206.9	789.4	65.4
HAWA	902.6	535.3	59.3
JAPHE	902.4	708.4	78.5
JHULE	567.1	454.2	80.1
JHYAKU	1,512.5	1,040.3	68.8
JIRI	2,276.9	1,413.7	62.1
JUGU	1,055.5	772.8	73.2
KABRE	1,167.9	1,032.0	88.4
KALINCHOK	818.5	387.3	47.3
KATAKUTI	1,126.9	1,015.6	90.1
KHARE	757.2	387.5	51.2
KHOPACHAGU	645.1	423.2	65.6
LADUK	992.2	801.4	80.8
LAKURI DANDA	1,042.5	814.5	78.1
LAMABAGAR	512.7	336.5	65.6
LAMIDANDA	751.6	621.4	82.7
LAPILANG	1,118.9	719.4	64.3
MAGAPAUWA	934.8	696.6	74.5
MALI	1,457.8	900.9	61.8
MALU	531.4	360.3	67.8
MARBU	689.5	379.4	55.0
MELUNG	782.6	528.5	67.5
MIRGE	613.9	448.2	73.0
NAMDU	1,266.2	1,087.8	85.9
ORANG	617.3	456.2	73.9
PHASKU	1,740.6	1,226.1	70.4
POWATI	1,088.8	842.5	77.4
SAILUNGESHWAR	1,227.5	927.6	75.6
SHAHARE	530.4	343.1	64.7
SUNDRAWATI	574.6	460.5	80.1
SUNKHANI	929.5	675.0	72.6
SURI	1,059.2	702.9	66.4
SUSPA CHHAMABATI	728.2	569.2	78.2
SYAMA	1,459.8	926.7	63.5
TAMCHET DUDHPOKHARI	946.3	649.5	68.6
THULOPATAL	1,395.5	902.7	64.7
DOLAKHA Total	**51,715.6**	36,633.9	70.8

3. Ramechhap

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability (ha)	Percent
BAMTI BHANDAR	1,300.8	614.3	47.2
BETALI	1,038.8	899.6	86.6
BETHAN	1,044.8	741.0	70.9
BHALUWAJOR	988.3	640.3	64.8
BHATAULI	927.9	603.1	65.0
BHIRPANI	920.9	432.2	46.9
BHUJI	876.0	541.6	61.8
BIJULIKOT	1,585.3	941.1	59.4
CHANKHU	851.8	339.5	39.9
CHISAPANI	626.4	504.8	80.6
CHUCHURE	1,179.4	672.9	57.1
DADHUWA	1,503.2	1,098.3	73.1
DEURALI	965.2	591.2	61.3
DIMIPOKHARI	980.5	656.0	66.9
DORAMBA	1,022.2	801.7	78.4
DURAGAUN	1,081.7	660.2	61.0
GAGAL BHADAURE	735.7	202.7	27.6
GELU	1,481.9	880.0	59.4
GOSHWARA	1,059.8	587.4	55.4
GOTHGAUN	632.4	398.9	63.1
GUMDEL	1,630.4	1,062.1	65.1
GUNSI	1,106.4	757.0	68.4
GUPTESHWAR	898.1	596.1	66.4
HILEDEVI	918.5	749.1	81.6
HIMGANGA	1,296.5	678.6	52.3
KATHJOR	1,196.3	850.8	71.1
KHANDADEVI	806.3	273.0	33.9
KHANIYAPANI	1,072.0	451.7	42.1
KHIMTI	966.1	636.1	65.8
KUNBHUKASTHALI	1,292.6	487.1	37.7
LAKHANPUR	1,691.8	1,179.6	69.7
MAJUWA	685.0	312.5	45.6
MAKADUM	551.8	321.6	58.3
MANTHALI	631.1	531.7	84.3
NAGDAHA	1,029.4	754.4	73.3
NAMADI	1,197.7	888.2	74.2
OKHRENI	1,036.1	597.7	57.7
PAKARBAS	1,440.0	1,023.5	71.1
PHARPU	604.2	414.0	68.5
PHULAS	1,536.5	1,146.2	74.6
PINGKHURI	622.3	274.9	44.2
PRITI	2,041.5	1,282.1	62.8
PURANAGAUN	835.1	542.0	64.9
RAKATHUM	914.7	486.1	53.1
RAMECHHAP	1,595.4	988.7	62.0
RAMPUR	1,530.8	755.3	49.3
RASANALU	1,893.0	1,426.0	75.3
SAIPU	662.0	387.1	58.5
SALU	1,124.1	871.1	77.5
SANGHUTAR	480.3	250.9	52.3
SUKAJOR	1,305.8	741.4	56.8
SUNARPANI	648.7	451.1	69.5
THOKARPUR	741.1	388.8	52.5
THOSE	1,175.0	786.4	66.9
TILPUNG	897.6	622.6	69.4
RAMECHHAP Total	**58,857.2**	36,772.3	62.5

4. Sindhuli

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability (ha)	Percent
AMALE	666.2	149.9	22.5
ARUN THAKUR	1,442.9	659.2	45.7
BAHUN TILPUNG	709.0	477.2	67.3
BALAJOR	1,316.2	807.8	61.4
BASESHWAR	604.0	338.9	56.1
BASTIPUR	709.9	206.5	29.1
BELGHARI	874.8	288.0	32.9
BHADRAKALI	1,077.3	363.1	33.7
BHIMESHWAR	373.6	179.3	48.0
BHIMSTHAN	1,549.0	531.2	34.3
BHUWANESHWARI GWALTAR	418.1	262.0	62.7
BITIJOR BAGAINCHA	684.9	382.6	55.9
DANDIGURANSE	820.0	279.1	34.0
DUDHAULI	1,074.4	834.7	77.7
DUDHBHANJYANG	742.0	420.2	56.6
HARIHARPUR GADHI	883.3	493.9	55.9
HARSAHI	470.5	367.8	78.2
HATPATE	1,199.6	561.1	46.8
JALKANYA (CHAPAULI)	357.5	254.7	71.3
JARAYOTAR	1,700.0	730.4	43.0
JHANGAJHOLI RATMATA	1,137.9	433.5	38.1
JINAKHU	1,715.0	883.0	51.5
KAKUR THAKUR	1,610.5	711.7	44.2
KALPABRIKSHA	2,282.3	315.7	13.8
KAMALAMAI MUNICIPALITY	4,562.5	1,672.9	36.7
KAPILAKOT	2,123.9	814.2	38.3
KHANGSANG	658.6	452.2	68.7
KHOLAGAUN	751.7	472.7	62.9
KUSHESHWAR (DUMJA)	1,035.9	342.7	33.1
KYANESHWAR	2,280.8	293.0	12.8
LAMPANTAR	1,202.5	620.0	51.6
MAHADEVDANDA	947.0	674.2	71.2
MAHADEVSTHAN	1,139.6	415.7	36.5
MAHENDRA LADABHIR	1,027.4	598.9	58.3
MAHENDRAJHYADI	1,099.4	515.7	46.9
MAJHUWA	548.4	296.2	54.0
NETRAKALI	732.3	218.9	29.9
NIPANE	269.7	164.9	61.1
PIPALMADI	1,278.1	848.2	66.4
PURANO JHANGAJHOLI	1,049.6	433.1	41.3
RANIBAS	522.1	451.2	86.4
RANICHAURI	2,440.1	795.0	32.6
RATANCHURA	876.7	565.6	64.5
RATNAWATI	743.6	413.6	55.6
SANTESHWARI RAMPUR	540.3	241.9	44.8
SIRTHAULI	1,034.7	605.6	58.5
SITALPATI	785.4	402.6	51.3
SUNAM POKHARI	545.7	306.9	56.2
SWALPATHANA	748.1	519.8	69.5
TAMAJOR	654.5	154.6	23.6
TANDI	1,260.7	990.7	78.6
TINKANYA	1,250.6	713.7	57.1
TOSAMKHOLA	458.0	301.3	65.8
TRIBHUWAN AMBOTE	1,354.2	702.6	51.9
SINDHULI Total	**58,341.0**	26,930.0	46.2
Grand Total	**234,688.1**	**145,409.5**	**62.0**

Annex4: Agriculture Area Suitable for Cultivation based on Land Capability and Soil Texture

1. Kavre

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability and soil texture (ha)	Percent
ANEKOT	653.9	653.9	100.0
BALTHALI	376.7	354.9	94.2
BANAKHU	456.7	438.4	96.0
BANEPA MUNICIPALITY	422.6	422.6	100.0
BEKHSIMLE	369.0	142.5	38.6
BHIMKHORI	473.0	473.0	100.0
BHUGDEU MAHANKAL	672.1	639.8	95.2
BHUMLUTAR	290.7	286.7	98.6
BIRTADEURALI	563.4	550.0	97.6
BOLDE PHEDICHE	260.1	260.1	100.0
BUDHAKHANI	277.7	277.7	100.0
CHALAL GANESHTHAN	602.5	598.2	99.3
CHANDENI MANDAN	476.7	453.2	95.1
CHAPAKHORI	314.2	314.2	100.0
CHAUBAS	622.6	622.6	100.0
CHAURI POKHARI	603.2	603.2	100.0
CHHATREBANJH	386.3	365.4	94.6
CHYAMRANGBESI	173.9	126.6	72.8
CHYASING KHARKA	370.1	342.5	92.6
DANDAGAUN	404.7	404.7	100.0
DARAUNE POKHARI	386.8	384.3	99.4
DEUBHUMI BALUWA	465.0	457.4	98.4
DEVITAR	453.3	453.3	100.0
DHULIKHEL MUNICIPALITY	783.1	783.1	100.0
DHUNGKHARKA	745.7	634.7	85.1
DHUSENI SIWALAYA	463.8	463.8	100.0
DOLALGHAT	194.7	194.7	100.0
GAIRI BISAUNA DEUPUR	436.0	426.3	97.8
GHARTICHHAP	292.3	292.3	100.0
GOKULE	466.3	466.3	100.0
GOTHPANI	862.1	862.1	100.0
HOKSE BAZAR	425.5	393.7	92.5
JAISITHOK	355.4	342.2	96.3
JYAMDI	620.4	620.2	100.0
KABHRE NITTYA CHANDESHWARI	476.9	476.9	100.0
KANPUR KALAPANI	767.1	767.1	100.0
KATTIKE DEURALI	676.2	675.6	99.9
KATUNJE BESI	241.1	241.1	100.0
KHAHARE PANGU	526.1	486.7	92.5
KHANALTHOK	529.1	529.2	100.0
KHARELTHOK	362.9	309.1	85.2
KHARPACHOK	162.0	162.0	100.0
KOLANTI	229.8	229.8	100.0
KOLANTI BHUMEDANDA	55.8	48.3	86.5
KOSHIDEKHA	198.6	198.6	100.0
KUSHADEVI	770.1	665.4	86.4
MADAN KUNDARI	316.5	316.5	100.0
MAHADEVSTHAN	1,385.9	1,355.9	97.8
MAHADEVTAR	110.5	107.3	97.1
MAHENDRA JYOTI BANSDOL	391.0	378.6	96.8

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability and soil texture (ha)	Percent
MAJHIPHEDA	635.3	635.3	100.0
MANGALTAR	210.0	210.0	100.0
MATHURAPATI PHULBARI	935.3	935.3	100.0
MECHCHHE	320.6	320.6	100.0
METHINKOT	689.4	689.4	100.0
MILCHE	214.9	194.0	90.3
NALDUNG BALUWAPATI	1,395.4	927.1	66.4
NANGRE GAGARCHE	411.4	382.2	92.9
NASIKASTHAN SANGA	614.0	493.2	80.3
NAYAGAUN	832.2	832.2	100.0
PANAUTI MUNICIPALITY	2,239.5	2,121.1	94.7
PANCHKHAL	922.0	922.0	100.0
PATLEKHET	667.5	667.5	100.0
PHALAMETAR	682.5	682.5	100.0
PHALANTE	362.6	362.6	100.0
PHOKSINGTAR	158.3	158.3	100.0
POKHARI NARAYANSTHAN	651.4	651.4	100.0
PURANOGAUN	245.0	245.0	100.0
RABI OPI	592.2	592.2	100.0
RYALE	1,236.5	1,013.8	82.0
SALDHARA	269.8	269.8	100.0
SALLE	402.2	402.2	100.0
SALME	211.1	172.8	81.8
SANKHUPATI CHAUR	322.1	322.1	100.0
SANU WANGTHALI	464.6	464.6	100.0
SAPING	995.4	729.8	73.3
SARADA BATASE	311.0	311.0	100.0
SARMATHALI	163.6	161.1	98.5
SARSUNKHARKA	633.9	633.9	100.0
SATHIGHAR BHAGAWATI	471.0	436.3	92.6
SHIKHAR AMBOTE	523.1	319.7	61.1
SIMTHALI	298.5	210.5	70.5
SIPALI CHILAUNE	228.1	228.1	100.0
SISAKHANI	81.1	81.1	100.0
SYAMPATI SIMALCHAUR	569.9	569.9	100.0
THULO PARSEL	354.1	352.1	99.4
TUKUCHA NALA	655.9	282.8	43.1
UGRACHANDI NALA	631.2	624.3	98.9
UGRATARA JANAGAL	349.5	349.5	100.0
WALTING	200.8	200.8	100.0
KAVRE Total	**45,073.3**	42,210.8	93.6

2. Dolakha

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability and soil texture (ha)	Percent
ALAMPU	178.4	178.4	100.0
BABARE	694.7	694.7	100.0
BHEDPU	966.5	960.5	99.4
BHIMESHWAR MUNICIPALITY	2,728.9	2,728.9	100.0
BHIRKOT	447.5	447.5	100.0
BHUSAPHEDI	515.7	515.7	100.0
BIGU	533.4	533.4	100.0
BOCH	554.2	554.2	100.0
BULUNG	534.3	534.3	100.0
CHANGKHU	316.9	316.9	100.0
CHHETRAPA	395.6	395.6	100.0
CHILANGKHA	836.8	836.8	100.0
CHYAMA	449.6	449.6	100.0
DANDAKHARKA	814.4	814.4	100.0
GAIRIMUDI	1,004.2	1,004.2	100.0
GAURISHANKAR	326.3	325.7	99.8
GHYANGSUKATHOR	789.4	776.7	98.4
HAWA	535.3	535.3	100.0
JAPHE	708.4	708.4	100.0
JHULE	454.2	454.2	100.0
JHYAKU	1,040.3	1,040.3	100.0
JIRI	1,413.7	1,413.8	100.0
JUGU	772.8	772.8	100.0
KABRE	1,032.0	1,032.0	100.0
KALINCHOK	387.3	387.3	100.0
KATAKUTI	1,015.6	1,015.6	100.0
KHARE	387.5	387.1	99.9
KHOPACHAGU	423.2	423.2	100.0
LADUK	801.4	801.4	100.0
LAKURI DANDA	814.5	814.4	100.0
LAMABAGAR	336.5	336.4	100.0
LAMIDANDA	621.4	621.4	100.0
LAPILANG	719.4	719.4	100.0
MAGAPAUWA	696.6	696.6	100.0
MALI	900.9	889.0	98.7
MALU	360.3	359.0	99.6
MARBU	379.4	379.4	100.0
MELUNG	528.5	513.1	97.1
MIRGE	448.2	448.2	100.0
NAMDU	1,087.8	1,087.8	100.0
ORANG	456.2	456.2	100.0
PHASKU	1,226.1	1,223.9	99.8
POWATI	842.5	832.5	98.8
SAILUNGESHWAR	927.6	927.6	100.0
SHAHARE	343.1	340.9	99.4
SUNDRAWATI	460.5	460.5	100.0
SUNKHANI	675.0	675.0	100.0
SURI	702.9	702.9	100.0
SUSPA CHHAMABATI	569.2	569.2	100.0
SYAMA	926.7	926.7	100.0
TAMCHET DUDHPOKHARI	649.5	649.5	100.0
THULOPATAL	902.7	902.7	100.0
DOLAKHA Total	**36,633.9**	36,571.0	99.8

3. Ramechhap

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability and soil texture (ha)	Percent
BAMTI BHANDAR	614.3	614.3	100.0
BETALI	899.6	899.6	100.0
BETHAN	741.0	728.3	98.3
BHALUWAJOR	640.3	640.3	100.0
BHATAULI	603.1	603.1	100.0
BHIRPANI	432.2	432.2	100.0
BHUJI	541.6	532.4	98.3
BIJULIKOT	941.1	941.1	100.0
CHANKHU	339.5	339.5	100.0
CHISAPANI	504.8	504.8	100.0
CHUCHURE	672.9	672.9	100.0
DADHUWA	1,098.3	1,098.3	100.0
DEURALI	591.2	591.2	100.0
DIMIPOKHARI	656.0	656.0	100.0
DORAMBA	801.7	801.7	100.0
DURAGAUN	660.2	649.9	98.4
GAGAL BHADAURE	202.7	202.7	100.0
GELU	880.0	880.0	100.0
GOSHWARA	587.4	587.4	100.0
GOTHGAUN	398.9	398.9	100.0
GUMDEL	1,062.1	914.3	86.1
GUNSI	757.0	724.2	95.7
GUPTESHWAR	596.1	596.1	100.0
HILEDEVI	749.1	749.1	100.0
HIMGANGA	678.6	678.6	100.0
KATHJOR	850.8	850.8	100.0
KHANDADEVI	273.0	273.0	100.0
KHANIYAPANI	451.7	451.7	100.0
KHIMTI	636.1	636.1	100.0
KUNBHUKASTHALI	487.1	485.1	99.6
LAKHANPUR	1,179.6	1,173.8	99.5
MAJUWA	312.5	312.5	100.0
MAKADUM	321.6	321.6	100.0
MANTHALI	531.7	531.7	100.0
NAGDAHA	754.4	754.4	100.0
NAMADI	888.2	888.2	100.0
OKHRENI	597.7	597.7	100.0
PAKARBAS	1,023.5	1,023.5	100.0
PHARPU	414.0	414.0	100.0
PHULAS	1,146.2	1,146.2	100.0
PINGKHURI	274.9	274.9	100.0
PRITI	1,282.1	1,280.9	99.9
PURANAGAUN	542.0	542.0	100.0
RAKATHUM	486.1	486.1	100.0
RAMECHHAP	988.7	988.7	100.0
RAMPUR	755.3	755.3	100.0
RASANALU	1,426.0	1,425.9	100.0
SAIPU	387.1	362.7	93.7
SALU	871.1	871.1	100.0
SANGHUTAR	250.9	250.9	100.0
SUKAJOR	741.4	741.4	100.0
SUNARPANI	451.1	451.1	100.0
THOKARPUR	388.8	388.8	100.0
THOSE	786.4	723.4	92.0
TILPUNG	622.6	622.6	100.0
RAMECHHAP Total	**36,772.3**	36,463.2	99.2

4. Sindhuli

VDC	Agriculture Land Area (ha)	Land suitable for cultivation based on land capability and soil texture (ha)	Percent
AMALE	149.9	149.9	100.0
ARUN THAKUR	659.2	633.2	96.0
BAHUN TILPUNG	477.2	477.2	100.0
BALAJOR	807.8	807.8	100.0
BASESHWAR	338.9	338.9	100.0
BASTIPUR	206.5	206.5	100.0
BELGHARI	288.0	288.0	100.0
BHADRAKALI	363.1	331.4	91.3
BHIMESHWAR	179.3	179.2	99.9
BHIMSTHAN	531.2	456.1	85.9
BHUWANESHWARI GWALTAR	262.0	261.9	100.0
BITIJOR BAGAINCHA	382.6	382.6	100.0
DANDIGURANSE	279.1	232.7	83.4
DUDHAULI	834.7	357.3	42.8
DUDHBHANJYANG	420.2	420.2	100.0
HARIHARPUR GADHI	493.9	493.7	100.0
HARSAHI	367.8	235.5	64.0
HATPATE	561.1	302.3	53.9
JALKANYA (CHAPAULI)	254.7	254.7	100.0
JARAYOTAR	730.4	730.1	100.0
JHANGAJHOLI RATMATA	433.5	433.4	100.0
JINAKHU	883.0	856.4	97.0
KAKUR THAKUR	711.7	699.5	98.3
KALPABRIKSHA	315.7	155.5	49.3
KAMALAMAI MUNICIPALITY	1,672.9	1,241.8	74.2
KAPILAKOT	814.2	677.7	83.2
KHANGSANG	452.2	452.1	100.0
KHOLAGAUN	472.7	472.6	100.0
KUSHESHWAR (DUMJA)	342.7	328.1	95.7
KYANESHWAR	293.0	293.0	100.0
LAMPANTAR	620.0	553.8	89.3
MAHADEVDANDA	674.2	674.2	100.0
MAHADEVSTHAN	415.7	303.7	73.1
MAHENDRA LADABHIR	598.9	399.9	66.8
MAHENDRAJHYADI	515.7	416.6	80.8
MAJHUWA	296.2	296.2	100.0
NETRAKALI	218.9	218.9	100.0
NIPANE	164.9	92.5	56.1
PIPALMADI	848.2	635.3	74.9
PURANO JHANGAJHOLI	433.1	433.0	100.0
RANIBAS	451.2	258.9	57.4
RANICHAURI	795.0	794.8	100.0
RATANCHURA	565.6	565.6	100.0
RATNAWATI	413.6	413.5	100.0
SANTESHWARI RAMPUR	241.9	241.9	100.0
SIRTHAULI	605.6	88.2	14.6
SITALPATI	402.6	402.6	100.0
SUNAM POKHARI	306.9	306.9	100.0
SWALPATHANA	519.8	519.8	100.0
TAMAJOR	154.6	154.6	100.0
TANDI	990.7	764.1	77.1
TINKANYA	713.7	713.7	100.0
TOSAMKHOLA	301.3	301.3	100.0
TRIBHUWAN AMBOTE	702.6	695.4	99.0
SINDHULI Total	**26,930.0**	23,394.7	86.9
Grand Total	**145,409.5**	138,639.7	95.3

Annex5: Agriculture Area Suitable for Cultivation by Climatic Region (Agriculture Zones)

1. Kavre

VDC	Upper temperate	Lower temperate	Sub-tropical	Tropical	Total
ANEKOT		482.7	171.2		653.9
BALTHALI		354.9			354.9
BANAKHU		106.3	332.1		438.4
BANEPA MUNICIPALITY		422.6			422.6
BEKHSIMLE	13.9	128.6			142.5
BHIMKHORI	1.4	467.1	4.5		473.0
BHUGDEU MAHANKAL	8.6	631.2			639.8
BHUMLUTAR		249.5	37.2		286.7
BIRTADEURALI		406.6	143.4		550.0
BOLDE PHEDICHE		146.8	113.4		260.1
BUDHAKHANI	8.3	267.6	1.8		277.7
CHALAL GANESHTHAN	23.6	574.6			598.2
CHANDENI MANDAN		207.8	245.4		453.2
CHAPAKHORI		268.5	45.7		314.2
CHAUBAS	88.1	534.5			622.6
CHAURI POKHARI		471.7	131.5		603.2
CHHATREBANJH		365.4			365.4
CHYAMRANGBESI	29.3	97.3			126.6
CHYASING KHARKA	23.1	319.4			342.5
DANDAGAUN		280.3	101.1	23.2	404.7
DARAUNE POKHARI		384.3			384.3
DEUBHUMI BALUWA		92.2	365.2		457.4
DEVITAR		453.3			453.3
DHULIKHEL MUNICIPALITY		783.0	0.1		783.1
DHUNGKHARKA	253.3	381.5			634.7
DHUSENI SIWALAYA		463.8			463.8
DOLALGHAT		78.5	116.2		194.7
GAIRI BISAUNA DEUPUR		290.5	135.8		426.3
GHARTICHHAP		81.1	211.2		292.3
GOKULE		215.1	237.4	13.8	466.3
GOTHPANI	11.0	821.5	29.6		862.1
HOKSE BAZAR		33.7	360.0		393.7
JAISITHOK		220.1	122.1		342.2
JYAMDI		299.2	321.0		620.2
KABHRE NITTYA CHANDESHWARI		438.4	38.5		476.9
KANPUR KALAPANI		733.1	34.0		767.1
KATTIKE DEURALI		546.3	129.3		675.6
KATUNJE BESI		140.4	100.7		241.1
KHAHARE PANGU		486.7			486.7
KHANALTHOK		472.9	56.2		529.2
KHARELTHOK		231.0	78.1		309.1
KHARPACHOK		114.0	48.0		162.0
KOLANTI		143.6	86.2		229.8
KOLANTI BHUMEDANDA		48.3			48.3
KOSHIDEKHA		102.0	96.6		198.6
KUSHADEVI	20.3	645.1			665.4
MADAN KUNDARI		241.4	75.1		316.5
MAHADEVSTHAN		158.6	1,197.3		1,355.9
MAHADEVTAR	0.5	106.8			107.3
MAHENDRA JYOTI BANSDOL		378.6			378.6

VDC	Upper temperate	Lower temperate	Sub-tropical	Tropical	Total
MAJHIPHEDA		616.6	18.7		635.3
MANGALTAR		157.9	52.1		210.0
MATHURAPATI PHULBARI		934.9	0.5		935.3
MECHCHHE		270.0	50.6		320.6
METHINKOT		558.3	131.1		689.4
MILCHE		71.9	115.6	6.5	194.0
NALDUNG BALUWAPATI		845.9	81.2		927.1
NANGRE GAGARCHE	0.3	381.8			382.2
NASIKASTHAN SANGA		493.2			493.2
NAYAGAUN		664.2	167.9		832.2
PANAUTI MUNICIPALITY		2,121.1			2,121.1
PANCHKHAL		196.2	725.8		922.0
PATLEKHET		509.4	158.1		667.5
PHALAMETAR	1.4	539.5	141.6		682.5
PHALANTE		310.6	52.0		362.6
PHOKSINGTAR		104.5	53.7		158.3
POKHARI NARAYANSTHAN		631.4	20.0		651.4
PURANOGAUN		245.0			245.0
RABI OPI		567.1	25.0		592.2
RYALE	32.0	981.7			1,013.8
SALDHARA		104.3	146.8	18.7	269.8
SALLE		401.6	0.6		402.2
SALME		45.0	119.5	8.3	172.8
SANKHUPATI CHAUR		322.1			322.1
SANU WANGTHALI	130.2	334.4			464.6
SAPING		718.1	11.7		729.8
SARADA BATASE		311.0			311.0
SARMATHALI		101.2	60.0		161.1
SARSUNKHARKA		410.5	223.4		633.9
SATHIGHAR BHAGAWATI		341.0	95.3		436.3
SHIKHAR AMBOTE	0.5	317.8	1.4		319.7
SIMTHALI	9.8	200.6			210.5
SIPALI CHILAUNE		210.9	17.2		228.1
SISAKHANI		73.8	7.3		81.1
SYAMPATI SIMALCHAUR		569.9			569.9
THULO PARSEL		237.4	114.7		352.1
TUKUCHA NALA	0.5	282.3			282.8
UGRACHANDI NALA	4.2	620.1			624.3
UGRATARA JANAGAL		349.5			349.5
WALTING	1.5	199.3			200.8
KAVRE Total	661.9	33,720.4	7,758.0	70.5	42,210.8

2. Dolakha

VDC	Upper temperate	Lower temperate	Sub-tropical	Tropical	Total
ALAMPU	100.2	78.2			178.4
BABARE	2.9	691.7			694.7
BHEDPU	193.2	666.9	100.5		960.5
BHIMESHWAR MUNICIPALITY	494.5	2,189.3	45.1		2,728.9
BHIRKOT	20.4	416.3	10.7		447.5
BHUSAPHEDI	246.8	268.9			515.7
BIGU	411.4	122.0			533.4
BOCH	184.7	369.4			554.2
BULUNG	190.5	343.8			534.3
CHANGKHU	170.9	146.1			316.9
CHHETRAPA	79.5	310.9	5.2		395.6
CHILANGKHA	492.7	344.2			836.8
CHYAMA	78.9	370.7			449.6
DANDAKHARKA	105.9	708.5			814.4
GAIRIMUDI	21.5	982.5	0.2		1,004.2
GAURISHANKAR	187.2	138.5			325.7
GHYANGSUKATHOR	216.3	505.1	55.3		776.7
HAWA	336.2	199.1			535.3
JAPHE	16.3	547.5	144.6		708.4
JHULE	209.4	244.8			454.2
JHYAKU	379.0	661.3			1,040.3
JIRI	960.8	452.9			1,413.8
JUGU	135.7	637.1			772.8
KABRE	454.2	577.8			1,032.0
KALINCHOK	106.9	280.4			387.3
KATAKUTI	438.7	577.0			1,015.6
KHARE	92.8	294.3			387.1
KHOPACHAGU	100.6	322.6			423.2
LADUK	192.7	608.7			801.4
LAKURI DANDA	567.6	246.8			814.4
LAMABAGAR	28.3	308.1			336.4
LAMIDANDA	29.4	580.0	12.0		621.4
LAPILANG	230.4	489.0			719.4
MAGAPAUWA	225.6	471.0			696.6
MALI	768.9	120.1			889.0
MALU	13.9	312.7	32.4		359.0
MARBU	118.6	260.8			379.4
MELUNG		328.8	184.3		513.1
MIRGE	75.3	372.9			448.2
NAMDU		1,081.4	6.4		1,087.8
ORANG	69.4	386.8			456.2
PHASKU	264.6	953.3	6.0		1,223.9
POWATI		791.6	40.9		832.5
SAILUNGESHWAR	600.9	326.7			927.6
SHAHARE		249.6	91.3		340.9
SUNDRAWATI	83.6	376.9			460.5
SUNKHANI	3.5	662.7	8.8		675.0
SURI	133.1	569.8			702.9
SUSPA CHHAMABATI	76.5	492.7			569.2
SYAMA	767.8	158.9			926.7
TAMCHET DUDHPOKHARI	439.0	210.6			649.5
THULOPATAL	672.3	230.4			902.7
DOLAKHA Total	11,789.4	24,038.1	743.5		36,571.0

3. Ramechhap

VDC	Upper temperate	Lower temperate	Sub-tropical	Tropical	Total
BAMTI BHANDAR	400.4	213.9			614.3
BETALI	194.9	704.8			899.6
BETHAN		515.3	213.0		728.3
BHALUWAJOR		439.0	158.2	43.0	640.3
BHATAULI		324.2	266.6	12.3	603.1
BHIRPANI		193.6	237.2	1.5	432.2
BHUJI	47.0	484.9	0.5		532.4
BIJULIKOT		859.5	81.6		941.1
CHANKHU		257.8	81.7		339.5
CHISAPANI		198.1	293.6	13.1	504.8
CHUCHURE	547.2	125.7			672.9
DADHUWA	611.6	486.7			1,098.3
DEURALI		489.5	101.7		591.2
DIMIPOKHARI	0.1	655.8			656.0
DORAMBA	271.8	529.9			801.7
DURAGAUN	102.5	547.1	0.3		649.9
GAGAL BHADAURE		158.7	44.0		202.7
GELU		556.7	320.8	2.5	880.0
GOSHWARA	358.9	228.5			587.4
GOTHGAUN		236.4	162.5		398.9
GUMDEL	777.2	137.0			914.3
GUNSI		572.8	151.4		724.2
GUPTESHWAR	478.9	117.2			596.1
HILEDEVI	37.5	681.6	29.9		749.1
HIMGANGA		397.5	273.0	8.1	678.6
KATHJOR		594.6	256.0	0.2	850.8
KHANDADEVI	6.2	266.8			273.0
KHANIYAPANI	10.3	372.5	68.9		451.7
KHIMTI		486.1	150.0		636.1
KUNBHUKASTHALI	50.7	434.4			485.1
LAKHANPUR	19.0	1,139.6	15.2		1,173.8
MAJUWA		251.8	60.7		312.5
MAKADUM		283.1	38.6		321.6
MANTHALI		33.1	419.7	78.9	531.7
NAGDAHA	1.6	752.8			754.4
NAMADI	278.9	609.0	0.4		888.2
OKHRENI		582.5	15.2		597.7
PAKARBAS		437.1	522.5	63.9	1,023.5
PHARPU	3.0	404.3	6.6		414.0
PHULAS		965.9	180.3		1,146.2
PINGKHURI	3.1	262.9	8.9		274.9
PRITI	627.3	653.7			1,280.9
PURANAGAUN	4.6	454.2	83.2		542.0
RAKATHUM		367.0	119.1		486.1
RAMECHHAP		732.9	238.7	17.0	988.7
RAMPUR		632.2	119.6	3.5	755.3
RASANALU	745.0	681.0			1,425.9
SAIPU		216.9	145.8		362.7
SALU		825.7	45.4		871.1
SANGHUTAR		101.1	149.9		250.9
SUKAJOR		640.5	64.7	36.2	741.4
SUNARPANI		219.7	231.4		451.1
THOKARPUR	108.8	280.0			388.8
THOSE	591.2	132.1			723.4
TILPUNG		378.7	243.9		622.6
RAMECHHAP Total	6,277.7	24,304.5	5,600.8	280.2	36,463.2

4. Sindhuli

VDC	Upper temperate	Lower temperate	Sub-tropical	Tropical	Total
AMALE		61.7	88.3		149.9
ARUN THAKUR		257.5	359.0	16.7	633.2
BAHUN TILPUNG		475.9	1.3		477.2
BALAJOR		146.5	661.3		807.8
BASESHWAR		81.0	168.5	89.5	338.9
BASTIPUR	1.3	141.5	63.8		206.5
BELGHARI			260.7	27.3	288.0
BHADRAKALI		101.9	217.3	12.2	331.4
BHIMESHWAR		2.5	91.9	84.7	179.2
BHIMSTHAN		232.2	182.6	41.3	456.1
BHUWANESHWARI GWALTAR		83.3	111.3	67.3	261.9
BITIJOR BAGAINCHA		83.1	279.9	19.5	382.6
DANDIGURANSE		6.7	43.0	183.0	232.7
DUDHAULI				357.3	357.3
DUDHBHANJYANG		208.0	180.2	32.0	420.2
HARIHARPUR GADHI		21.6	297.3	174.8	493.7
HARSAHI				235.5	235.5
HATPATE			139.2	163.1	302.3
JALKANYA (CHAPAULI)		246.0	8.7		254.7
JARAYOTAR		32.4	628.5	69.2	730.1
JHANGAJHOLI RATMATA		156.0	242.3	35.1	433.4
JINAKHU		327.4	528.8	0.1	856.4
KAKUR THAKUR		226.2	321.5	151.8	699.5
KALPABRIKSHA				155.5	155.5
KAMALAMAI MUNICIPALITY		91.7	768.1	382.0	1,241.8
KAPILAKOT		53.5	345.7	278.5	677.7
KHANGSANG		235.1	174.1	43.0	452.1
KHOLAGAUN	5.9	383.2	83.5		472.6
KUSHESHWAR (DUMJA)		158.2	169.9		328.1
KYANESHWAR			72.8	220.2	293.0
LAMPANTAR		120.2	432.5	1.1	553.8
MAHADEVDANDA	26.0	631.1	17.1		674.2
MAHADEVSTHAN			7.7	296.0	303.7
MAHENDRA LADABHIR				399.9	399.9
MAHENDRAJHYADI		10.2	72.5	333.9	416.6
MAJHUWA		256.1	40.0		296.2
NETRAKALI		168.6	50.3		218.9
NIPANE				92.5	92.5
PIPALMADI			7.9	627.3	635.3
PURANO JHANGAJHOLI		202.6	210.4	20.0	433.0
RANIBAS				258.9	258.9
RANICHAURI		182.4	593.2	19.3	794.8
RATANCHURA		537.2	28.4		565.6
RATNAWATI		237.2	110.8	65.5	413.5
SANTESHWARI RAMPUR		176.7	65.2		241.9
SIRTHAULI				88.2	88.2
SITALPATI		122.0	227.1	53.5	402.6
SUNAM POKHARI		188.9	113.4	4.6	306.9
SWALPATHANA	1.8	171.4	306.4	40.3	519.8
TAMAJOR	0.0	136.1	18.5		154.6
TANDI				764.1	764.1
TINKANYA		540.4	173.3		713.7
TOSAMKHOLA		298.4	2.9		301.3
TRIBHUWAN AMBOTE		289.6	405.7	0.1	695.4
SINDHULI Total	35.0	8,082.2	9,372.7	5,904.8	23,394.7
Grand Total	18,764.0	90,145.2	23,475.0	6,255.5	138,639.7

Annex6: Accessible Agriculture Lands

1. Kavre

VDC	Agriculture area (ha)Total	Accessibility situation		
		Acccessible	Likely accessible	Inaccessbile
ANEKOT	653.9	268.5	12.8	372.7
BALTHALI	354.9	286.7	2.4	65.8
BANAKHU	438.4		194.5	243.9
BANEPA MUNICIPALITY	422.6	382.4		40.2
BEKHSIMLE	142.5	23.5		119.1
BHIMKHORI	473.0	127.7		345.3
BHUGDEU MAHANKAL	639.8	369.2	59.9	210.6
BHUMLUTAR	286.7	243.1		43.6
BIRTADEURALI	550.0	265.5		284.5
BOLDE PHEDICHE	260.1	201.8		58.4
BUDHAKHANI	277.7	42.4	85.1	150.2
CHALAL GANESHTHAN	598.2	341.2		256.9
CHANDENI MANDAN	453.2	183.7		269.5
CHAPAKHORI	314.2	134.6		179.6
CHAUBAS	622.6	205.8		416.8
CHAURI POKHARI	603.2	121.0		482.2
CHHATREBANJH	365.4	169.3	13.6	182.5
CHYAMRANGBESI	126.6	24.4	42.0	60.2
CHYASING KHARKA	342.5	229.0		113.5
DANDAGAUN	404.7	114.3	71.0	219.4
DARAUNE POKHARI	384.3	279.1		105.2
DEUBHUMI BALUWA	457.4	313.6		143.8
DEVITAR	453.3	231.9	61.4	160.0
DHULIKHEL MUNICIPALITY	783.1	539.8		243.3
DHUNGKHARKA	634.7	337.8		297.0
DHUSENI SIWALAYA	463.8	374.7		89.2
DOLALGHAT	194.7	84.9		109.8
GAIRI BISAUNA DEUPUR	426.3	252.3		174.0
GHARTICHHAP	292.3		106.1	186.2
GOKULE	466.3		189.0	277.4
GOTHPANI	862.1	514.7		347.4
HOKSE BAZAR	393.7	231.1		162.6
JAISITHOK	342.2	59.7		282.5
JYAMDI	620.2	251.3		368.8
KABHRE NITTYA CHANDESHWARI	476.9	288.2		188.8
KANPUR KALAPANI	767.1	324.9		442.2
KATTIKE DEURALI	675.6	289.9		385.7
KATUNJE BESI	241.1	159.9		81.2
KHAHARE PANGU	486.7	212.8	13.4	260.6
KHANALTHOK	529.2	248.1		281.0
KHARELTHOK	309.1	238.4		70.7
KHARPACHOK	162.0	119.5		42.5
KOLANTI	229.8	149.9		79.9
KOLANTI BHUMEDANDA	48.3	3.0		45.3
KOSHIDEKHA	198.6	149.5		49.1
KUSHADEVI	665.4	246.5		418.9
MADAN KUNDARI	316.5	36.1		280.4
MAHADEVSTHAN	1,355.9	882.3		473.6
MAHADEVTAR	107.3			107.3
MAHENDRA JYOTI BANSDOL	378.6	241.1		137.5

VDC	Agriculture area (ha)Total	Accessibility situation		
		Acccessible	Likely accessible	Inaccessbile
MAJHIPHEDA	635.3	429.0		206.3
MANGALTAR	210.0	88.1		121.9
MATHURAPATI PHULBARI	935.3	489.1		446.2
MECHCHHE	320.6	125.1		195.5
METHINKOT	689.4	353.6		335.8
MILCHE	194.0	20.9	66.1	107.0
NALDUNG BALUWAPATI	927.1	290.4	63.6	573.2
NANGRE GAGARCHE	382.2	263.9		118.3
NASIKASTHAN SANGA	493.2	334.8		158.4
NAYAGAUN	832.2	455.9	97.4	278.9
PANAUTI MUNICIPALITY	2,121.1	1,555.9		565.2
PANCHKHAL	922.0	646.7		275.3
PATLEKHET	667.5	475.5		192.0
PHALAMETAR	682.5	40.8	199.5	442.2
PHALANTE	362.6	265.2		97.4
PHOKSINGTAR	158.3		23.8	134.5
POKHARI NARAYANSTHAN	651.4	300.0		351.4
PURANOGAUN	245.0	76.1	18.7	150.2
RABI OPI	592.2	483.0		109.2
RYALE	1,013.8	566.5		447.3
SALDHARA	269.8	33.0	2.0	234.8
SALLE	402.2	258.6		143.7
SALME	172.8	75.7	67.3	29.7
SANKHUPATI CHAUR	322.1	248.7		73.4
SANU WANGTHALI	464.6	218.6		245.9
SAPING	729.8	355.3		374.4
SARADA BATASE	311.0	198.5		112.5
SARMATHALI	161.1	114.3		46.8
SARSUNKHARKA	633.9	454.0		179.9
SATHIGHAR BHAGAWATI	436.3	155.2		281.1
SHIKHAR AMBOTE	319.7	135.1	40.1	144.4
SIMTHALI	210.5	167.9		42.6
SIPALI CHILAUNE	228.1	142.1		86.0
SISAKHANI	81.1	45.0		36.1
SYAMPATI SIMALCHAUR	569.9	169.1	3.1	397.7
THULO PARSEL	352.1	260.0		92.0
TUKUCHA NALA	282.8	145.7		137.2
UGRACHANDI NALA	624.3	357.2		267.1
UGRATARA JANAGAL	349.5	222.5		127.0
WALTING	200.8	93.8		107.0
KAVRE Total	**42,210.8**	21,905.8	1,433.0	18,872.0

2. Dolakha

VDC	Agriculture area (ha)Total	Accessibility situation		
		Acccessible	Likely accessible	Inaccessbile
ALAMPU	178.4	80.5		97.9
BABARE	694.7	524.3		170.4
BHEDPU	960.5	639.6		320.9
BHIMESHWAR MUNICIPALITY	2,728.9	1,708.7		1,020.2
BHIRKOT	447.5	317.0		130.4
BHUSAPHEDI	515.7	299.3	10.7	205.7
BIGU	533.4	182.3	177.8	173.2
BOCH	554.2	311.8		242.3
BULUNG	534.3	214.2	141.0	179.0
CHANGKHU	316.9	0.4		316.5
CHHETRAPA	395.6	334.3		61.3
CHILANGKHA	836.8	426.8		410.0
CHYAMA	449.6	237.0		212.6
DANDAKHARKA	814.4	391.6		422.7
GAIRIMUDI	1,004.2	259.4		744.8
GAURISHANKAR	325.7			325.7
GHYANGSUKATHOR	776.7	460.7		315.9
HAWA	535.3	295.2		240.1
JAPHE	708.4	476.1		232.3
JHULE	454.2	340.7		113.5
JHYAKU	1,040.3	62.1		978.2
JIRI	1,413.8	767.5		646.3
JUGU	772.8	550.9		221.9
KABRE	1,032.0	846.5		185.5
KALINCHOK	387.3	66.7		320.7
KATAKUTI	1,015.6	483.6		532.1
KHARE	387.1	140.0		247.1
KHOPACHAGU	423.2	0.9	270.4	152.0
LADUK	801.4	295.8		505.6
LAKURI DANDA	814.4	416.1		398.3
LAMABAGAR	336.4	194.1		142.4
LAMIDANDA	621.4	430.6		190.7
LAPILANG	719.4	422.9		296.6
MAGAPAUWA	696.6	282.8		413.8
MALI	889.0	505.0		384.0
MALU	359.0	180.3		178.7
MARBU	379.4	207.5		171.9
MELUNG	513.1	392.7		120.4
MIRGE	448.2	319.5		128.6
NAMDU	1,087.8	902.6		185.2
ORANG	456.2	355.3		100.9
PHASKU	1,223.9	878.5		345.4
POWATI	832.5	626.6		205.9
SAILUNGESHWAR	927.6	622.9		304.8
SHAHARE	340.9	264.5		76.4
SUNDRAWATI	460.5	251.0		209.5
SUNKHANI	675.0	428.8		246.2
SURI	702.9	4.4		698.5
SUSPA CHHAMABATI	569.2	438.7		130.4
SYAMA	926.7	514.6		412.1
TAMCHET DUDHPOKHARI	649.5	135.3	68.4	445.8
THULOPATAL	902.7	346.4		556.2
DOLAKHA Total	**36,571.0**	19,835.2	668.2	16,067.6

3. Ramechhap

VDC	Agriculture area (ha)Total	Accessibility situation		
		Acccessible	Likely accessible	Inaccessbile
BAMTI BHANDAR	614.3	438.9		175.5
BETALI	899.6	382.3		517.3
BETHAN	728.3	457.7		270.6
BHALUWAJOR	640.3	618.9		21.4
BHATAULI	603.1	400.7		202.4
BHIRPANI	432.2	424.8		7.4
BHUJI	532.4	232.7	167.0	132.7
BIJULIKOT	941.1	535.9	1.6	403.5
CHANKHU	339.5	218.1	17.3	104.1
CHISAPANI	504.8	501.4		3.4
CHUCHURE	672.9	494.0	96.6	82.3
DADHUWA	1,098.3	577.6		520.7
DEURALI	591.2	275.4		315.8
DIMIPOKHARI	656.0	641.9		14.1
DORAMBA	801.7	612.6	50.9	138.2
DURAGAUN	649.9	44.6	410.3	195.1
GAGAL BHADAURE	202.7	97.6	40.9	64.2
GELU	880.0	634.7		245.3
GOSHWARA	587.4	121.9		465.4
GOTHGAUN	398.9	319.3		79.6
GUMDEL	914.3	311.9	19.2	583.2
GUNSI	724.2	673.6		50.6
GUPTESHWAR	596.1	289.8	10.8	295.5
HILEDEVI	749.1	717.7		31.4
HIMGANGA	678.6	124.4		554.2
KATHJOR	850.8	751.7		99.1
KHANDADEVI	273.0	263.3	1.0	8.8
KHANIYAPANI	451.7	372.3		79.3
KHIMTI	636.1	431.8		204.3
KUNBHUKASTHALI	485.1	201.1		284.0
LAKHANPUR	1,173.8	863.9	164.6	145.3
MAJUWA	312.5	261.4	47.7	3.3
MAKADUM	321.6	244.7		76.9
MANTHALI	531.7	508.9		22.8
NAGDAHA	754.4	548.9		205.5
NAMADI	888.2	504.5		383.7
OKHRENI	597.7	353.0		244.7
PAKARBAS	1,023.5	809.3		214.2
PHARPU	414.0	297.4		116.6
PHULAS	1,146.2	820.9		325.3
PINGKHURI	274.9	142.7	66.4	65.8
PRITI	1,280.9	407.9	197.3	675.8
PURANAGAUN	542.0	421.5	27.5	92.9
RAKATHUM	486.1	390.6		95.5
RAMECHHAP	988.7	747.0		241.7
RAMPUR	755.3	576.2		179.1
RASANALU	1,425.9	831.9		594.0
SAIPU	362.7	174.9	72.3	115.5
SALU	871.1	670.0		201.1
SANGHUTAR	250.9	240.5		10.4
SUKAJOR	741.4	601.7		139.8
SUNARPANI	451.1	347.5	6.8	96.8
THOKARPUR	388.8	367.4		21.5
THOSE	723.4	328.4		395.0
TILPUNG	622.6	465.4		157.2
RAMECHHAP Total	**36,463.2**	24,094.9	1,398.2	10,970.0

4. Sindhuli

VDC	Agriculture area (ha)Total	Accessibility situation		
		Acccessible	Likely accessible	Inaccessbile
AMALE	149.9	49.2		100.7
ARUN THAKUR	633.2	88.7		544.5
BAHUN TILPUNG	477.2	145.8	94.4	236.9
BALAJOR	807.8	180.0	30.6	597.2
BASESHWAR	338.9	191.8	37.0	110.1
BASTIPUR	206.5	64.1	40.2	102.3
BELGHARI	288.0	105.6		182.4
BHADRAKALI	331.4	214.9		116.5
BHIMESHWAR	179.2	144.9		34.3
BHIMSTHAN	456.1	312.4		143.7
BHUWANESHWARI GWALTAR	261.9	90.7	30.2	141.0
BITIJOR BAGAINCHA	382.6	34.6	58.8	289.1
DANDIGURANSE	232.7	114.2		118.5
DUDHAULI	357.3	271.2		86.2
DUDHBHANJYANG	420.2	78.2	0.4	341.6
HARIHARPUR GADHI	493.7	145.6	0.1	348.0
HARSAHI	235.5	219.1		16.4
HATPATE	302.3	134.3	47.3	120.8
JALKANYA (CHAPAULI)	254.7	212.2		42.5
JARAYOTAR	730.1	415.6	9.1	305.5
JHANGAJHOLI RATMATA	433.4	222.4	34.4	176.6
JINAKHU	856.4	273.0		583.4
KAKUR THAKUR	699.5	0.0		699.5
KALPABRIKSHA	155.5	0.0	7.4	148.0
KAMALAMAI MUNICIPALITY	1,241.8	580.9		660.9
KAPILAKOT	677.7	290.6		387.1
KHANGSANG	452.1	52.2	61.7	338.2
KHOLAGAUN	472.6	101.5	76.7	294.5
KUSHESHWAR (DUMJA)	328.1	205.1		123.0
KYANESHWAR	293.0	51.4	3.8	237.9
LAMPANTAR	553.8	298.6		255.2
MAHADEVDANDA	674.2	171.8	95.6	406.8
MAHADEVSTHAN	303.7	179.2		124.4
MAHENDRA LADABHIR	399.9	184.9		215.0
MAHENDRAJHYADI	416.6	194.2	24.7	197.7
MAJHUWA	296.2	152.0	76.9	67.3
NETRAKALI	218.9	114.6		104.3
NIPANE	92.5	85.4		7.1
PIPALMADI	635.3	430.3		204.9
PURANO JHANGAJHOLI	433.0	257.9	73.0	102.1
RANIBAS	258.9	142.1		116.7
RANICHAURI	794.8	212.4		582.4
RATANCHURA	565.6	340.1		225.5
RATNAWATI	413.5	87.3	101.3	224.8
SANTESHWARI RAMPUR	241.9	1.6	22.2	218.2
SIRTHAULI	88.2	65.7		22.5
SITALPATI	402.6	189.3	16.5	196.8
SUNAM POKHARI	306.9	190.2	1.9	114.8
SWALPATHANA	519.8	145.5	85.4	288.8
TAMAJOR	154.6	10.9	66.8	76.9
TANDI	764.1	645.0		119.1
TINKANYA	713.7	170.3	15.3	528.1
TOSAMKHOLA	301.3		66.1	235.2
TRIBHUWAN AMBOTE	695.4	275.5		419.8
SINDHULI Total	**23,394.7**	**9,535.2**	**1,177.9**	**12,681.6**
Grand Total	**138,639.7**	**75,371.1**	**4,677.3**	**58,591.2**

Annex7: Accessible and Likely Accessible Agricultural Pockets by Climatic Region and VDCs

1. Kavre

VDCs	Accessible Agriculture Pockets					Likely accessible agriculture pockets				
	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total
ANEKOT	186	82			268	13				13
BALTHALI	287				287	2				2
BANAKHU						15	179			194
BANEPA MUNICIPALITY	382				382					
BEKHSIMLE	10			13	23					
BHIMKHORI	127			1	128					
BHUGDEU MAHANKAL	362			7	369	60				60
BHUMLUTAR	207	36			243					
BIRTADEURALI	229	36			266					
BOLDE PHEDICHE	96	106			202					
BUDHAKHANI	42				42	81	1		3	85
CHALAL GANESHTHAN	335			6	341					
CHANDENI MANDAN	2	182			184					
CHAPAKHORI	109	26			135					
CHAUBAS	122			84	206					
CHAURI POKHARI	94	27			121					
CHHATREBANJH	169				169	14				14
CHYAMRANGBESI	20			4	24	42				42
CHYASING KHARKA	214			15	229					
DANDAGAUN	114	0			114	16	41	14		71
DARAUNE POKHARI	279				279					
DEUBHUMI BALUWA	62	251			314					
DEVITAR	232				232	61				61
DHULIKHEL MUNICIPALITY	540				540					
DHUNGKHARKA	231			107	338					
DHUSENI SIWALAYA	375				375					
DOLALGHAT	1	84			85					
GAIRI BISAUNA DEUPUR	225	27			252					
GHARTICHHAP						10	96			106
GOKULE						20	160	9		189
GOTHPANI	474	29		11	515					
HOKSE BAZAR	28	203			231					
JAISITHOK	1	59			60					
JYAMDI	2	249			251					
KABHRE NITTYA CHANDESHWARI	278	10			288					
KANPUR KALAPANI	292	33			325					
KATTIKE DEURALI	288	2			290					
KATUNJE BESI	66	94			160					
KHAHARE PANGU	213				213	13				13
KHANALTHOK	192	56			248					
KHARELTHOK	185	53			238					
KHARPACHOK	72	47			120					
KOLANTI	112	38			150					
KOLANTI BHUMEDANDA	3				3					
KOSHIDEKHA	74	75			150					
KUSHADEVI	247				247					
MADAN KUNDARI	36	0			36					
MAHADEVSTHAN	65	818			882					
MAHENDRA JYOTI BANSDOL	241				241					

VDCs	Accessible Agriculture Pockets					Likely accessible agriculture pockets				
	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total
MAJHIPHEDA	420	9			429					
MANGALTAR	46	42			88					
MATHURAPATI PHULBARI	489	0			489					
MECHCHHE	89	36			125					
METHINKOT	250	103			354					
MILCHE		15	6		21	26	40			66
NALDUNG BALUWAPATI	290				290	64				64
NANGRE GAGARCHE	264			0	264					
NASIKASTHAN SANGA	335				335					
NAYAGAUN	395	61			456	97				97
PANAUTI MUNICIPALITY	1,556				1,556					
PANCHKHAL	166	480			647					
PATLEKHET	348	127			475					
PHALAMETAR	41				41	174	24		1	199
PHALANTE	224	41			265					
PHOKSINGTAR						23	1			24
POKHARI NARAYANSTHAN	286	14			300					
PURANOGAUN	76				76	19				19
RABI OPI	462	21			483					
RYALE	560			6	566					
SALDHARA		15	19		33		2			2
SALLE	259				259					
SALME	39	35	1		76	2	62	3		67
SANKHUPATI CHAUR	249				249					
SANU WANGTHALI	118			100	219					
SAPING	344	11			355					
SARADA BATASE	199				199					
SARMATHALI	84	31			114					
SARSUNKHARKA	317	137			454					
SATHIGHAR BHAGAWATI	149	6			155					
SHIKHAR AMBOTE	134	1			135	40				40
SIMTHALI	158			10	168					
SIPALI CHILAUNE	126	16			142					
SISAKHANI	38	7			45					
SYAMPATI SIMALCHAUR	169				169	3				3
THULO PARSEL	203	57			260					
TUKUCHA NALA	145			1	146					
UGRACHANDI NALA	353			4	357					
UGRATARA JANAGAL	223				223					
WALTING	94				94					
KAVRE Total	17,617	3,893	26	369	21,906	795	607	27	5	1,433

2. Dolakha

VDCs	Accessible Agriculture Pockets					Likely accessible agriculture pockets				
	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total
ALAMPU	42			39	81					
BABARE	524				524					
BHEDPU	441	29		169	640					
BHIMESHWAR MUNICIPALITY	1,255	13		440	1,709					
BHIRKOT	306	11			317					
BHUSAPHEDI	158			141	299	11				11
BIGU	0			182	182	45			133	178
BOCH	157			154	312					
BULUNG	175			40	214	2			139	141
CHANGKHU	0				0					
CHHETRAPA	268	5		62	334					
CHILANGKHA	315			112	427					
CHYAMA	173			64	237					
DANDAKHARKA	367			24	392					
GAIRIMUDI	259			0	259					
GHYANGSUKATHOR	299	23		140	461					
HAWA	155			140	295					
JAPHE	336	124		16	476					
JHULE	216			125	341					
JHYAKU	62			-	62					
JIRI	327			441	767					
JUGU	522			29	551					
KABRE	436			411	847					
KALINCHOK	67				67					
KATAKUTI	168			315	484					
KHARE	139			1	140					
KHOPACHAGU	1				1	192			78	270
LADUK	272			24	296					
LAKURI DANDA	132			284	416					
LAMABAGAR	188			6	194					
LAMIDANDA	393	11		26	431					
LAPILANG	307			116	423					
MAGAPAUWA	158			125	283					
MALI	85			420	505					
MALU	176	2		2	180					
MARBU	144			64	207					
MELUNG	227	165			393					
MIRGE	247			73	320					
NAMDU	897	5			903					
ORANG	338			17	355					
PHASKU	656	4		219	879					
POWATI	609	17			627					
SAILUNGESHWAR	174			449	623					
SHAHARE	224	40			265					
SUNDRAWATI	236			15	251					
SUNKHANI	422	3		3	429					
SURI	4				4					
SUSPA CHHAMABATI	370			69	439					
SYAMA	70			445	515					
TAMCHET DUDHPOKHARI				135	135	64			4	68
THULOPATAL	161			186	346					
DOLAKHA Total	13,662	454		5,720	19,835	313			355	668

3. Ramechhap

VDCs	Accessible Agriculture Pockets					Likely accessible agriculture pockets				
	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total
BAMTI BHANDAR	166			272	439					
BETALI	382				382					
BETHAN	390	68			458					
BHALUWAJOR	436	140	43		619					
BHATAULI	179	210	12		401					
BHIRPANI	193	231	1		425					
BHUJI	199			34	233	167	0			167
BIJULIKOT	492	44			536	2				2
CHANKHU	148	70			218	17				17
CHISAPANI	196	292	13		501					
CHUCHURE	117			377	494				97	97
DADHUWA	320			258	578					
DEURALI	188	88			275					
DIMIPOKHARI	642			0	642					
DORAMBA	362			251	613	51				51
DURAGAUN	18	0		26	45	385	0		25	410
GAGAL BHADAURE	55	42			98	41				41
GELU	464	168	2		635					
GOSHWARA	58			63	122					
GOTHGAUN	236	84			319					
GUMDEL	63			249	312	2			17	19
GUNSI	565	109			674					
GUPTESHWAR	90			200	290	11				11
HILEDEVI	670	24		24	718					
HIMGANGA	124				124					
KATHJOR	505	247	0		752					
KHANDADEVI	257			6	263	1				1
KHANIYAPANI	300	68		4	372					
KHIMTI	306	126			432					
KUNBHUKASTHALI	179			22	201					
LAKHANPUR	837	10		18	864	164			1	165
MAJUWA	203	59			261	48				48
MAKADUM	240	5			245					
MANTHALI	32	398	79		509					
NAGDAHA	547			2	549					
NAMADI	378			126	504					
OKHRENI	353				353					
PAKARBAS	381	365	64		809					
PHARPU	291	6			297					
PHULAS	680	141			821					
PINGKHURI	131	9		3	143	66				66
PRITI	81			327	408	153			44	197
PURANAGAUN	352	65		5	422	28				28
RAKATHUM	310	81			391					
RAMECHHAP	630	106	12		747					
RAMPUR	511	62	3		576					
RASANALU	516			316	832					
SAIPU	51	124			175	72				72
SALU	634	36			670					
SANGHUTAR	98	143			241					
SUKAJOR	532	34	36		602					
SUNARPANI	193	155			347		7			7
THOKARPUR	272			95	367					
THOSE	105			224	328					
TILPUNG	293	173			465					
RAMECHHAP Total	16,949	3,981	265	2,901	24,095	1,207	7		183	1,398

4. Sindhuli

VDCs	Accessible Agriculture Pockets					Likely accessible agriculture pockets				
	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total	Lower temperate	Sub-tropical	Tropical	Upper temperate	Total
AMALE	7	42			49					
ARUN THAKUR	2	84	3		89					
BAHUN TILPUNG	146				146	93	1			94
BALAJOR		180			180	31				31
BASESHWAR		110	82		192	28	9			37
BASTIPUR	9	54		1	64	36	4			40
BELGHARI		106			106					
BHADRAKALI	65	138	12		215					
BHIMESHWAR		61	84		145					
BHIMSTHAN	130	142	41		312					
BHUWANESHWARI GWALTAR		25	65		91		29	1		30
BITIJOR BAGAINCHA		15	19		35	33	25			59
DANDIGURANSE		1	113		114					
DUDHAULI			271		271					
DUDHBHANJYANG		68	10		78		0			0
HARIHARPUR GADHI	4	110	31		146			0		0
HARSAHI			219		219					
HATPATE		67	67		134		36	11		47
JALKANYA (CHAPAULI)	212	0			212					
JARAYOTAR	19	334	63		416	7	2			9
JHANGAJHOLI RATMATA	63	129	31		222	34				34
JINAKHU	1	272	0		273					
KAKUR THAKUR			0		0					
KALPABRIKSHA			0		0			7		7
KAMALAMAI MUNICIPALITY	3	396	182		581					
KAPILAKOT	45	128	118		291					
KHANGSANG		10	42		52	38	24			62
KHOLAGAUN	93	2		6	101	76	1			77
KUSHESHWAR (DUMJA)	55	150			205					
KYANESHWAR			51		51			4		4
LAMPANTAR	20	278	1		299					
MAHADEVDANDA	161			11	172	96			0	96
MAHADEVSTHAN		0	179		179					
MAHENDRA LADABHIR			185		185					
MAHENDRAJHYADI			194		194			25		25
MAJHUWA	125	27			152	75	2			77
NETRAKALI	68	47			115					
NIPANE			85		85					
PIPALMADI			430		430					
PURANO JHANGAJHOLI	89	156	12		258	73				73
RANIBAS			142		142					
RANICHAURI	3	191	18		212					
RATANCHURA	326	14			340					
RATNAWATI		23	64		87	87	14			101
SANTESHWARI RAMPUR		2			2	8	14			22
SIRTHAULI			66		66					
SITALPATI	36	100	53		189	3	13			17
SUNAM POKHARI	116	70	4		190	2				2
SWALPATHANA		106	40		146		85			85
TAMAJOR	9	2			11	56	11			67
TANDI			645		645					
TINKANYA	170				170	15	0			15
TOSAMKHOLA						66	0			66
TRIBHUWAN AMBOTE	19	257	0		276					
SINDHULI Total	1,994	3,897	3,626	18	9,535	857	273	48	0	1,178
Grand Total	**50,221**	**12,225**	**3,917**	**9,008**	**75,371**	**3,172**	**887**	**74**	**543**	**4,677**

Annex8: VDC Level Information by Accessible and Likely Accessible Area by Climatic Region

1. Kavre

Raod Code	Road Name	Length (Km)	Climatic Zones	No.of Pockets	Area (Ha)
24DR001	Mane Dhovan-Ranikot - Surya Binayak	4.3	Accessible Lower Temperate	18	269.064
			Accessible Upper Temperate	3	5.407
Total				**21**	**274.471**
24DR002	Namobuddha - Sankhu - Panauti - Kushadevi - Rayale - Gwarko (Lalitpur)	19.6	Accessible Lower Temperate	16	820.325
Total				**16**	**820.325**
24DR003	Sanga - Aashapuri - Ryale	9.4	Accessible Lower Temperate	9	283.464
Total				**9**	**283.464**
24DR004	Nala - Ghimire Gaun - Nagarkot	10	Accessible Lower Temperate	7	115.737
Total				**7**	**115.737**
24DR005	BhaisepatiPanauti (Sanga) - Basdol (Mahendrajyoti) -	7.3	Accessible Lower Temperate	7	430.953
Total				**7**	**430.953**
24DR006	Nagarkot(Kavrechock) - Garibisuna - Hinguawapati - Jogitar - Jyamdi - Dolalghat	38.9	Accessible Lower Temperate	13	2.896
			Accessible Sub-tropical	25	507.978
Total				**38**	**510.874**
24DR007	Kuntabesi - Nayagaun - Nagarkot	18.2	Accessible Lower Temperate	11	947.681
			Accessible Sub-tropical	18	479.924
			Likely Accessible Lower Temperate	2	0.619
Total				**31**	**1428.224**
24DR008	Dhulikhel - Raviopi - Nagarkot	11.4	Accessible Lower Temperate	4	228.044
			Accessible Upper Temperate	2	4.504
Total				**6**	**232.548**
24DR009	Banepa - Raviopi - Panchkhal	14.5	Accessible Lower Temperate	4	474.948
			Accessible Sub-tropical	7	170.543
Total				**11**	**645.491**
24DR010	Panauti - Malpi - Kolati Bhumidanda	6	Accessible Lower Temperate	5	148.563
Total				**5**	**148.563**
24DR011	Khopasi - Dhungkharka - Chyamrangbesi - Milche Borang	18.4	Accessible Lower Temperate	40	713.954
			Accessible Upper Temperate	12	112.792
			Likely Accessible Lower Temperate	27	63.661
			Likely Accessible Sub-tropical	3	33.809
Total				**82**	**924.216**
24DR012	Ravi Opi (Dundamukh) - Devitar - Anekot (Ghumauni Chour) - Nayagaun	13.2	Accessible Lower Temperate	7	294.911
			Likely Accessible Lower Temperate	4	0.339
Total				**11**	**295.25**

Raod Code	Road Name	Length (Km)	Climatic Zones	No.of Pockets	Area (Ha)
			Accessible Lower Temperate	4	186.531
			Accessible Sub-tropical	1	0.637
24DR013	Samajkalyan (Panchkhal) - Anekot - Nagarkot	7.5	Likely Accessible Lower Temperate	6	186.581
Total				**11**	**373.749**
			Accessible Lower Temperate	57	1206.571
			Accessible Sub-tropical	23	59.595
			Accessible Tropical	9	24.793
			Accessible Upper Temperate	9	20.885
			Likely Accessible Lower Temperate	4	84.677
24DR014	Khopasi - Kamidanda - Taaldhunga	59.1	Likely Accessible Sub-tropical	2	0.046
Total				**104**	**1396.567**
			Accessible Lower Temperate	30	260.906
24DR015	Katunjebesi - Sikhar Ambote - Roshikinar - Panauti	7.1	Likely Accessible Lower Temperate	29	104.74
Total				**59**	**365.646**
	Chyalti - Falametar - Taal(Makwanpur) Dhunga - Bhorleni	7	Accessible Lower Temperate	4	12.796
			Accessible Sub-tropical	2	0.045
			Accessible Tropical	1	0.108
			Accessible Upper Temperate	1	4.973
			Likely Accessible Lower Temperate	16	78.196
			Likely Accessible Sub-tropical	28	60.036
			Likely Accessible Tropical	2	3.798
24DR016			Likely Accessible Upper Temperate	1	1.405
Total				**55**	**161.357**
			Accessible Sub-tropical	12	50.754
			Likely Accessible Sub-tropical	31	451.374
24DR017	Milche Borang Danda - Taal Dhunga - Banakhu	29.1	Likely Accessible Tropical	6	21.741
Total				**49**	**523.869**
	Kavrebhanjyang - Faskot - Inte - Sankhu Fendi - Shyampati Kuru Gaun - Bhalu	12.1	Accessible Lower Temperate	8	190.522
24DR018	Kharka - Baseri		Accessible Sub-tropical	3	7.485
Total				**11**	**198.007**
24DR019	BP Highway - Sharda Batase - Inte	2.7	Accessible Lower Temperate	3	9.909
Total				**3**	**9.909**
	Kavrebhangyang - Dapcha - Pipaltar - Sikhar Ambote - Sanjhakot - Tara Khase	24.6	Accessible Lower Temperate	42	990.542
	LekhGokule		Accessible Sub-tropical	2	1.448
			Likely Accessible Lower Temperate	14	61.479
24DR020			Likely Accessible Sub-tropical	1	0.547
Total				**59**	**1054.016**

Raod Code	Road Name	Length (Km)	Climatic Zones	No.of Pockets	Area (Ha)
24DR021	Kamidanda Bhanjyang - Medhamsu - Falamsangu - Sikhar Ambote - Mahadevtar - Sisakhani(Pota Dhovan)	24.5	Accessible Lower Temperate	4	31.634
			Accessible Sub-tropical	1	0.737
Total				**5**	**32.371**
24DR022	Katunje - Sipali - Budakhani - Banakhu	20.9	Accessible Lower Temperate	36	121.026
			Accessible Sub-tropical	7	17.337
			Likely Accessible Lower Temperate	24	71.124
			Likely Accessible Sub-tropical	8	38.546
Total				**75**	**248.033**
24DR023	Katunje - Thalibesi - Kharpachock - Kalinchock - Sungure - Sipali Bhanjyang	15	Accessible Lower Temperate	17	136.043
			Likely Accessible Lower Temperate	15	12.86
			Likely Accessible Upper Temperate	1	3.316
Total				**33**	**33**
24DR024	Bhakunde - Pokhari Narayansthan - Mechhe	30.4	Accessible Lower Temperate	25	766.029
Total				**91**	**951.248**
24DR025	Tinpiple - Kalchhe - Bela (BPHighway)	9.9	Accessible Lower Temperate	4	59.011
			Accessible Sub-tropical	4	179.505
Total				**8**	**238.516**
24DR026	Tinpiple - Baluwa - Bhedabhari	11.8	Accessible Lower Temperate	2	19.934
			Accessible Sub-tropical	12	158.418
Total				**14**	**178.352**
24DR027	Panchkhal - Bohere Dhovan - Timalbsi - Thulo Parsel	30.6	Accessible Lower Temperate	3	14.957
			Accessible Sub-tropical	16	309.856
Total				**19**	**324.813**
24DR028	Bohore Dovan - Aadha Bato - Sarsyunkharka (Danda Gaun) - Saramthali - Maur	19.1	Accessible Lower Temperate	16	574.269
			Accessible Sub-tropical	4	6.422
Total				**20**	**580.691**
24DR029	Palanchowk - Kharelthok - Koshi Dekha	10	Accessible Lower Temperate	19	629.972
			Accessible Sub-tropical	18	88.187
Total				**37**	**718.159**
24DR030	Mamti - TitretarDolalghat - Chopatar - Thulo Parshel -	20	Accessible Lower Temperate	10	287.742
			Accessible Sub-tropical	39	400.974
Total				**49**	**688.716**
24DR031	Piple Deurali - Chisapani - Ghyangdanda Bhimkhori) - Betini - Ahale Banspur	13.2	Accessible Lower Temperate	15	107.318
Total				**15**	**107.318**

Raod Code	Road Name	Length (Km)	Climatic Zones	No.of Pockets	Area (Ha)
		30.2	Accessible Lower Temperate	11	1120.443
24DR032	Dolalghat - Falante - Kolati - Birta Deurali - Gothpani - Kattike Deurali - Madank		Accessible Sub-tropical	16	189.447
Total				**27**	**1309.89**
	Dolalghat - Sallebhumlu - Chaubas - Lauredeurali - Nagregagarche	38.7	Accessible Lower Temperate	41	846.927
			Accessible Sub-tropical	3	16.33
24DR033			Accessible Upper Temperate	17	169.588
Total				**61**	**1032.845**
			Accessible Lower Temperate	9	503.129
24DR034	Dolalghat - Saping - Simthali - Bekhsimle	23.8	Accessible Sub-tropical	2	0.894
Total				**11**	**504.023**
			Accessible Lower Temperate	16	919.673
24DR035	Kolati - Dhadkharka - Pokhari Chauri - Gurase	14.4	Accessible Sub-tropical	7	6.996
Total				**23**	**926.669**
			Accessible Lower Temperate	22	142.637
24DR036	Chiuribas (Mangaltar) - Dandakharka - Budakhani (Killa)	15.5	Accessible Sub-tropical	2	0.479
Total				**24**	**143.116**
			Accessible Lower Temperate	20	421.058
24DR037	Chaubas - Gumpati - Salambu Kafle - Kilpubagar	20.6	Accessible Sub-tropical	11	54.98
Total				**31**	**476.038**
Araniko			Accessible Lower Temperate	12	764.926
Total				**12**	**764.926**
			Accessible Lower Temperate	10	12.514
H06	BP Highway		Accessible Sub-tropical	5	289.408
Total				**15**	**301.922**
F029	Banepa - Khopasi	9.54	Accessible Lower Temperate	3	107.739
Total				**3**	**107.739**
F030	Panchkhal - Melamchi - Helembu	10.63	Accessible Lower Temperate	3	204.8
Total				**3**	**204.8**
F073	Bakhundol(ARM) - Bogatigaun(Ktm University Road	2	Accessible Lower Temperate	3	5.956
Total				**3**	**5.956**
			Accessible Lower Temperate	15	1074.44
F097	Amaldol - Nala - Banepa	4.73	Accessible Sub-tropical	42	427.641
Total				**57**	**1502.081**
			Accessible Lower Temperate	57	1523.369
F098			Accessible Sub-tropical	52	274.141
Total				**109**	**1797.51**
Grand Total				**1307**	**23338.97**

2. Dolakha

Road Code	Road Name	Length (Km)	Climatic Zone	No. of Pockets	Total Area (Ha)	Remarks
22DR001	Bhorle - Jaintipur - Marbu	16	Accessible Lower Temperate	56	519.09	
			Accessible Upper Temperate	14	98.19	
Total				**70**	**617.27**	
22DR002	Singati - Bulung - Gagar	18.5	Accessible Lower Temperate	51	943.89	
			Accessible Sub-tropical	2	3.16	
			Accessible Upper Temperate	15	104.15	
			Likely Accessible Lower Temperate	3	2.03	
			Likely Accessible Upper Temperate	5	140.40	
Total				**76**	**1193.63**	
22DR003	Singati - Sorung Sangwa	7.07	Accessible Lower Temperate	50	450.11	
			Accessible Sub-tropical	2	2.28	
			Accessible Upper Temperate	13	342.92	
Total				**65**	**795.31**	
22DR004	Sunkhani - Sangwa	28.92	Accessible Lower Temperate	33	1090.55	
			Accessible Upper Temperate	5	141.93	
			Likely Accessible Lower Temperate	2	45.52	
			Likely Accessible Upper Temperate	5	62.61	
Total				**45**	**1340.61**	
22DR005	Kalinchok - Bigu	7.5	Accessible Lower Temperate	8	19.39	
			Accessible Upper Temperate	1	3.24	
			Likely Accessible Lower Temperate	10	202.04	
			Likely Accessible Upper Temperate	6	147.74	
Total				**25**	**372.41**	
22DR006	Namdu - Jugu - Jhyaku - Bhorle	28.23	Accessible Lower Temperate	119	2096.01	
			Accessible Sub-tropical	36	16.20	
			Accessible Upper Temperate	50	400.31	
Total				**205**	**2512.51**	
22DR007	Makaibari - Deurali - Panighat - Kshemawati	9	Accessible Lower Temperate	23	257.14	
			Accessible Upper Temperate	17	242.65	
Total				**40**	**499.79**	
22DR008	Busti - Putalikath - Thulopatal - Laharemane	15	Accessible Lower Temperate	35	408.38	
			Accessible Upper Temperate	30	149.40	
Total				**65**	**557.78**	
22DR009	Khawa - Chhaude	19.3	Accessible Lower Temperate	14	72.78	
			Accessible Upper Temperate	54	302.47	
Total				**68**	**375.25**	

Road Code	Road Name	Length (Km)	Climatic Zone	No. of Pockets	Total Area (Ha)	Remarks
22DR010	Bhirkot - Gairimudi - Chhaude - Hawa	25	Accessible Lower Temperate	38	801.85	
			Accessible Upper Temperate	13	85.43	
Total				**51**	**887.28**	
22DR011	Bhirkot - Sahare - Hawa - Jiri	34	Accessible Lower Temperate	110	1025.45	
			Accessible Sub-tropical	35	76.80	
			Accessible Upper Temperate	61	232.88	
Total				**206**	**1335.13**	
22DR012	Ghyawapani - Sera - Surke - Nigale	15	Accessible Lower Temperate	19	310.38	
			Accessible Upper Temperate	10	73.54	
Total				**29**	**383.92**	
22DR013	Nayapul - Pawati - Dandakharka	28	Accessible Lower Temperate	50	1467.86	
			Accessible Sub-tropical	94	253.64	
			Accessible Upper Temperate	11	68.84	
Total				**155**	**1790.33**	
22DR014	Mude - Melung - Sitali	51	Accessible Lower Temperate	74	1506.69	
			Accessible Sub-tropical	9	80.11	
			Accessible Upper Temperate	102	1578.18	
Total				**185**	**3164.97**	
22DR015	Nigale - Bagkhor - Bhusafeda - Tamchet - Dudhpokhari	14	Accessible Lower Temperate	5	107.65	
			Accessible Upper Temperate	8	88.34	
			Likely Accessible Lower Temperate	2	64.41	
			Likely Accessible Upper Temperate	1	4.44	
Total				**16**	**264.85**	
16	Bhimeshor-Katakuti		Accessible Lower Temperate	28	425.49	No Code in Map
			Accessible Upper Temperate	2	6.11	
Total				**30**	**431.59**	
17	Mude-Charikot-Jiri-Mali		Accessible Lower Temperate	69	948.82	
			Accessible Sub-tropical	14	11.26	
			Accessible Upper Temperate	166	1623.48	
Total				**249**	**2583.56**	
18	Charikot-Singati		Accessible Lower Temperate	46	1053.32	
			Accessible Sub-tropical	8	10.82	
			Accessible Upper Temperate	8	85.20	
Total				**62**	**1149.33**	
F033	Jiri-Those (Dolakha Part)		Accessible Lower Temperate	81	157.39	
			Accessible Upper Temperate	39	91.07	
Total				**120**	**248.46**	
Grand Total				**1762**	**20503.98**	

3. Ramechap

District Roads

Road Code	Road Name	Length	Climatic Zones	No. of Pockets	Area (Ha)
			Accessible Lower Temperate	45	884.45
			Accessible Sub-tropical	1	53.72
			Accessible Upper Temperate	22	271.53
21DR001	Devitar-Doramba-Paseban-Koilibagar	50.50	Likely Accessible Lower Temperate	1	0.01
Total				**69**	**1209.71**
			Accessible Lower Temperate	40	1632.04
			Accessible Sub-tropical	37	215.97
21DR002	Manthali-Galba-Chauri	65.00	Accessible Tropical	15	35.26
Total				**92**	**1883.27**
			Accessible Lower Temperate	7	695.17
			Accessible Sub-tropical	28	71.96
21DR003	Khairenighat-Bethan-Galba	30.00	Accessible Upper Temperate	7	17.93
Total				**42**	**785.05**
			Accessible Lower Temperate	8	381.47
			Accessible Sub-tropical	11	24.55
21DR004	Khairenighat-Galba-Doramba-Kholakharka	36.35	Accessible Upper Temperate	12	230.26
Total				**31**	**636.29**
21DR005	Puditar-Tharbhanjyang-Alchidhunga	21.12	Accessible Lower Temperate	24	216.54
Total				**24**	**216.54**
			Accessible Lower Temperate	7	64.13
21DR006	Chauri(Bangebeshi)-Gunsi-Bhadaure-Guranse	12.48	Accessible Sub-tropical	15	104.25
Total				**22**	**168.38**
			Accessible Lower Temperate	16	291.00
			Accessible Sub-tropical	9	103.04
21DR007	Khairenighat-Khanyapani-Danse-Sunapati-Dogma	23.45	Accessible Upper Temperate	8	14.97
Total				**33**	**409.00**
			Accessible Lower Temperate	20	202.08
			Accessible Upper Temperate	13	9.70
			Likely Accessible Lower Temperate	33	784.67
			Likely Accessible Sub-tropical	4	6.67
21DR008	Goganpani-Sunarkhop-Majhuwa	7.78	Likely Accessible Upper Temperate	6	139.24
Total				**76**	**1142.36**
			Accessible Lower Temperate	10	177.21
21DR009	Majhuwa (Dadhuwa)-Nigalbas-Timu	19.48	Accessible Upper Temperate	6	156.27
Total				**16**	**333.49**

Road Code	Road Name	Length	Climatic Zones	No. of Pockets	Area (Ha)
			Accessible Lower Temperate	3	142.14
21DR010	Sitkha-Goganpani-Dhulebesi	15.20	Accessible Sub-tropical	2	69.27
Total				**5**	**211.41**
21DR011	Bhatauli-Dhulebesi-Mahakalsthan (Gagal)	23.30	Accessible Sub-tropical	18	44.99
Total				**18**	**44.99**
			Accessible Lower Temperate	1	164.08
21DR012	Sathimure-Kalleri-Pinkhuri (Gothdanda)	8.00	Accessible Sub-tropical	23	51.59
Total				**24**	**215.67**
			Accessible Lower Temperate	3	190.32
21DR013	Manthali-Chisapani-Puranagaun (Healthpost)-Thanapati	12.50	Accessible Sub-tropical	4	123.47
Total				**7**	**313.80**
			Accessible Lower Temperate	3	129.14
21DR014	Manthali-Chanakhu Gabisa Bhawan-Pokharidanda	13.72	Accessible Sub-tropical	10	132.88
Total				**13**	**262.01**
			Accessible Lower Temperate	10	253.41
			Accessible Sub-tropical	6	161.49
21DR015	Manthali-Gelu-Pokhari Danda	17.00	Accessible Tropical	3	4.32
Total				**19**	**419.22**
			Accessible Lower Temperate	23	1102.89
			Accessible Sub-tropical	6	0.03
21DR016	Khimti-Betali-Dharapani	34.50	Accessible Upper Temperate	9	28.13
Total				**38**	**1131.05**
			Accessible Lower Temperate	13	27.03
			Accessible Upper Temperate	8	175.85
21DR017	Shivalaya-Garjang-Sangbadanda	12.50	Likely Accessible Upper Temperate	2	10.02
Total				**23**	**212.89**
			Accessible Lower Temperate	3	0.92
21DR018	Deurali-Serdang-Gumdel	23.00	Accessible Upper Temperate	10	189.35
Total				**13**	**190.26**
			Accessible Lower Temperate	13	564.71
21DR019	Salu-Dhobi-Base-Bamti	54.39	Accessible Upper Temperate	54	188.58
Total				**67**	**753.29**
			Accessible Lower Temperate	8	230.45
			Accessible Upper Temperate	19	270.36
			Likely Accessible Lower Temperate	7	167.07
21DR020	Dilauri-Sabra-Kaileshor-Bamti	48.66	Likely Accessible Upper Temperate	1	0.26
Total				**35**	**668.14**

Road Code	Road Name	Length	Climatic Zones	No. of Pockets	Area (Ha)
			Accessible Lower Temperate	2	21.13
21DR021	Those-Singati-Priti	26.00	Accessible Upper Temperate	11	194.46
Total				**13**	**215.60**
			Accessible Lower Temperate	5	85.90
21DR022	Rasnalu-Bhitrikhani-Gupteshwor-Kaileshwor-Dhungebhir-E	23.35	Accessible Upper Temperate	41	470.90
Total				**46**	**556.81**
			Accessible Lower Temperate	12	131.94
21DR023	Yonjantole-Pharpu Gabisa Bhawan	4.98	Accessible Sub-tropical	5	6.29
Total				**17**	**138.23**
			Accessible Lower Temperate	23	909.19
21DR025	Haldebesi-Dhobi-Dhadebesi	36.00	Accessible Sub-tropical	22	264.68
Total				**45**	**1173.86**
			Accessible Lower Temperate	13	401.67
			Accessible Sub-tropical	9	106.06
21DR026	Manthali-Kathajor-Dhobi	22.00	Accessible Upper Temperate	2	1.54
Total				**24**	**509.27**
			Accessible Lower Temperate	1	293.03
21DR027	Manthali-Sunarpani	8.50	Accessible Sub-tropical	5	135.10
Total				**6**	**428.13**
			Accessible Lower Temperate	1	182.16
21DR028	Manthali-Bhaluwajor	11.06	Accessible Sub-tropical	14	13.83
Total				**15**	**195.99**
			Accessible Lower Temperate	2	90.81
21DR029	Manthali-Raltar-Samalithan (Salu)	12.00	Accessible Sub-tropical	9	73.04
Total				**11**	**163.85**
			Accessible Lower Temperate	11	155.07
21DR030	Kukurkatte Bhanjyang-Gothgaun-Sirise	17.28	Accessible Sub-tropical	24	49.90
Total				**35**	**204.96**
21DR031	Ramechhap-Bhalukhop-Okhreni-Himganga	15.00	Accessible Lower Temperate	15	317.21
Total				**15**	**317.21**
			Accessible Lower Temperate	7	474.08
			Accessible Sub-tropical	6	22.27
21DR032	Ramechhap-Rampur-Kolunjorghat	23.00	Accessible Tropical	4	1.54
Total				**17**	**497.89**
			Accessible Lower Temperate	2	55.06
			Accessible Sub-tropical	4	30.30
21DR033	Ramechhap-Birtaghat	11.74	Accessible Tropical	2	34.85
Total				**8**	**120.21**
Sub-total				**919**	**15728.81**

Village Roads

Road Code	Road Name	Length	Climatic Zones	No. of Pockets	Area (Ha)
21VR001	Pharpu Gabisa Bhawan-Base-Bhitrikhani	3.40	Accessible Lower Temperate	5	219.54
Total				**5**	**219.54**
			Accessible Lower Temperate	5	116.28
21VR002	Namadi-Munadevi-Base	5.98	Accessible Upper Temperate	3	66.69
Total				**8**	**182.97**
			Accessible Lower Temperate	1	76.21
21VR003	Bhitrikhani-Bhuji Koldaka	14.50	Accessible Upper Temperate	13	33.85
Total				**14**	**110.07**
			Accessible Upper Temperate	15	43.00
21VR004	Dhaule-Khahare	4.25	Likely Accessible Upper Temperate	7	5.06
Total				**22**	**48.06**
			Accessible Lower Temperate	17	131.63
			Accessible Upper Temperate	14	162.09
			Likely Accessible Lower Temperate	1	0.01
21VR005	Bhandar-Sano Balding-Chari-Chyauke	5.50	Likely Accessible Upper Temperate	3	28.57
Total				**35**	**322.30**
			Accessible Lower Temperate	6	124.54
21DRVR007	Sotarmu-Bamti	8.95	Accessible Upper Temperate	1	0.47
Total				**7**	**125.01**
			Accessible Lower Temperate	1	0.25
21VR008	Saipu Danda-Pipalchaur	5.00	Likely Accessible Lower Temperate	7	123.19
Total				**8**	**123.44**
			Accessible Lower Temperate	7	397.71
21VR009	Shivalaya-Dhobi	14.14	Accessible Sub-tropical	5	25.00
Total				**12**	**422.71**
			Accessible Lower Temperate	1	1.09
21VR010	Dihi-Thulibar	5.59	Accessible Sub-tropical	3	64.00
Total				**4**	**65.08**
21VR011	Bhutekhola-Tekanpur	6.40	Accessible Sub-tropical	5	130.14
Total				**5**	**130.14**
			Accessible Lower Temperate	8	148.19
			Accessible Sub-tropical	27	81.37
21VR012	Manthali-Arhcale	10.50	Likely Accessible Sub-tropical	1	0.44
Total				**36**	**230.00**

Road Code	Road Name	Length	Climatic Zones	No. of Pockets	Area (Ha)
			Accessible Lower Temperate	3	40.08
21VR013	Gothgaun-Dhuseni	3.85	Accessible Sub-tropical	5	55.65
Total				**8**	**95.72**
			Accessible Lower Temperate	3	127.34
21VR014	Gothpapani-Baghkhordanda	9.26	Accessible Sub-tropical	3	49.31
Total				**6**	**176.65**
21VR015	Bankimeri-Sanghutar	4.44	Accessible Sub-tropical	4	9.51
Total				**4**	**9.51**
21VR016	Bhalukhop-Gaitar-Chyaukethati	6.12	Accessible Lower Temperate	3	123.99
Total				**3**	**123.99**
			Accessible Lower Temperate	6	194.30
			Accessible Sub-tropical	8	39.39
21VR017	Sukajor-Rampur-Basantapur (To Dhaneghat)	7.75	Accessible Tropical	6	0.36
Total				**20**	**234.05**
21VR018	Ramechhap-Dhaneghat	4.30	Accessible Lower Temperate	2	45.05
Total				**2**	**45.05**
			Accessible Lower Temperate	5	120.45
21VR020	Sunarpani-Ramechhap	11.50	Accessible Sub-tropical	16	20.79
Total				**21**	**141.24**
21VR021	Ramechhap-Plastikpokhari-Bhaluwajot	5.30	Accessible Lower Temperate	3	76.05
Total				**3**	**76.05**
			Accessible Lower Temperate	5	114.50
21VR022	Manthali-Babiyakharka	9.53	Accessible Sub-tropical	7	40.70
Total				**12**	**155.19**
			Accessible Lower Temperate	6	142.43
21VR023	Hulakdanda-Manthali	10.04	Accessible Sub-tropical	12	33.46
Total				**18**	**175.89**
			Accessible Lower Temperate	1	9.77
21VR024	Pakarbas-Sannegaun-Madimuhan	4.72	Accessible Sub-tropical	3	16.47
Total				**4**	**26.24**
			Accessible Sub-tropical	7	24.41
21VR025	Bhatauli-Mugitar-Pakarbas 4-Phedi-Triveni	6.76	Accessible Tropical	11	62.05
Total				**18**	**86.46**
21VR027	Manthali-Chisapani	6.85	Accessible Sub-tropical	5	70.86
Total				**5**	**70.86**

Road Code	Road Name	Length	Climatic Zones	No. of Pockets	Area (Ha)
21VR028	Bhatauli-Tunibote-Kaucheni	3.85	Accessible Lower Temperate	4	35.71
			Accessible Sub-tropical	6	20.37
Total				**10**	**56.08**
21VR029	Chisapani-Puranagaun	8.85	Accessible Lower Temperate	3	340.46
Total				**3**	**340.46**
21VR030	Jabade-Puranagaun-Hulak	5.00	Accessible Sub-tropical	4	135.58
Total				**4**	**135.58**
21VR031	Harre-Gelu	8.25	Accessible Lower Temperate	9	226.16
			Accessible Sub-tropical	9	38.75
Total				**18**	**264.91**
21VR034	Pokharidanda-Bishli Baudhha-Nagthali	7.49	Accessible Lower Temperate	2	434.10
Total				**2**	**434.10**
21VR035	Ghyangdanda-Khodbesi-Pinkhuri-Talla Bhadaure	12.35	Accessible Lower Temperate	6	80.47
			Accessible Sub-tropical	2	12.60
			Likely Accessible Lower Temperate	10	132.01
Total				**18**	**225.08**
21VR038	Pakarbas-Fulpa-Dhulebesi-Gagal	2.75	Accessible Lower Temperate	2	11.60
			Accessible Sub-tropical	11	193.93
Total				**13**	**205.53**
21VR039	Phulpa-Deurali-Lakpa-Dhapkha-Sithkhaghat	9.56	Accessible Lower Temperate	1	25.77
			Accessible Sub-tropical	6	51.51
Total				**7**	**77.28**
21VR040	Lapka-Bhirpani-Sitkhaghat	3.75	Accessible Lower Temperate	4	13.68
			Accessible Sub-tropical	3	9.63
Total				**7**	**23.31**
21VR041	Sithkhaghat-Aapchaur-Goganpani	7.50	Accessible Lower Temperate	5	65.62
			Accessible Sub-tropical	5	55.01
Total				**10**	**120.62**
21VR042	Sithkaghat-Nigalpani-Majhuwa	9.15	Accessible Lower Temperate	2	120.38
			Accessible Sub-tropical	7	99.60
			Accessible Tropical	3	0.24
Total				**12**	**220.22**
21VR047	Rupakot-Bhirkot Ma.Vi	5.00	Accessible Lower Temperate	4	77.43
Total				**4**	**77.43**
21VR048	Galba-Thansing	6.00	Accessible Lower Temperate	5	55.77
Total				**5**	**55.77**

Road Code	Road Name	Length	Climatic Zones	No. of Pockets	Area (Ha)
21VR050	Dimipokhari-Alampur-Doramba	8.50	Accessible Lower Temperate	7	210.98
			Accessible Upper Temperate	3	39.57
Total				**10**	**250.56**
21VR051	Gunsal-Riste	6.79	Accessible Lower Temperate	4	156.82
			Likely Accessible Lower Temperate	1	0.04
Total				**5**	**156.86**
21VR055	Bhismachaur-Gunsi Ma.Vi.-Gunsi-Dahu	5.90	Accessible Lower Temperate	3	270.79
			Accessible Sub-tropical	2	1.58
Total				**5**	**272.37**
21VR056	Gunsi Ma.Vi.-Gunsi Dovan	1.50	Accessible Lower Temperate	1	39.83
			Accessible Sub-tropical	9	2.25
Total				**10**	**42.08**
21VR057	Gunsi Ma. Vi.-Hirketar-Maire-Odare-Galba	14.25	Accessible Lower Temperate	13	468.82
Total				**13**	**468.82**
21VR058	Aaru Kharka-Sakshyam Chautaro-Manpur	6.75	Accessible Lower Temperate	4	46.99
Total				**4**	**46.99**
21VR059	Sandidada-Hirketar	4.25	Accessible Lower Temperate	4	58.82
Total				**4**	**58.82**
21VR060	Sandidada-Gunsi	4.00	Accessible Lower Temperate	1	75.51
Total				**1**	**75.51**
21VR061	Bhalayakharka 9-Khimtibesi	3.00	Accessible Lower Temperate	6	15.72
			Accessible Sub-tropical	5	17.96
Total				**11**	**33.68**
21VR062	Bhalayakharka-Bethan	4.00	Accessible Lower Temperate	3	142.16
			Accessible Sub-tropical	5	6.12
Total				**8**	**148.28**
F320	Tamakoshi - Khurkot		Accessible Sub-tropical	71	494.26
			Accessible Tropical	32	126.44
Total				**103**	**620.70**
F159	Khurkot - Okhaldhunga		Accessible Lower Temperate	26	1039.02
			Accessible Sub-tropical	13	220.04
Total				**39**	**1259.06**
4102	Manthali - Khurkot		Accessible Lower Temperate	1	122.60
			Accessible Sub-tropical	22	102.15
Total				**23**	**224.75**
F202	Siuraune (Dharapani)-Those-Bamti		Accessible Lower Temperate	27	138.01
			Accessible Upper Temperate	20	335.50
Total				**47**	**473.51**
Sub-total				**676**	**9764.54**
Grand Total				**1595**	**25493.35**

4. Sindhuli

District Roads

Road Code	Name of Road	Length (Km)	Climatic Zones	No. of Pockets	Area (Ha)
20DR001	Sandhe-Khorbhyang-Hariharpur Gadhi	11.15	Accessible Tropical	30	152.56
Total				**30**	**152.56**
20DR002	Pipalmadhi-Karmaiya	18.5	Accessible Lower Temperate	23	129.42
Total				**23**	**129.42**
20DR003	Hariwan-Kyaneswor-Bhitri Jamune-Boteni	23.35	Accessible Tropical	9	30.05
			Likely Accessible Tropical	18	35.85
Total				**27**	**65.90**
20DR004	Kapilakot-Madhubani-Rampur-Netrakali-Kusheshwor Dumja	58	Accessible Lower Temperate	47	171.22
			Accessible Sub-tropical	31	92.17
			Accessible Tropical	3	5.45
Total				**81**	**268.84**
20DR005	Pipalbhanjyang-Haitar-Netrakali	37.2	Accessible Lower Temperate	13	7.92
			Accessible Sub-tropical	42	159.65
			Likely Accessible Lower Temperate	10	40.54
			Likely Accessible Sub-tropical	14	15.02
Total				**79**	**223.12**
20DR006	Sindhuligadhi-Majhuwa-Kaphalchauri Dumja	39	Accessible Lower Temperate	9	205.74
			Likely Accessible Lower Temperate	15	150.76
Total				**24**	**356.50**
20DR007	Khaniyakharka-Kamarebhanjynag -Dhapchauki-Tilpung Bhanjhyang	47.5	Accessible Lower Temperate	19	180.16
			Accessible Sub-tropical	1	3.40
			Likely Accessible Sub-tropical	25	39.09
Total				**45**	**222.65**
20DR008	Sindhulimadi-Bhimasthan-Chakmake—Bahuntilpung	45.6	Accessible Sub-tropical	13	56.58
			Accessible Tropical	10	71.56
Total				**23**	**128.14**

Road Code	Name of Road	Length (Km)	Climatic Zones	No. of Pockets	Area (Ha)
			Accessible Lower Temperate	44	154.30
			Accessible Sub-tropical	30	219.51
			Accessible Tropical	11	42.18
			Accessible Upper Temperate	3	11.06
			Likely Accessible Lower Temperate	57	191.52
			Likely Accessible Sub-tropical	6	19.50
20DR009	Bahuntilpung-Mahadevdanda-Tinkhande	45.53	Likely Accessible Upper Temperate	1	0.04
Total				**152**	**638.10**
			Accessible Lower Temperate	32	139.12
			Accessible Sub-tropical	15	27.63
			Likely Accessible Lower Temperate	8	76.53
20DR010	Bahuntilpung-Nawalpur Ghat	29.38	Likely Accessible Sub-tropical	5	2.02
Total				**60**	**245.30**
			Accessible Lower Temperate	5	17.48
20DR011	Chakmake-Aambote-Jinakhu-Jhankritar	30.75	Accessible Sub-tropical	66	672.19
Total				**71**	**689.68**
			Accessible Sub-tropical	18	62.42
			Accessible Tropical	5	1.64
			Likely Accessible Sub-tropical	13	29.53
20DR012	Ratanpur-Langurkhola-Majhuwa-Balajor	31	Likely Accessible Tropical	1	10.86
Total				**37**	**104.44**
			Accessible Lower Temperate	11	115.11
			Accessible Sub-tropical	24	160.42
			Likely Accessible Lower Temperate	8	3.76
20DR013	Mulkot-Nagedanda-Amare-Majhuwa	22	Likely Accessible Sub-tropical	3	10.24
Total				**46**	**289.52**
Sub-total				**698**	**3514.17**

Village Roads

Road Code	Name of Road	Length (Km)	Climatic Zones	No. of Pockets	Area (Ha)
20VR001	Silame-Pathaparan-Khayarmara (Mahotari)	5.00	Accessible Sub-tropical	3	0.39
Total				**3**	**0.39**
			Accessible Lower Temperate	2	3.76
			Accessible Sub-tropical	14	110.28
20VR007	Bhokteni-Chisapani Danda-Hariharpur Gadhi	13.16	Accessible Tropical	5	31.43
Total				**21**	**145.47**
			Accessible Lower Temperate	1	0.09
			Accessible Sub-tropical	7	83.51
			Likely Accessible Lower Temperate	8	13.04
20VR008	Kartike-Panchhagahre-Bhaudura-Chukte	4.02	Likely Accessible Sub-tropical	5	14.07
Total				**21**	**110.72**
20VR010	Jure-Tamajor	1.95	Likely Accessible Lower Temperate	1	17.43
Total				**1**	**17.43**
			Accessible Lower Temperate	2	0.95
			Accessible Upper Temperate	1	1.29
20VR011	Haitar-Netrakali	6.4	Likely Accessible Lower Temperate	17	45.24
Total				**20**	**47.48**
			Accessible Lower Temperate	1	5.16
20VR013	Sandhe-Panipokharibhanjyang-Malandadumja	5.8	Accessible Sub-tropical	15	121.28
Total				**16**	**126.44**
			Accessible Lower Temperate	10	61.90
20VR015	Ratmata-Tamlingdanda-Shikre-Bandipur	9.76	Accessible Sub-tropical	20	63.90
Total				**30**	**125.80**
			Accessible Lower Temperate	4	34.01
			Accessible Sub-tropical	10	27.60
			Likely Accessible Lower Temperate	3	35.78
20VR017	Sitapati-Majhuwa	8.99	Likely Accessible Sub-tropical	2	0.23
Total				**19**	**97.62**
			Accessible Lower Temperate	4	6.75
20VR018	Amale-Sukachuri	1.44	Accessible Sub-tropical	4	19.43
Total				**8**	**26.18**

Road Code	Name of Road	Length (Km)	Climatic Zones	No. of Pockets	Area (Ha)
20VR020	Pipalbhanjyang-Beshare-Maiwale	6.12	Accessible Lower Temperate	10	41.78
			Accessible Sub-tropical	15	33.44
Total				**25**	**75.22**
20VR021	Gadi-Jalkanya 12-Bhimeshowar	5.45	Accessible Lower Temperate	2	91.56
			Accessible Sub-tropical	3	0.46
Total				**5**	**92.02**
20VR024	Sindhulimadhi-Bardautar-Jarayotar	2.81	Accessible Sub-tropical	12	85.11
Total				**12**	**85.11**
20VR026	Pallorampur-Tansar-Sarswatidovan-Kotgaun	6	Accessible Lower Temperate	1	2.72
			Accessible Sub-tropical	17	43.71
Total				**18**	**46.42**
20VR027	Ratanchura 8 - Thusashe-Thangse-Chisapani	2.42	Accessible Lower Temperate	4	65.51
			Accessible Sub-tropical	6	5.42
Total				**10**	**70.92**
20VR028	Sutarchhapdanda (26+550 BP Highway)-Ratanchur	5.17	Accessible Lower Temperate	2	17.11
Total				**2**	**17.11**
20VR030	Bara-Ghoksila-Chepuwa	12.7	Accessible Sub-tropical	7	75.78
			Likely Accessible Lower Temperate	5	27.68
			Likely Accessible Sub-tropical	8	9.26
Total				**20**	**112.73**
20VR031	Gwaltar-Deuralitar	1.8	Accessible Sub-tropical	2	21.73
			Accessible Tropical	1	1.46
			Likely Accessible Sub-tropical	2	29.26
			Likely Accessible Tropical	2	0.86
Total				**7**	**53.31**
20VR032	Satdobato-Kubhinde	3.36	Accessible Lower Temperate	4	14.34
			Likely Accessible Lower Temperate	8	13.37
			Likely Accessible Sub-tropical	2	0.25
Total				**14**	**27.96**
20VR033	Kali-Aap-Harkapur	11.38	Accessible Sub-tropical	9	39.53
			Accessible Tropical	1	1.23
			Likely Accessible Lower Temperate	17	33.37
			Likely Accessible Sub-tropical	13	25.76
Total				**40**	**99.90**

Road Code	Name of Road	Length (Km)	Climatic Zones	No. of Pockets	Area (Ha)
20VR034	Kudulephedi-Dundbhanjyang M.V. Bhavan	3.26	Accessible Sub-tropical	9	38.52
Total				**9**	**38.52**
			Likely Accessible Lower Temperate	2	38.05
20VR035	Kuibhir-Khansang	3.13	Likely Accessible Sub-tropical	9	18.56
Total				**11**	**56.61**
20VR036	Swalpa Bhanjyang-Katuwa	3.33	Likely Accessible Sub-tropical	1	59.97
Total				**1**	**59.97**
			Accessible Lower Temperate	16	44.91
20VR037	Pauti-Kholagau-Phikaldanda	8.2	Likely Accessible Lower Temperate	8	37.90
Total				**24**	**82.81**
			Likely Accessible Lower Temperate	24	68.83
20VR038	Tilpung Bhanjyang-Toshram Bhanjyang	8.23	Likely Accessible Sub-tropical	1	0.34
Total				**25**	**69.17**
			Accessible Lower Temperate	1	4.30
20VR039	Tilpung Bhanjyang-Khurhari	6.14	Likely Accessible Lower Temperate	8	63.25
Total				**9**	**67.55**
			Accessible Lower Temperate	7	17.38
20VR040	Majhuwa-Bijayapur	12.74	Accessible Sub-tropical	16	245.95
Total				**23**	**263.33**
			Accessible Lower Temperate	38	134.76
20VR041	Gahunbari-Phikaldanda	11.16	Accessible Upper Temperate	1	5.42
Total				**39**	**140.18**
20VR044	Dhdhauli-Katari (Kokti Dudhauli-Dadagau Ladabhi	2.18	Accessible Tropical	4	113.15
Total				**4**	**113.15**
			Accessible Lower Temperate	1	1.83
			Accessible Sub-tropical	11	18.11
20VR045	Dudhauli-Arunthakur-Mahadevdanda	17.17	Accessible Tropical	16	37.02
Total				**28**	**56.95**
20VR047	Nipane-Tandi-Dhansari	29.50	Accessible Tropical	28	615.26
Total				**28**	**615.26**
20VR048	Jagadi-Harshai-Mathilo Patringa	5.00	Accessible Tropical	7	144.10
Total				**7**	**144.10**

Road Code	Name of Road	Length (Km)	Climatic Zones	No. of Pockets	Area (Ha)
20VR050	Sirthauli-Jinakhu	11	Accessible Sub-tropical	2	0.08
			Accessible Tropical	11	3.00
Total				**13**	**3.08**
20VR051	Chakmake-Dakaha-Chisapani	27.9	Accessible Sub-tropical	11	40.90
			Accessible Tropical	7	9.42
Total				**18**	**50.32**
20VR053	Hatpate-Mahadevsthan	3.16	Accessible Sub-tropical	13	48.47
Total				**13**	**48.47**
20VR054	Ruchani-Charchare-Hatpate	13.53	Accessible Sub-tropical	7	126.15
			Accessible Tropical	7	7.51
Total				**14**	**133.66**
20VR057	Bimasthan-Kotgaun-Dhapbhanjayan-Siddheshowa	15.00	Accessible Sub-tropical	2	6.88
Total				**2**	**6.88**
20VR058	Rampur-Eakpakhe-Sikhere-Kotgaun	22	Accessible Lower Temperate	1	119.66
			Accessible Sub-tropical	46	290.33
Total				**47**	**409.99**
20VR059	Phiting-Lamidanda	15.00	Accessible Sub-tropical	25	129.44
Total				**25**	**129.44**
H06	BP Highway	97	Accessible Lower Temperate	5	205.07
			Accessible Sub-tropical	102	378.69
			Accessible Tropical	48	324.16
Total				**155**	**907.92**
F057 (04)	Baireni-Bhiman	77.00	Accessible Tropical	49	793.48
Total				**49**	**793.48**
F057 (05)	Sindhulibazar-Gurji	87.8	Accessible Sub-tropical	31	160.46
			Accessible Tropical	73	914.54
Total				**104**	**1075.00**
H18 (14)	Patitar (District Border)-Khurkot (Mid Hill)	61	Accessible Sub-tropical	41	227.51
			Accessible Tropical	57	326.79
Total				**98**	**554.30**
Sub-total				**1038**	**7198.33**
Grand Total				**1736**	**10712.50**

Section 4
Selected Value Chain Studies

Section 4: Selected Value Chain Studies

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SN4.1: Cauliflower Value Chain Study

SN4.2: Dairy Value Chain Study

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SN4.4: Tomato Value Chain Study

SN4.1: Cauliflower Value Chain Study

CHAPTER 1 INTRODUCTION

1.1 Background

The study aims to assess existing conditions of High Value Commodities (HVC) development along SRC aiming at reviewing development potential of the HVC, identifying potential commodities along their value chains, and testing their improvement through pilot project as a part of master plan development. In this pursuit, JICA study team intends to conduct detailed value chain assessment of selected 11 commodities (Table 1.1) which have commercialization potential in the Sindhuli Road Corridor (SRC)[1] area. These commodities have been identified by following robust methodology along with wider consultations with the local, district and central level stakeholders.

Table 1.1: Commodities Selected for Value Chain Study

SN	Commodities	Districts			
		Kavre	Dolakha	Ramechhap	Sindhuli
1	Junar			✔	✔
2	Orange (Mandarin)	✔	✔		✔
3	Goat	✔	✔	✔	✔
4	Dairy	✔	✔	✔	✔
5	Cabbage	✔		✔	
6	Cauliflower	✔	✔	✔	
7	Potato	✔	✔	✔	✔
8	Tomato	✔	✔	✔	✔
9	Lapsi	✔	✔		
10	Turmeric		✔		✔
11	Pineapple				✔

The main purpose of the value chain study is to thoroughly understand the value chains of selected HVCs from inputs to consumption as well as associated factors such as various support services and policy environment with a view to identify constraints and points of interventions in the chains so as to inform the preparation of Draft Basic Development Strategy.

This report is one of the 11 of series, which presents detailed value chain analysis of cauliflower while focusing on existing production and distribution system of two districts of SRC, namely Ramechhap and Kavre.

1.2 Objective

The overall objective of the study is conduct detailed value chain analysis of cauliflower, while focusing on:

- Mapping of value chain actors and stakeholders operating at different level
- Analysis of cost and margin analysis of different value chain stakeholders
- Explore potentialities and constraints of the selected commodities

[1] Sindhuli Road Corridor encompasses four districts, namely Kavre, Dolakha, Ramechhap and Sindhuli

- Conduct the SWOT analysis and recommend potential strategy and interventions

1.3 Study Approach and Methodology

1.3.1 Conceptual Framework

The study will follow value chain approach in conducting the study. A value chain is defined as the full range of activities required to take a product or service from conception to final disposal after use, through the intermediary phases of production, processing and delivery to final consumers. The value chain approach (VCA) focuses on the interaction of actors along each step of the production system as well as the linkages within each set of actors. VCA considers trade relations as being part of a series of networks of producers, exporters, importers, processors and retailers, whereby knowledge and relationships are developed to gain access to markets and suppliers.

Value chain analysis is a process that requires four interconnected steps: data collection and research, value chain mapping, analysis of opportunities and constraints, and vetting of findings with stakeholders and recommendations for future actions. These four steps are not necessarily sequential and can be carried out simultaneously. Figure 1.1 shows simple graphic illustrating the analysis process and components. The value chain team collects data and information through secondary and primary sources by way of research and interviews. The collected data is analyzed using the value chain framework to reveal constraints within the chain that prevent or limit the exploitation of end market opportunities. The resulting analysis of opportunities and constraints should be verified with stakeholders through events such as workshops and focus groups discussions.

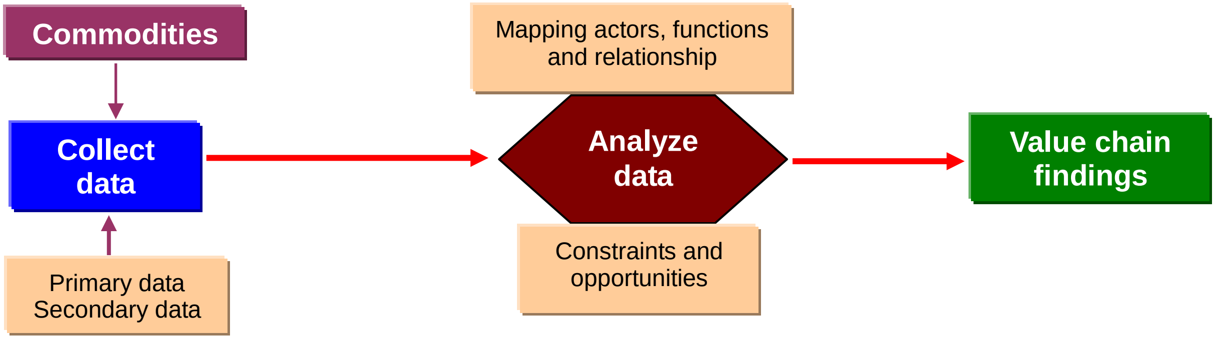


Figure 1.1: Value Chain Analysis Methods

1.3.2 Study Methods

Literature review: Available study reports, annual progress reports, statistical information on Nepalese agriculture were reviewed to collect information related with cultivars, area, production, yield, market price, sale quantity, production location, price, producer groups, etc

Interaction with producers: Interaction with producers was carried out in key production zone of each district while focusing on:

- Production processes (Cropping calendar)
- Access to services/Mapping of service providers (Technical/technological, finance)

- Input suppliers and mechanism
- Market chain mapping (Place and actors)
- Transportation system and practices
- Grading and packing practices
- Cost of cultivations
- Price and pricing mechanism
- Problems and constraints

Table 1.2 presents brief overview on consultations with producer groups with detailed on Annex 1.1. Consultations were carried out in four key production areas of two districts where 34 farmers have participated in the group discussions.

Table 1.2: Consultations with Producers

District	Study area/Location	Number of participants
Kavre	Kuntabesi	10
Ramechhap	Khimti	13
Dolakha	Makaibari, BNP	11
Total		**34**

Interaction with value chain stakeholders also focused on (a) core processes in the value chain, i.e from input provision to retailers and (b) Identifying and mapping the main actors involved in above processes

Interaction with the value chain actors: After interaction with the producer groups, value chain actors operating at different level of value chains are mapped. After wards survey was carried out in selected market places within and outside district. Table 1.3 below number of value chain stakeholders, who are consulted for purpose of study while ***Annex 1.2*** presents name of stakeholders consulted for the purpose of study.

Table 1.3: Number of Value Chain Stakeholders Consulted

Actors	Kavre	Dolakha	Ramechhap
Collector	5	7	1
Traders	4	9	1
Wholesaler	3	1	2
Retailers	5	1	4
Total	**17**	**18**	**8**

Interactions with value chain stakeholders was carried out to (a) visualize networks in order to get a better understanding of connections between actors; (b) identify processes in value chain (c) examine interdependency between actors and processes in the value chain and (d) enhance awareness of stakeholders to look beyond their own involvement in the value chain. Following issues were discussed during the interactions

- Identifying and mapping the main actors

- Volume of products handled including distribution mechanism (Place and actors)
- Geographical flow of the product or service
- Relationships, linkages and business services between value chain actors
- Price and pricing mechanism
- Transportation system and practices, including mode of transport and cost of transport
- Quality control
- Problems and constraints

After mapping of the value chain, cost and margin analysis of the value chain stakeholders was carried out while focusing on:

- Costs and required investments
- Value added costs
- Estimation of revenues
- Estimation of relative financial position of actors in the value chain

Interactions with service delivery/input suppliers' agencies: Consultations with the service delivery agencies such as District Agriculture Development Office, Agro-vets, private sector, cooperatives etc, non government agencies etc were carried out to understand:

- Nature and type of services
- Service delivery mechanism including cost of services
- Problems and constraints

Table 1.4 presents service delivery agencies consulted for the purpose of study with details in ***Annex 1.3.***

Table 1.4: Number of Service Providers Consulted

Actors	Kavre	Dolakha	Ramechhap
DADO Officials	2	4	5
Agro vet	1	1	2
Cooperatives	3	1	2
Total	**6**	**6**	**9**

CHAPTER 2 CAULIFLOWER PRODUCTION AND MARKETING

2.1 Introduction

Cauliflower is one of the most important winter vegetables of Nepal. *Cauliflower (Brassica oleracea*) var. botrytis belonging to cruciferaceae family is a herbaceous crop, which is grown across all over the country. However, its commercial cultivation is confined in teria and few hill districts of Nepal. Varieties are very responsive to temperature and photoperiod. It is therefore, very important to sow the appropriate variety at right time. Early varieties if sown late produce "button" head and late varieties if sown early will go on giving leafy growth and will produce curds very late. Cauliflower is a cool season vegetable that is considered a delicacy by many persons.

Table 2.1 presents cropping calendar of major studied crops in SRC. Cauliflower is grown for two seasons in Nepal, depending upon altitudes and variety. Most of the farmers first prefer to cultivate paddy in low land and maize in the rained area. After paddy, they prefer to cultivate different vegetable crops, such as potato, cauliflower, cabbage, tomato etc. However, the seasons of plantation differs by type of crops. Nepal in general and SRC in particular has comparative advantage on growing different type of vegetables because of high variations on altitude and physiographic region.

Table 2.1: Cropping Calendar of Studied Crops

Crops	Land type	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
		B	J	A	S	Bh	As	K	M	P	Mag	F	C
Paddy													
Potato	Low land												
	Upland												
Cauliflower	Low land												
	Upland												
Cabbage	Low land												
	Upland												
Tomato	Low land												
	Upland												

2.2 Production Practices

2.2.1 Calendar of operation

Cauliflower production is dominated by small-scale farmers. Table 2.2 presents the cropping calendar of cauliflower. Cauliflower is annual herb which is generally grown two times a year (summer seasons and winter seasons). Season for cultivation of cauliflower varies on altitude. Cauliflower is grown in summer time in upland while it is grown in winter in low land.

Cauliflower production systems vary according to the altitude. In the mid-hills (800 to 1,500 m asl), couliflowers are generally cropped on irrigated land after paddy. In mid and higher hills (1,500 to 1,800 m and above), it is grown in upland with maize as a mixed crop.

In low land, nursery is established in August whereas that for upland is May and June. Land is prepared for planting seedling between September and October whereas that for upland (above 1800

M height from mean sea level) is June and July. Planting seedling takes place between September and October in low land whereas that for high land is from June to July. Plant need frequent irrigation immediately after plantation in low land whereas upland farmers do not need irrigation as the time of the year is monsoon they have adequate rainfall for cauliflower. After one month of planting they generally do weeding and earthing up. Pesticides and fungicides as and when required depending upon nature of problems. Cauliflower generally takes around 90 to 100 days for harvest. Hence crop planted during early September will be harvested around December while that planted during November will harvested from January to February. Upland cauliflowers are harvested during September to November. However in some places of upland such as Makaibari in Dolakha they also plant seedling in February and harvest the product in April to May.

Table 2.2: Calendar of Operation of Cauliflower

Crops	Land type	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
		B	**J**	**A**	**S**	**Bh**	**As**	**K**	**M**	**P**	**Mag**	**F**	**C**
Nursery establish	Low land												
	Upland												
Land Preparation	Low land												
	Upland												
Planting seedling	Low land												
	Upland												
Irrigation	Low land												
	Upland												
Spraying insecticides and pesticides	Low land												
	Upland												
Weeding/ Earthing up	Low land												
	Upland												
Harvesting	Low land												
	Upland												

Note: Nepalese Calender months (B- Baisakh; J – jestha, A – Ashad, S – Shrawan, Bh – Bhadra, As – Ashwin, K – Kartik, M- Mangshir, P - Poush M – Magh, F - Falgun, C – Chaitra)

2.2.2 Product input use and sources

Seed: Farmers use Nepali, Indian and sometime from overseas such as America. Farmers of Kavre, Dolakha and Ramechap districts are producing cauliflower in commercial scale. Two former districts are major sources of cauliflower to the Kathmandu valley while most of the cauliflower produced in Ramechhap is consumed locally within the district. The farmers are quite aware about the varieties of cauliflower. The major varieties being cultivated in Kavre, Dolakha and Ramechhap are, White Top, Snow Mastic and Snow Crown and local variety.

White Top variety is small in size, around a kilogram in weight whereas latter two are bigger, around 2-3 kilogram. For the inputs, farmers of all districts rely almost 100% on Agro-vet particularly for seed. Average area of cauliflower production per household is 1-2 ropani in Ramechhap whereas that in Kavre and Dolakha is more than 4 ropani.

Fertilizers: Compost fertilizer is available in the own farm of farmers since they are also rearing livestock. However, farmers in Dolakha use poultry excrete. Farmers purchase chemical fertilizer from cooperative or agro-vets. With the reintroduction of subsidy by the government of Nepal, the fertilizers are available through cooperatives only. Hence, most of the farmers are now purchasing from cooperatives unlike previsions practice of purchasing chemical fertilizers from shops of local markets. Nevertheless, few agro-vets are also selling fertilizers, however farmers are less reliable with fertilizers. They often complained for timely availability of the fertilizers.

Farmers mainly apply chemical fertilizers during two times (a) first during seedling plantation and (b) top dressing during weeding and earthning up. The quantity of chemical fertilizers used depends on the level of commercialization and availability. Most of the places in Kavre districts such as Kunta Besi, Panchkhal use of chemical fertilizer is very high then recommended dose as cauliflower cultivation is very commercial in those areas and farmers have relatively easy access to the fertilizers. The use of chemical fertilizer in is relatively low than in all the districts. This is mainly because of high use of chemical fertilizers in Kavre during cauliflower cultivation while untimely availability in Dolakha and Ramechhap, Moreover, farmers in Dolakha prefer poultry excreta compared to farm yard manure.

Table 2.4: Use of Fertilizers

	Recommended dose* (kg/Ropani)	Current use (Kg/Ropani)		
		Kavre	Dolakha	Ramechhap
Compost	1,500	1,200	480 (Poultry)	1,530
Urea (46:0:0)#	10	3	11	10
DAP Di Ammonium Phosphate (18:46:0) #	6	5	15	7
MoP (Murate of Potash) (0:0:60) #	10	-	5	4

Source: * Annual Report of Horticulture Center, Kritipur, 2009/2019. Kathmandu, Nepal; ** Field Study, 2012
Figure in Parenthesis denote Nitrogen, Phosphorus and Potash content

Pesticides: Farmers of all districts rely on Agro-vet for pesticides. Whenever farmers have problems in their crop their first place for consultation is agro-vet and buy required inputs such as pesticides and insecticides in recommendation of the agro-vets. Only in very few cases, they go to government service centers to get advice. Farmers are using different pesticides and insecticides two to three times in crop cycle. Farmers often complained about duplicate or unreliable pesticides available in the market.

Irrigation: Farmers cultivating cauliflower in lowland from September to January irrigate cauliflower field for 5-8 times in whole crop cycle, however, farmers cultivating in upland during July to November basically depends on rain for irrigation. Non-conventional irrigation technologies such as pond constructions, rain water harvesting, waste water use etc are hardly used. Applying appropriate water storage and conservation system need to be promoted to enhance capacity of farmers to utilize water resources. Farmers generally cultivate cauliflower in those areas which have well developed irrigation system.

2.2.3 Care and management

Major activities performed by farmers for the care and management of field include:

- **Weeding/earthning up:** It is done after one to one and half month to of planting seedling. This minimizes the nutrient competition between weeds and cauliflower.
- **Top dressing:** Top dressing with urea and DAP is done during earthning up process.
- **Chemical Treatment:** Most commonly used chemical treatment is spraying of pesticides and insecticides. Cauliflower is very sensitive towards bug, in case of bug problem they use insecticides.

2.2.4 Credit

Large majority of farmers don't need credit for cultivating cauliflower. Production labor is performed by own family members while production inputs are provided by Agro-vets. All the activities related to farming will be performed by family members and hence they even don't need cash for hiring labor. However, it largely depends upon the extent of cultivation area.

Few farmers who are cultivating in large scale used to take loan from cooperatives with interest of 12 – 15 percent per annum. Likewise, few farmers take credit in kind (seeds, fertilizers) from Agro-vets. Hence, farmers don't need big amount of credit for cauliflower cultivation.

Dependency of farmers on formal financial institutions does not exists or diminishing. Farmer's often complained about cumbersome processes which need to follow for obtaining loan. Hence, they preferred local cooperatives for credit compared to financial institutions.

2.2.5 Technical services

Farmers mostly rely on Agro-vets and DADO for technical knowledge and services. However, access of farmers to DADO is very limited, mainly because of distance as well as less number of staff. Hence, farmers often consult with their peers and agro-vets for technical advices. Role of DADO has been mainly confined on providing subsidy for saplings and other equipments.

2.3 Area, Production and Yield

2.3.1 Area

SRC area covers almost five percent (1,604 ha) of country's cauliflower area (32,521 ha). Of the four districts of SRC, Kavre is known for commercial cauliflower production. Table 2.5 presents extent of cultivation of cauliflower in SRC districts.

Cauliflower is cultivated at 1.1 percent of the total cultivated area of the country. Likewise, cauliflower is cultivated at 4.9 percent of total cultivated land of the SRC. Of the total cultivated land of the SRC districts, cultivation is high in Kavre district (3.6 percent), followed by Dolakha (0.6 percent) and Ramechhap (0.2percent).

Table 2.5: Extent of Cultivation of Cauliflower in SRC Districts

SN	District	Total Cultivated land (ha)	Area under Cauliflower cultivation (2009/10)		% Cauliflower cultivated area to total cultivated area
			Area (ha)	%	
1	Kavre	36,442	1,170	3.6	3.2
2	Dolakha	29,423	180	0.6	0.6
3	Ramechhap	40,050	80	0.2	0.2
4	Sindhuli	39,485	174	0.5	0.4
	SRC total	145,400	1,604	4.9	1.1
	Nepal	**3,052,900**	**32,521**	**100.0**	**1.1**

Source: MoAC, 2010/11

Table 2.6 compares trend of area under cauliflower cultivation over last four years. Area under cauliflower is increasing rapidly in SRC (28.9 percent per annum) as compared to Nepal (9.5 percent per annum). Area under cauliflower is increasing in the all districts except in Ramechhap. Increase is significantly high in Kavre district (40.9 percent) and Sindhuli (26.8 percent). This is mainly of expansion of road network together whi have created easy market access of Kathmandu.

Table 2.6: Area under Cauliflower Cultivation over Last Seven Years (2003/04 – 2009/10)

Unit: ha

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2006/07	379	174	110	80	743	25,325
2007/08	379	174	90	85	728	24,671
2008/09	1,158		80	91	1,329	29,836
2009/10	1,170	180	80	174	1,604	32,521
Annual Growth Rate (%)	40.9	(1.2)	(11.1)	26.8	28.9	9.5

Source: MoAC, 2010/11

2.3.2 Production

Total production of cauliflower in the country is 454,570 MT per year in 20009/10 of which SRC contributed just more than 4.5 percent of total cauliflower production. Sizable amount of cauliflower is produced in Kavre while production amount is very less in rest of SRC districts.

Table 2.7 Production of Cauliflower

SN	District	Production (Mt)	Percent
1	Kavre	16,380	3.6
2	Dolakha	1,670	0.4
3	Ramechhap	897	0.2
4	Sindhuli	1,692	0.4
	SRC area	20,639	4.6
	Nepal	**454,570**	**100.0**

Source: MoAC, 2011

Table 2.8 presents production of cauliflower over last 4 years. Production of cauliflower is increasing in Nepal 3.8 percent per annum whereas rate of increase in SRC area is 30.4 percent). Production of cauliflower increases at 40.3 percent per annum in Kavre while it decreases by 10.6 percent per annum in Ramechhap. Increase in production is mainly because of expansion of cultivated area.

Table 2.8: Production of Cauliflower over 2006/07 – 2009/10

Unit: MT

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2006/07	4,996	1,696	1,210	920	8,822	388,028
2007/08	6,237.9	1,696	990	978	9,901	438,806
2008/09	16,268		880	1,047	18,195	399,012
2009/10	16,380	1,670	897	1,692	20,639	454,570
Annual Growth Rate (%)	40.3	-0.6	-10.6	20.6	30.4	3.8

2.3.3 Yield

Table 2.9 presents yield of cauliflower over last four years. The table shows that average trend of average yield in SRC is slightly lower than national average of yield. Yield of cauliflower is high in Kavre in compare to other districts of SRC. Yield of cauliflower decreases in all the districts. Over the last four years, yield decreased very high in Sindhuli (4.8 percent) while there is no improvement in Kavre. The table shows that overall yield in SRC area is decreased by 3.6 percent in last four years. This can be attributed to many factors such as rising input costs, pests and diseases, effects of climate change, declining farming land due to rise in population, poor crop husbandry practices such as lack of crop rotation and use of poor quality seeds.

Table 2.9: Yield of Cauliflower over Last Seven Years (2003/04 – 2009/10)

Unit: kg/ha

Year	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2006/07	13,182	9,747	11,000	11,500	11,357	15,322
2007/08	16,459	9,747	11,000	11,500	12,176	17,786
2008/09	14,048		11,000	11,505	9,138	13,374
2009/10	14,000	9,278	11,213	9,724	11,054	13,978
Annual Growth Rate (%)	0.0	-1.7	0.6	-4.8	-3.6	-5.6

Source: MoAC, 2011

2.4 Production Locations

2.4.1 Production Area

During the consultative meeting, DADO officials were requested to classify VDCs into three classes while considering extent of cultivation and commercialization. This exercise was carried out for all districts of SRC Production is highly scattered and fragmented and confined in few VDCs only.

- ***Fully commercial***, large area under cultivation and produce generally sold outside districts
- ***Semi-commercial*** – relatively high area under cultivation but produce are mostly sold in local market
- ***Subsistence*** – area is very small and produce mainly come to local markets or sufficient for self consumption only

Map 2.1 shows results of consultative meeting to map cauliflower grown area by VDCs where the detailed value chain assessment has been carried out. The map reveals that cauliflower is grown commercially in 20 VDCs; semi commercially in 93 VDCs. Likewise, cauliflower is ether cultivated home garden/subsistence level or not cultivated in remaining VDCs of SRC.

2.4.2 Production Pockets

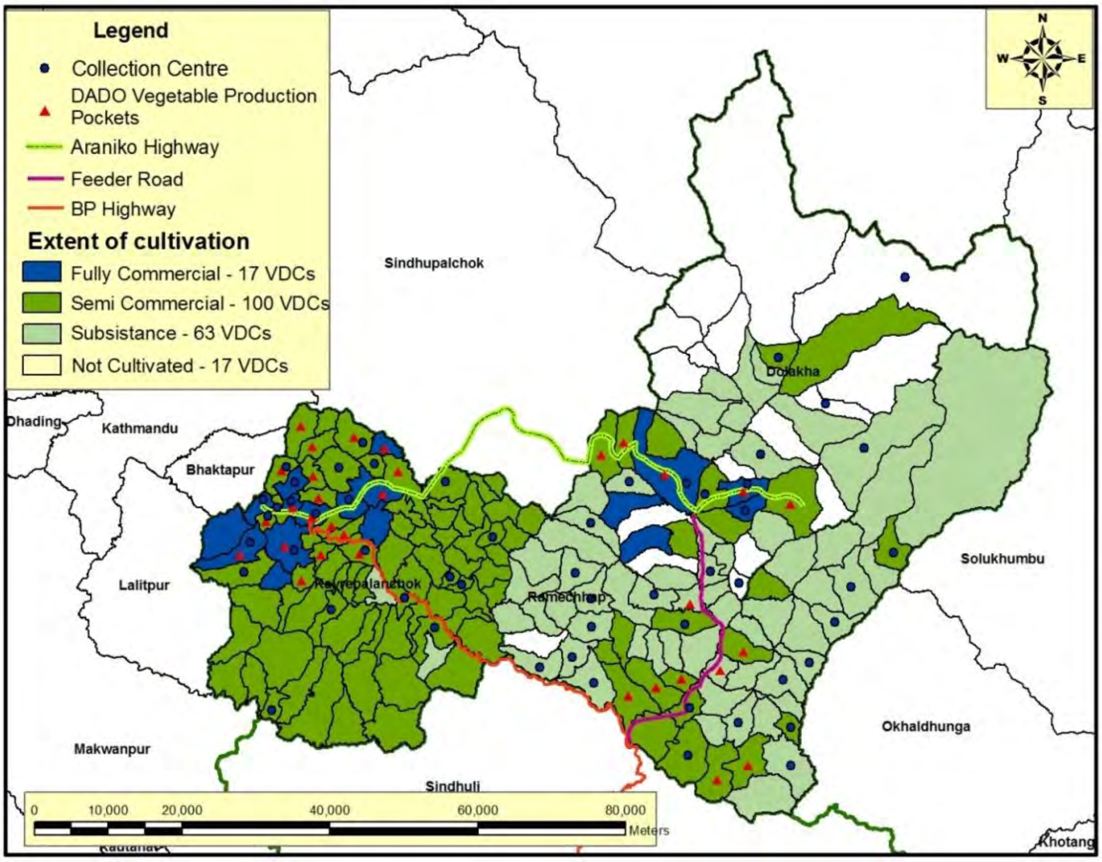
DADO has not designated specific area as production pockets of cauliflower, however they have identified vegetable production pockets considering road access and extent of cultivation. Table 2.10 presents production pockets of cauliflower in the study districts. Number of production area varies by districts from 26 in Kavre to 8 in Ramechhap and 3 in Dolakha. Map 2.1 also shows production pockets of DADO/DLSO.

Table 2.10: Vegetable Production Pockets of DADO/DLSO

Districts	Production Pockets (VDCs/locations)	Number
Kavre	Dhulikhel N.P., Panchkhal, Baluwa, Hokse, Jyamdi, Nayagaon, Mahadevsthan, Chandeni, Banepa N.P., Panauti N.P., Kavre, Patlekhet, Phulbari, Methinkot, Kanpur, Sarsyukharka, Khanalthok, Mangaltar, Sipalichilaune, Sankhu, Balthali, Tukuchanala, Devitar, Raviopi, Mahendrajyoti, Kushadevi	26
Dolakha	Bhimeshwar N.P., Melung, Jiri,	3
Ramechhap	Khimti, Tilpung, Manthali, Bhatauli, Pakarbas, Okhreni, Chisapani, Sukajor	8
Sinduli	Bhadrakali, Kamalamai N.P., Hatpate, Mahadevsthan, Bhimsthan, Dudhauli, Cithauli, Kapilakot, Jalkanya, Ratanchura	10

Source: Computed from annual progress report of DADO of respective districts, 2011

Map 2.1: Cultivation Area and Production Pockets of Cauliflower



2.5 Marketing and Distribution System

2.5.1 Harvesting and Sale

Farmers harvest cauliflower by cutting the flower buds keeping few leaves. In low land areas such as Kunta Besi, Panchkhal of Kavre and Pawati of Dolakha harvesting time starts from November and goes up to February whereas that in high land such as Makaibari and Sailungeshower of Dolakha that starts from September and goes up to November. As cauliflower could not be kept for longer time in field after it gets matured that has to harvest in short period of time. Farmers do not have opportunity to wait for better price, they have to sell whatever price they get in the market. After harvesting, farmers seldom do grading. Generally, after harvesting farmers wrap the flower buds with leaf to protect flower buds from being damaged during transportation.

During the consultative meeting with farmers/producer groups, they were requested to assign score on scale of 0- 10 to show harvesting and market arrival of cauliflower. From upland cauliflower is available in the market for about four months from last second half of August to first half of November. However, September and October are the highest available months. Likewise, from lowland, cauliflower is available in the market for about four months starting from second half of November to first half of February. Maximum availability of cauliflower from lowland is in December and January.

Table 2.11: Trends on Harvesting and Market Arrival of Cauliflower

	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	B	J	A	S	Bh	As	K	M	P	Mag	F	C
Upland												
Harvesting					4	8	10	3				
Sale					4	8	10	3				
Low land												
Harvesting								3	10	8	3	
Sale								3	10	8	3	

Source: Field Survey

Note: 0 for lowest and 10 for highest; Nepalese Calender months (B- Baisakh; J – jestha, A – Ashad, S – Shrawan, Bh – Bhadra, As – Ashwin, K – Kartik, M- Mangshir, P - Poush M – Magh, F - Falgun, C – Chaitra)

Generally local collectors reach to the place as close as to the cauliflower field with their vehicle. Farmers are responsible to bring cauliflower in bamboo basket up to road head where weighing takes place. The local traders generally buy cauliflower in credit and pay back to the farmers only after selling cauliflower in markets. The payback time ranges from one week to one month.

2.5.2 Market Arrival

Table 2.12 presents market arrival of cauliflower from study districts. Of the total production of cauliflower in the study districts, famers bring almost all produce (97.7 percent) to the market. Only 2.3 percent is self consumed.

Table 2.12: Market Arrival of Cauliflower

Unit: Percent

District	Kavre	Dolakha	Ramechhap
Self consumption	2	2	3
Brought to market	98	98	97

Source: Field Survey

2.5.3 Marketing Practices

The study showed the following distribution system of cauliflower in SRC area:

- Farmers –Collectors – Retailers - Consumers
- Farmers –Collectors –Commission agent – Retailers - Consumers
- Farmer – Collectors – Wholesalers– Retailers – Consumers
- Farmer –Retailers – Consumers
- Farmers –Consumers
- Farmers – Road head collectors – Wholesalers- Retailers- Consumers
- Farmers – Road head collectors – Collectors - Wholesalers- Retailers- Consumers

Major marketing practices followed by different marketing agents

- ***Producers/ Farmers:*** Farmers mostly sell cauliflower to local collectors. In some cases they also take to major city centers such as Banepa, Charikot, Manthali etc. and sell to retailers. However it depends upon size of the produce. Likewise, farmers are also bringing cauliflower to rural haat market for sale, especially in case of Rammechap and Dolakha.
- ***Road head collectors:*** They are operating in the road head center in the areas where the production pocket is scattered and production is less. Some buy cauliflower themselves and sale to collectors while few performed as commission agents of contractors/collectors. They purchase cauliflower from farmers supply to collectors or wholesalers operating in different market places based on demand. They get money from collectors/wholesalers within two weeks of sale of produce. They generally operate small grocery shops in the road head and provide food as well as other essential items needed to farmers.
- ***Contractors/Collectors:*** Collectors purchase cauliflower from farmers immediately after harvesting. Collectors fix price with farmers depending upon the Kalimat price, Farmers mostly get their money after a week or fortnight of sale of produce. Collectors bring products to district headquarters, major city centers and capital city Kathmandu. They sell produce to wholesalers and retailers or to commission agents at Kathmandu. They are operating at production center, district head quarters and Kathmandu.
- ***Commission agent/Traders:*** Commission agents receive cauliflower from collectors. They sell to retailers and wholesalers. They are operating at wholesale market of major urban cities such as Kathmandu, Narayanghat, Hetauda, Pokhara etc
- ***Wholesalers:*** Wholesalers purchase cauliflower from commission agents or from collectors. They are mostly operating at district head quarters, urban cities and Kathmandu. There are very few or none wholesalers in district headquarters, however, they are many in Kathmandu markets.

- ***Retailers:*** Retailers purchase cauliflower from wholesalers in urban maket or from producers directly in nearby weekly *haat markets*. They are operating at district head quarters, urban cities and Kathmandu.

2.5.4 Transportation Mechanism and Costs

Producer themselves or hire porters (if produce in big volume) mainly transporting cauliflower from production pocket to nearby road heads. Small producers carry cauliflower in bamboo basket (*doko*) to local and district haat markets for sale. But, in case of bigger consignments, mini-trucks and pick-ups, are used to transport the produce to outside big market places, especially in Kahmandu.

Depending upon volume of produce handled, different mode of transportation exists. Almost all production pockets/area is now connected with the earthen vehicle pliable roads. Farmers/Traders generally bring produce up to nearest road head in bamboo basket. Transportation cost varies from Rs 0.1 to 0. 75 per Kg depending upon distance to road head. This situation remains similar in all the districts.

After bringing to the road head, cauliflower is either loaded in a mini truck, which carry 3 to 5 MT or in public bus. People generally use local bus if the quantity is very small. Local buses generally charge Rs 1 to 5 per kg depending upon the distance. If farmers/collectors bring to district head quarter, they generally pay Rs 1 per kg while they pay Rs 5 if they bring to Kathmandu.

Use of small truck (popularly known as Tata mobile or Mini truck) is quite common nowadays to transport cauliflower. Collectors hire small truck/lorry with a capacity of 3 to 5 Mt. They collect the produce at road head and then bring to the market. The transporter charges about Rs 2500 – Rs 5500 to bring produce to District head quarters depending upon the capacity of truck. Likewise, transportation cost varies by distance/places and the capacity of truck. For example, truck with capacity of 5 MT charges Rs 2,500 – Rs 3,500 for bringing produce to Kathmandu market from Kavre districts.

Table 2.13 reveals that renting trucks is main mode of transportation followed by public transportation and labor. However, the mode of transportation varies by districts, which is mainly determined by production volume and market place. Use of public transport and labor is very less in Kavre while they are highest in Ramechhap. Farmers carry their produce in bamboo basket and bring to nearest markets; however such practice is now declining. Instead, farmers use public transport means to bring their produce to market.

Table 2.13: Mode of Transport to Different Market

Unit: Percent

Mode of transport to market	Kavre	Dolakha	Ramechhap
Porter (Labor)	5	15	25
Public transport (Passenger bus/jeep)	10	25	75
Truck/Mini Truck/Tata mobile	85	60	-
Total	**100**	**100**	**100**

Source: Field Survey

2.6 Pricing Mechanism and Prices

2.6.1 Price Determination Methods

Prices of the products are affected by the different factors like supply and demand of market, quality of the produce, speculative price based on situation and supply, previous day price, time, season, weather, ceremony, quantity disposed at the market, agreement with the farmers, availability of substitutes and bargaining based on quality. Besides these factors, previous days price, seasonality and cyclic variation are important for price formation in specific markets.

Market has major roles on determining prices at farmer level. Collectors and farmers inquire the price at Kathmandu and other city center and fix the price. In some cases where farmers directly bring to district headquarters, sell cauliflower in prevailing market price. At wholesalers' level, the supply and demand of the market determines the price followed by carteling of businessman; quality of the produce; speculative price based on situation and supply; purchased price; and bargaining based on quality. At retailer's level, the purchased price play key role in the retail price formation at all the retail markets followed by supply and demand of market; quality of the produce; previous day price; bargaining based on quality; and addition of profit. Table 2.14 presents different factors which play for determination of price.

Table 2.14: Criteria for Price Determinations

Farmers	Wholesalers/Collectors	Retailers
• Previous day/week price • Dealing with collectors • Urgency to dispose produce • Urgency of cash • Advance taken from the collectors • Production amount	• Supply and demand at market • Purchase price and associated costs • Last day/week market price • Quality of produce • Speculative price based on situation and supply • Risk associated with produce	• Purchase price and associated costs • Supply and demand at market • Last day price • Quality of produce • Bargaining based on quality • Risk associated with produce

Source: Field Survey

Farmer's consider last day price and urgency of sale as main factors which influences on determination of prices. Wholesalers/Collectors determine price based on supply and demand situation together with last day/week market price and other associated risks. Retailers determined price based on purchase price and associated costs including risk associated with the products.

2.6.2 Market price of Cauliflower at Different Markets

Prices are lowest in markets near production areas and highest in faraway markets. Table 2.15 presents average price of cauliflower at different market places in study districts. Market price of cauliflower varies by places and locations. Farm gate price of cauliflower varies from Rs 14 to 15 per kg. Retailing price also varies by districts.

Table 2.15: Market Price of Cauliflower

Prices	Kavre	Dolakha	Ramechhap
Farmers/Farm gate	15	14	14
Wholesalers/ Commission agents	-	28	28
Retailers	30	31	32

Source: Field Survey

2.7 Post Harvest Handling

2.7.1 Grading

Cauliflowers are generally traded without grading at the farm gate. No post-harvesting treatments are applied and traditional packaging is mainly used. No quality standards exist for cauliflower in Nepal. However, in some cases, retailers do grading for selling.

2.7.2 Packaging, Labeling and Branding

Bamboo baskets are used for packing and carrying to road head and transporting in public vehicle. However, transportation in truck is done without packing. Nevertheless, the flower buds used to wrap with its leaf to protect it from damage and from dirt during transportation.

2.7.3 Storage

Farmers used to sell cauliflowers immediately after harvesting. There is no practice of storing. Storing is done for 1-2 days in wholesale market if the produce could not be sold in time. However, cauliflower being perishable crop storing for value addition is not practical.

2.7.4 Value Addition and Processing

Consumption is mainly in unprocessed form in homes and restaurants. There is no any value addition and processing activity in cauliflower. Cauliflower is sold in fresh and consumed as fresh vegetable.

CHAPTER 3 VALUE CHAIN ACTORS MAPPING AND ANALYSIS

3.1 Value Chain Analysis

3.1.1 Value Chain Map

Mapping of value chain actors was carried out to visualize networks in order to understand linkages between actors and processes in a value chain and assess interdependency between actors and processes in the value chain. Figure 3.1 presents core processes involved in value chain of cauliflower. It moves form production to consumers, passing through different stages and processes. The linkages are shown vertically from bottom to top. The left hand blocks represent the major functions of the chain. The functions, in this case, include production, collection, trading, processing and marketing.

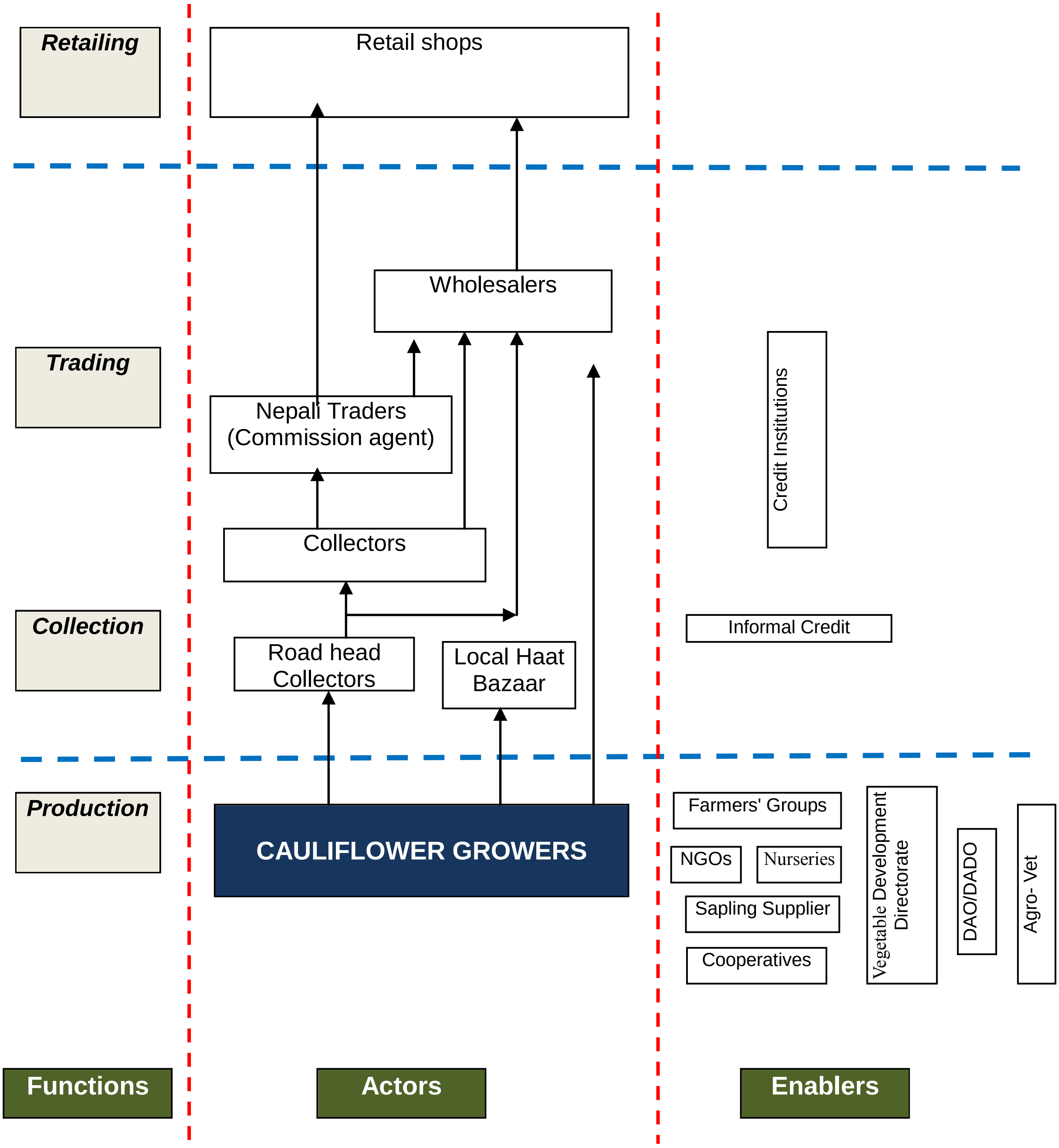


Figure 3.1: Cauliflower Value Chain Map

3.1.2 Value Chain Actors and Functions

Major actors involved in value chain of cauliflower and their function are:

Producers: Producers are mainly involved in cultivation and sale of cauliflower. Major functions performed by producers include:

- Preparing field and planting seedling of cauliflower along with its care and management
- Field care and management, including application of fertilizers, pesticides, weeding, irrigation etc
- Bring cauliflower up to the nearest road head

- Negotiation with collectors on price and sale of produce
- Provide cauliflower in credit for about 15 days to 1 months from harvest of produce

Road head collectors/contractors: They are generally involved in collection and sale of produce. They are mostly present at road heads where the production is scattered or less. They mostly sell produce to wholesalers or collectors. They operate their business mainly during cauliflower production seasons but might be involved in other vegetable crops as well. They generally establish small grocery shops in the village to supply food and other essential items required to farmers in credit. Some are the commission agents of collectors or wholesaler as well. Major functions performed by them include:

- ➢ Negotiation with farmers on price of produce, based on quality
- ➢ Provide foods (rice, pulses and oil) together with other grocery required by farmers in credit
- ➢ Sale produce to wholesalers and collectors, especially loading in public transportation
- ➢ Fix price with collectors and wholesalers and supply cauliflower

Contractors/Collectors: Collectors are generally involved in sell of produce. They are mostly present at production pockets. They mostly sell produce in Kathmandu. They operate their business mainly during vegetable including cauliflower production seasons. Major functions performed by them include:

- Negotiation with farmers and road head collector on price of produce, while considering quality and quantity of produce
- Provide credit or advance to the farmers and road head collectors prior to harvest, mainly for input purchase and meeting their immediate cash needs
- Transportation to market center
- Sale of producers to wholesalers/traders/commission agents

Traders/Commission agents: Traders and commission agents are operating at the wholesale market center, especially in Kathmandu and other urban market etc. They sell produce brought by collectors on commission basis. They generally take commission of 5-8 percent to sale produce. They are least bothered with the purchase price of collectors but fix prices considering market demand and supply situation. Likewise, they operate year round and sell cauliflower from other part of county such as terai or India in off season period for SRC areas. They generally operate business for about 6-8 hours a day. Major functions performed by them include:

- Determine price of cauliflower considering market demand and product flow situation
- Sale produce wholesalers, retailers and consumers on bulk quantity
- Provide interest free loan to collectors to purchase cauliflower during peak production seasons

Wholesalers: Wholesalers are operating at district head quarters and key market centers, especially in urban areas and also in Kathmandu. They purchase cauliflower either directly from collectors, especially in the market center like Baneshwor, Kalimati, Lagankhel, Banepa etc or from traders and commission agents in market centers. They sell produce to retailers or consumers. Wholesalers fix prices based on their purchase price along with market demand. Major functions performed by wholesalers include:

- Determine price of cauliflower considering market demand, product supply situation, quality and their profit margin
- Sale produce retailers and consumers on small quantity (at least 5 kg)
- Adjust prices considering volume of sale and quality of produce
- Provide goods to retailers on credit for a period of 2-3 days for selling of produce

Retailers: Retailers are operating at road head, weekly markets, and district head quarters as well as in key market centers in the urban areas. Retailers operating on production districts purchase cauliflower from farmers or collectors. Likewise, they purchase from traders/commission agents or wholesalers in case of market centers. Retailers sale produce to consumers. Retailers fix prices based on their purchase price along with market demand. Major functions performed by wholesalers include:

- Determine price of cauliflower considering demand, quality and their profit margin
- Sale produce consumers as per their need
- Bargaining on price with consumers based on quality of produce

Table 3.1 summarizes major functions performed by different value chain stakeholders and their involvement. Farmers are highly involved only in production and harvesting activities. Their involvement in marketing is very low. Only very few farmers are involve in marketing.

Table 3.1: Major Functions Performed by Value Chain Stakeholders

Functions	Farmer	Collector	Agro-vet	Cooperatives / Association	DADO	Commission Agent/Wholesalers	Retailers
Production/ Cultivation	High	No	No	Low	No	No	No
Input supply	No	No	High	High	Low	No	No
Credit/ loan/Finance	No	Low	Medium	Medium	No	No	No
Farm /management	High	No	No	Low	No	No	No
Technical support	Low	No	High	Low	Medium	No	No
Harvesting	High	Medium	No	No	No	No	No
Grading	No	No	No	No	No	Low	High
Sale/Marketing	Low	High	Low	Medium	No	High	High

Local collectors are highly involved in marketing and few also provide credits to farmers in a condition that the farmers have to sell cauliflower only to the loan lender trader. Role of agro vets is basically input supply and technical supports, however few of them also involved in financing credit and marketing of cauliflower. They supply insecticides and pesticides to farmers. In addition, they also supply chemical fertilizers. It is surprising to see that role of DADO in entire value chain is not prominent. Their involvement is only in technical supports that also at medium level. Product based cooperatives are involved in input supply and lending loan. These cooperatives sell chemical fertilizers and also provide credit to farmers. Financial cooperatives are only involved providing credit to farmers. Commission agents, wholesalers and retailers perform the role of marketing.

3.1.3 Volume Handled

Figure 3.2 shows volume handled by different value chain stakeholders.

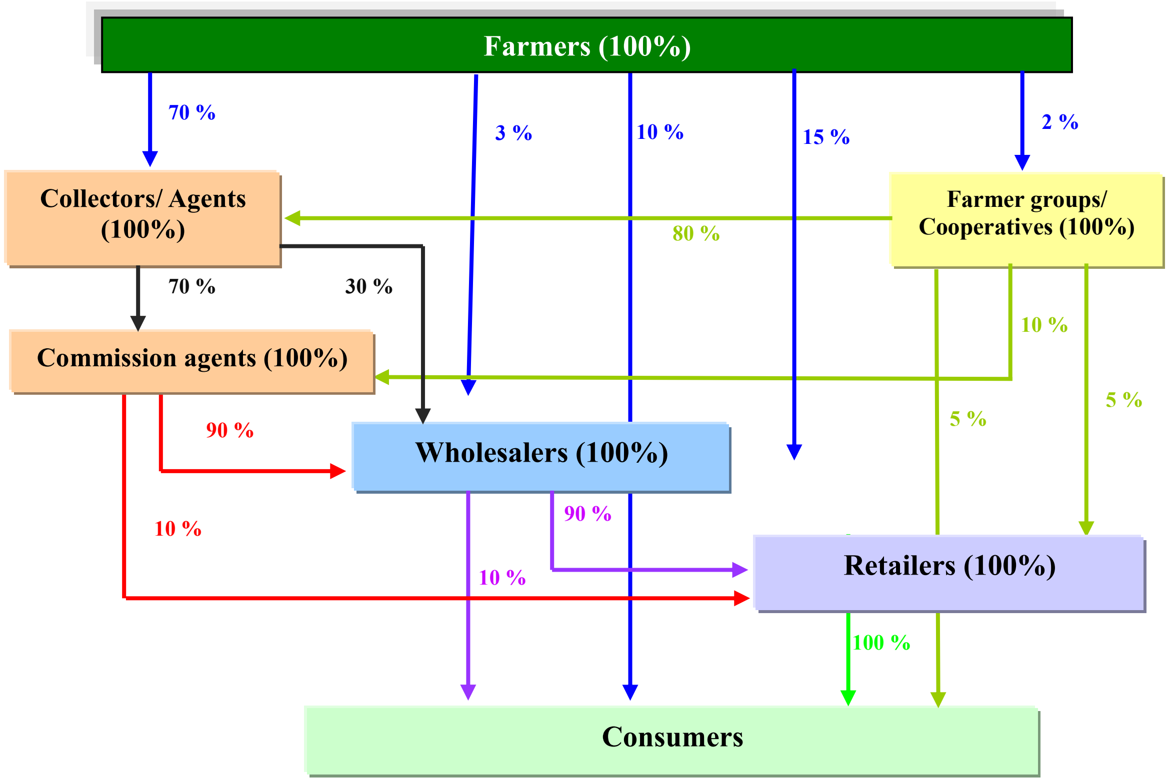


Figure 3.2: Volume Handled by Different Value Chain Stakeholders

A large part of the total production goes to outside markets, specifically from Kavre and Dolakha districts. One of the key reasons for going a large part of cauliflower in the market is the access of these districts to Kathmandu valley, particularly Kalimati fruits and vegetable wholesale market and a high demand of cauliflower.

Based on above figure, table 3.2 summarizes the key market chain stakeholders and volume handled by them. The majority of the product from Dolakha and Kavre goes to Kathmandu whereas around 90 percent of the produce from Ramechhap is locally sold and consumed.

Table 3.2: Produce Handled by Different Market Chain Stakeholders Directly

Unit: Percent

Market agents	Kavre	Dolakha	Ramechhap
Collectors	70	75	10
Farmers group/Cooperatives	5	-	-
Wholesalers	10	-	-
Retailers directly (including farmers self retailing)	15	25	90
Total	**100**	**100**	**100**

Source: Field Survey

3.1.4 Places

Cauliflower produced in the districts is sold locally as well as Kathmandu (see map 3.1). Table 3.3 presents proportion of cauliflower sold at different market places. Table reveals that most of the produce is sold in Kathmandu market followed by local market, district headquarters and neighboring districts. Arrival is high in Kathmandu, which is mainly because of Kavre and Dolakha districts.

Map 3.2: Market of Cauliflower

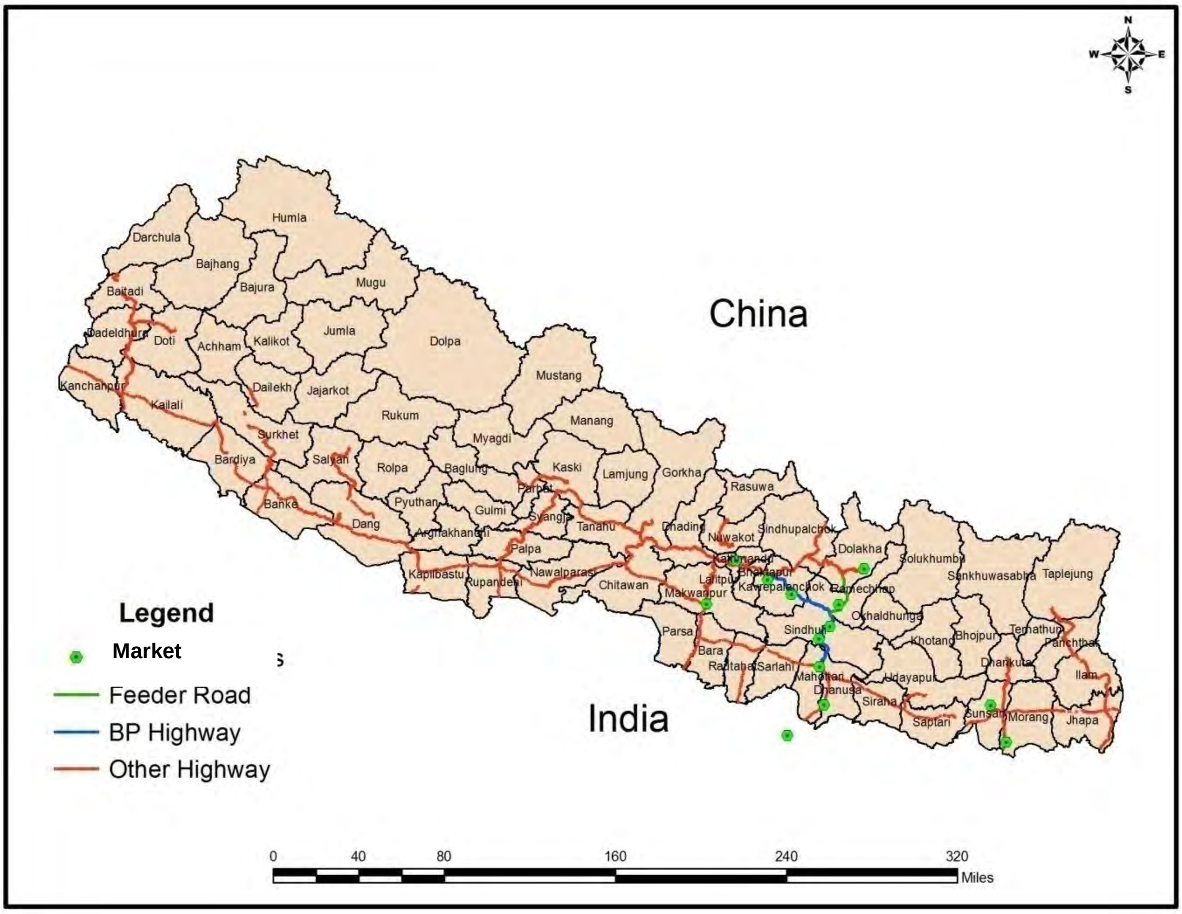


Table 3.3: Produce Sold in Different Market Places

Unit: Percent

Market places	Kavre	Dolakha	Ramechhap
Local markets (including weekly haat bazaars and within district)	30	10	80
District head quarters	2	10	20
Neighboring districts	5	5	-
Kathmandu	63	75	-
Total	**100**	**100**	**100**

Source: Field Survey

Table 3.4 shows the market access of different value chain stakeholders. The table reveled that farmers do not have access to Kathmandu market whereas local collectors have access to all market places. District traders/wholesalers mostly do not go to farm gate but they have a presence in other market places. Commission agents only present in Kathmandu and big market centers like Banepa, Narayanghat etc. Likewise, wholesalers are present in DHQ and Kathmandu. Similarly, retailers are present in all market places except farm gate.

Table 3.4: Market Access of Different Value Chain Stakeholders

Places	Farmers	Local collector	District traders/ wholesalers	Commission agent/ Wholesalers	Wholesalers (KTM/DHQ)	Retailers (KTM/DHQ)
Farm Gate	Yes	Yes	-	-	-	-
Road head market (High way)	Yes	Yes	Yes	-	-	Yes
DHQ	Yes	Yes	Yes	Yes	Yes	Yes
Kathmandu	-	Yes	Yes	Yes	Yes	Yes
Urban Cities	-	Yes	-	Yes	Yes	Yes

Source: Field Survey

3.2 Value Chain Performance

The analysis of priced margins has been carried out by using a standard format that shows major costs, losses, margins and prices along the chain and the share of each players as the product moves from production to local collectors, traders, wholesale market and finally up to the consumers. The information is based on the information obtained from the districts and Kathmandu market.

3.2.1 Producers

Table 3.5 presents cost and margin of producers. The study found that cost of cultivation differs by districts. This is mainly because of high different on wage rates, quantity of use of production inputs such as seeds, fertilizers, farm gate price and yield. Farmers are gaining high profit in all the districts from cultivation of cauliflower which varies from 45.6 percent in Dolakha to 68.1 percent each in Kavre. The profit of farmers is much higher than this, because they don’t hire labour for cultivation. Instead, they use their own family members. Hence, there direct production cost is very minimal. Use of input per unit cost of production in Dolakha is high because farmers used poultry manure as well apart from compost.

Table 3.5: Cost and Margin of Producers

Activities	Unit	Amount (Rs)		
		Kavre	Dolakha	Ramechhap
Input use	Rs/kg	3.1	4.9	4.0
Labor	Rs/kg	5.9	4.8	4.5
Total expense (Cost)	Rs/kg	9.0	9.7	8.5
Sale price	Rs/kg	15.0	14.0	14.0
Profit	Rs/kg	6.0	4.3	5.5
Profit percent	%	68.1	44.3	65.1

Source: Field Survey

Annex 3.1 presents cost of production by districts.

3.2.2 Collectors

Role of collectors along the value chain is important. They act as a bridge between producer and markets. They purchase cauliflower with farmers in weight basis. The margin enjoyed by them is around Rs 0.5 per kg. Nevertheless, they have to bear the risk of price fluctuation in the market. Depending upon relationship with farmers, they purchase on cash or credit. Farmers' don't sell their produce in credit if the collectors are outsider of villages. However, majority of local collectors purchase on credit and pay within fortnight to one month. The major cost incurred by collectors include loading, transporting, unloading. ***Annex 3.2*** presents details on cost associated with collectors and their income. If collectors bring produce to Kathmandu market, collectors take margin of Rs 1.3 per kg. Profit margin percent is 3.0 percent if traded locally and 7.1 percent if traded in Kathmandu. In some cases, for example in Ramechhap, farmers performs role of collectors too. They take their products directly to retailers. This happens mostly when farmers are closely located to the market centers.

Table 3.6: Cost and Margin of Collectors

Activities	Unit	District	Kathmandu
Purchase price	Rs/kg	14.3	14.3
Value addition cost	Rs/kg	2.2	4.1
Total Expense (cost)	Rs/kg	16.5	18.4
Sale price	Rs/kg	17	19.7
Profit	Rs/kg	0.5	1.3
Profit margin percent	**%**	3.0	7.1

Source: Field Survey

3.2.3 Commission Agents /Wholesalers

These actors are available in Kalimati, Baneshwor and Banepa markets at Kathmandu. They sell cauliflower in bulk quantities (wholesale) by charging commission. Commission is generally 5-8 % of sold quantity. In whole value chain, commission agents possess the lowest risk while their margin is very high. They are least affected by price fluctuation.

According to the traders who bring cauliflower to Kalimati or Baneshower market, the market opens at 3 AM in the morning. Commission agents fix the high price in the morning and start reducing prices as day proceeds, depending upon quantity of sale. They clear place for next consignment at the end or mid of the day. If commission agents charges 7% commission on sale amount of collectors/contractors, they will make profit margin of Rs 0.67 per kg

Table 3.7: Cost and Margin of Commission Agents/Wholesalers

Activities	Unit	Kathmandu
Rent	Rs/kg	0.17
Wage and other expense	Rs/kg	0.2
Interest (Advances)	Rs/kg	0.15
Value addition (Total cost/investment)	**Rs/kg**	**0.52**
Commission (Income)	Rs/kg	1.19
Net Profit	Rs/kg	0.67
Profit margin percent	**%**	**128.8**

Source: Field Survey

3.2.4 Wholesalers

These actors perform three roles; traders, wholesalers and retailers. They are situated in the districts as well as in urban market center. The study found that wholesalers of cauliflower are operating in Manthali and Banepa. Likewise, they are also operational at Kalimati. Wholesalers operate business for whole year but products dealt by them vary by seasons.

Table 3.8 presents cost and margin of wholesalers operating at district head quarters and Kathmandu, with details in **Annex 3.3**. Profit margin enjoyed by wholesalers operating at district and Kathmandu is Rs 2.1 and Rs 2.5 per kg respectively. However, their margin depends on their performance too. Margins of wholesalers are much higher than this because they also do retailing, where price increases almost by Rs 6 per kg. Nevertheless, they have to bear losses because of rotting up of cauliflower in selling or damaged in transportation. Their profit margin per kg is more than more than ten percent of their investment.

Table 3.8: Cost and Margin of Wholesalers

Activities	Unit	District	Kathmandu
Purchase price	Rs/kg	16.0	16.5
Value addition cost	Rs/kg	0.9	1.0
Total cost	Rs/kg	16.9	17.5
Sale price	Rs/kg	19	20
Profit	Rs/kg	2.1	2.5
Profit margin percent	**%**	**12.3**	**14.3**

Source: Field Survey

3.2.5 Retailers

Many small vegetable shops are available in major market centers. Cauliflower is available on all shops in Kathmandu and other urban market. Table 3.9 presents cost and margin of retailers operating at district and Kathmandu with details in ***Annex 3.4***. Profit margin enjoyed by retailers operating at district and Kathmandu is Rs 4.7 and Rs 4.2 per kg which 21.3 percent and 16.2 percent of their investment respectively.

Table 3.9: Cost and Margin of Retailers

Activities	Unit	District	Kathmandu
Purchase price	Rs/kg	17.7	20
Value addition cost	Rs/kg	4.3	5.8
Total cost	Rs/kg	22.0	25.8
Sale price	Rs/kg	26.7	30
Profit	Rs/kg	4.7	4.2
Profit margin percent	**%**	**21.3**	**16.2**

Source: Field Survey

3.3 Analysis of Service Providers/Enablers

Table 3.10 presents different service providers together with their major functions, frequency and their limitation/weakness. Table reveals that farmers have been accessing services from different service providers. However most of them regularly access services from Agro-vets despite of their complained with the quality of material supplied by them. Private as well as public sector service providers have not only inadequate technical knowledge and skills but also human resources required for effective and efficient delivery of services.

Table 3.10: Assessment of Service Providers

Name	Major functions	Frequency of service	Limitations/Weakness
DADO	• Technical support • Training production marketing and plant protection measures • Training to nursery growers • Seed distribution on subsidiary price (50%) • Demonstration on lime use against club root disease • Commercial vegetable production pocket area developed in highway road corridor • Training on IPM	Occasional	• Limited number of staff • Inadequate technical support and advice, including farm visit • Inadequate human resource development • Poor support on market linkage establishment • Little knowledge about variety and its seasonality • Timely technical services and advices not available • Less access of subsistence farmers on resources
Agro vets	• Technical advice • Input supply	Regular	• Un timely availability of production inputs • Unreliable quality • Limited technical knowledge
Financial Cooperative	• Loan	Occasional	• Limited amount of fund • No direct support for vegetable cultivation
Financial institutions	• Loan/credit	Rare	• Difficult and time consuming process

3.4 Opportunities and Challenges/Constraints Analysis

Table 3.11 analyzes on opportunities and constraints related to the value chain development of cauliflower. Major challenges or constraints includes availability of poor quality seed, inadequate technical knowledge and skills on cultivation practices, poor conditions of road, inactiveness of producers' or farmers group etc. Nevertheless, there exists ample of opportunities as well. Farmers are organized into producer associations and well established network exists. Potentiality for increase on production and productivity by small support and operation of agro-vets at the production center further provides opportunities for the development of cauliflower.

Table 3.11: Opportunities and Constraints

Category of Constraints	Constraints/Challenges	Opportunities
Technology/ Production processes	• Quality seeds • Less awareness about quality seeds as well as cultivars • Poor irrigation facility • Transportation from field to storage and storage to market expensive • Awareness of about the importance of quality seed and crop management • Special quality cauliflower for processing, Technical knowledge • Low production due to local seed • Road access to production area • Incidences of club root disease and its control • Little knowledge about the varieties and its seasonality • Inadequate irrigation facility • Lack of timely field supervision and advices • Little knowledge about packages, packaging and transportation (post harvest handlings) • Poor knowledge about bio- fertilizer and bio pesticide to promote organic farming	• GO, NGOs, Horticultural farms, nursery and Co-operatives are available to provide services • Ecologically friendly/suitable production area • Ecologically friendly/suitable production area • Production impulse are season vegetables • High income from crop produce • Area expansion is possible
Technical skills/ human resources	• Low technical skill/knowledge of producers • Limited manpower, DADO staff and ASC • High dependency with agro-vets • Shortage of labor during farming seasons • Little knowledge about IPM/ Organic farming • Lack of Advance knowledge in specific crop of technical person	• • Govt. field staff NGO and Private service provider are available • Leader farmers available at rural villages
Management/ Production and organization	• Cropping calendar not followed properly, especially harvesting and applications of fertilizers • No follow up of recommendations made by different agencies, mainly own knowledge and skills • Farmers not organized for production and marketing • Crop and diseases management not properly done/ challenging • Packages of production not followed properly • Members of farmers organization think individually and opportunist • Subsistence farmers are not organized	• Existence of farmers groups • Recommendations made by different agencies and institutions regarding input use and crop management • Few cooperatives are involved in production and marketing • Production inputs and technical support available

Category of Constraints	Constraints/Challenges	Opportunities
Marketing	• Losses of quality during transportation • Weak linkage between production and marketing • Difficut to transport farm to road had • Price fluctuation with season • Less information about market price • Poor road condition • High transportation cost from field to market access • Lack of market information about price and quality • Price and quantity variations influence the marketing • Price controlled by traders • Farmers don't know price of their produce/ cost record • Farmers unaware about market technique to sale their produce	• Local markets for selling produce. • Local traders buy and sale produce in the district and outside the district • Established market network and large number of collectors operating at production pockets
Policy/ Institutional issues	• Insufficient support and services for area expansion • Insufficient budget • No crop insurance	• Demand led service development approach followed by farmers • High priority for agricultural crops
Finance	• Financial institutes not provide the loan timely and needed amount • High interest rate • Interest payback period is not justifiable	• Easy availability from local cooperatives and collectors
Infrastructure	• No cold storage facility • Inadequate collection center • Rough road conditions • Inadequate irrigation facility	• DADO, DIO, VDC/DDC spent for improving irrigation and roads network • MDD spent for marketing shade/ collection center • Road head access to farmers field
Production inputs	• Un timely availability of production inputs • Unreliable quality • Unavailability of required inputs, especially seeds and medicines • Limited technical knowledge • High price	• Agro-vets and co-operatives available • Farmers demand is high

CHAPTER 4 CONCLUSIONS AND RECOMMENDATIONS

4.1 SWOT Analysis

Table below summarizes strengths, weakness, opportunities and threats of cauliflower production based on findings of value chain analysis. Strengths and weakness are mainly related with the internal factors while opportunities and threats are external.

Strengths	Weakness
• Farmers and farmer group involvement in cultivation • Profitable enterprise • Relatively good infrastructure including road, irrigation, electricity and market access • Long tradition of area on cauliflower production and marketing • Easy access to services, especially production inputs • Established network for technical advice and support • No marketing complexity • Farmers are experienced for producing the crop	• Lack of advance knowledge about production • Timely irrigation and recommended doses of fertilizer are not applied, either over or under applications • Knowledge about post harvest handling is limited • Decreasing supply or use of organic manure, declining soil productivity due to inappropriate application of fertilizers • Poor crop husbandry practices such as lack of crop rotation and use of uncertified seeds • Depend heavily on rain-fed system, less availability of irrigation, especially on high altitude area • No timely and regular supply of inputs from Agro-vet • Poor post harvest handlings especially in packaging and transportation • Weak linkages among the different service providers • Poor post harvest handlings especially in packaging and transportation • Suitable/ proper selection of cultivars according to season • Subsistence farmers are not able to buy hybrid costly seed

Opportunity	Threats
• Resource centers viz. govt. Horticulture farm and private nursery growers for seed and seedlings supply • Well established govt. organizations network, NGO and other service providers available for technical support • Suitable soil and climate condition for crop production • Public and NGO (ECARDS, CEPRED) involved in promoting the vegetable crops • Markets and consumers are increasing • Seeds and nursery equipment supply on subsidiary price is encouraging • Agro-vets and other service providers available • Loan facility provided by saving and credit co-operatives • High profitable enterprises • Increasing affordability • Collectors are operating at key market center and production places	• Very high competition in Kathmandu market mainly due to imports from Terai • Vegetables are of perishable nature, likely to be damaged • High cost of transport • High incidences of disease and pests • Hailstones • Very high use of pesticide application • Likely dominance of cauliflower from Terai market after the completion of Sunkoshi bridge • Labor intensive, shortage of human labor during production seasons; new generations/ young people less attracted towards farming • Increasing number of quality conscious consumers • Highly fluctuating market prices, often controlled by few market places • Declining farming land due to rise in population • Small plots and sloping topography limit the options for mechanization

4.2 Recommendations

Based on the above SWOT analysis and findings of value chain analysis, the study recommended on following actions with a view to increase income and productivity from cauliflower cultivation. The focused should be on (a) improving the farming practices to increase production and productivity of farmers (b) Strengthen farmer's organizations and (c) improvement on marketing and distribution of cauliflower.

With a view to increase production and productivity of farmers by improving farming practices, following suggestions are made:

- Support for ensuring timely available of good quality seed
- Promote farm mechanization suitable for mountainous regions as a substitute for costly labour;
- Introduce crop insurance schemes;
- Provision of finance for farmers to buy hybrid seeds and non-conventional irrigation technologies
- Provision of sufficient and quality extension services by strengthening farmer's organization and networks
- Mobilization of farmers and utilization of other linkages for bulk purchases and access to government subsidized fertilizer
- Develop crop husbandry practices/calendar of operation for cauliflower cultivation and disseminate with farmers
- Orient farmers on balance use of plant nutrients, to control disease and pests
- Strengthen capacity of farmers' on cultivation practices, especially on plant care management in case of disease and pest
- Establish resource center/information center at key production zones with a view to disseminate technical knowledge and market price information
- Develop and mobilize local resource persons for providing support services to farmers, especially on training and safe and efficient use of pesticide, insecticide and fertilizers
- Promote non-conventional irrigation technologies, especially rain water harvesting, catchment ponds and plastic ponds to supply water for irrigation during dry seasons
- Work in partnership with different agencies on delivery of inputs and services
- Conduct regular monitoring of diseases and pests
- Conduction of Integrated Crop Management (ICM) and Integrated pest managment training to farmers
- Train agro-vets and other input suppliers on different cultivars suitable for the locality and discourage use of un-recommended variety

Following actions are suggested for developing and strengthening of farmers' institutions

- Raise awareness about the benefits of working in a group and cooperative
- Organize farmers into group and cooperatives for collective marketing and support to form a co-operative
- Involve cooperatives and groups on marketing of produce
- Support cooperative and producer's association to develop business plan of their produce
- Build the capacity of producer's associations and cooperatives by supporting on assets building and addressing their operational constraints
- Support for organizations and registrations cooperatives with concerned government institutions
- Mobilize farmers co-operatives to function as Agri-input suppliers along with technical advice
- Following actions are suggested for strengthening marketing and distribution of cauliflower
- Collection and dissemination of information on market prices, demand-supply conditions, market destinations by using mobile network system etc
- Establish a revolving fund/loan at the cooperatives to provide loan to farmers who are on immediate need of cash for seed and fertilizer such that farmers don't depend on collectors
- Organize interactions between traders and producers to strengthen linkages and communications with each others
- Explore possibility of small value addition and processing of cauliflower
- Improve cauliflower marketing by promoting market information systems, and educating and raising farmers' awareness on group approach of marketing
- Training supports to farmers on post harvest handling mainly on minimizing losses during transportation
- Support for packaging of cauliflower so that freshness could be maintained
- Training the transporters and collectors on safety handling during transportation of the cauliflowers so as to reduce losses and maintain qualities.

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Annex 1.1: Consultations with Producers

District: Ramechhap

Location: Khimti
Name of participants

SN	Name of Person Met
1	Mrs Mira Poudel
2	Mr Bhoj Prasad Pokhrel
3	Mrs Dipsikha Dahal
4	Mrs Gita Dahal
5	Mrs Kalyani Thapa
6	Mrs Sushila Thapa
7	Mrs Durga Kadariya
8	Mrs Uma Devi Pokharel
9	Mrs Gova Dahal
10	Mrs Durga Dahal
11	Mrs Pushpa Dahal
12	Mr Bhoj Prasad Khadka
13	Mr Chitra Prasad Pokharel

District: Kavre

Location: Kuntabesi
Name of participants

SN	Name of Person Met
1	Mr Achyut Prasad Sapkota
2	Mr Shyam Prasad Sapkota
3	Mr Ram Prasad Sapkota
4	Mr Pashupati Prasad Sapkota
5	Mrs Parbati Sapkota
6	Mrs Bagititi Sapkota
7	Mrs Bhawani Sapkota
8	Mrs Menuka Sapkota
9	Mr Maheswar Dahal
10	Mr Hari Prasad Sapkota

District: Dolakha

Location: Makaibari, BNP
Name of participants

SN	Name	Location	Major functions
1	Mr Sher Bahadur Gurung	Makaibari	Trader/Collector
2	Mr Ramesh Shrestha	Charikot	Trader/Collector
3	Mr Puroshtam Ghimire	Charikot	Trader/Collector
4	Mr Rajan Shrestha	Dolalghat	Trader
5	Mr Indra Pathak	Charikot	Wholesellar
6	Mr. Shantosh Raut	Charikot	Retailer
7	Mr Shyam Shah	Charikot	Trader/Collector
8	Mr Narbahadur Tamang	Charikot	Trader/Collector
9	Mr Chitra Bahadur Tamang	Charikot	Trader/Collector
10	Mr Sher Bahadur Tamang	Charikot	Trader/Collector
11	Mr. Bal Krishna Oli	Pawati	Trader

Annex 1.2: Consultations with Value Chain Stakeholders

District: Dolakha

Name of participants

SN	Name	Location	Major functions
1	Mr Sher Bahadur Gurung	Makaibari	Trader/Collector
2	Mr Ramesh Shrestha	Charikot	Trader/Collector
3	Mr Puroshtam Ghimire	Charikot	Trader/Collector
4	Mr Rajan Shrestha	Dolalghat	Trader
5	Mr Indra Pathak	Charikot	Wholesellar
6	Mr. Shantosh Raut	Charikot	Retailer
7	Mr Shyam Shah	Charikot	Trader/Collector
8	Mr Narbahadur Tamang	Charikot	Trader/Collector
9	Mr Chitra Bahadur Tamang	Charikot	Trader/Collector
10	Mr Sher Bahadur Tamang	Charikot	Trader/Collector
11	Mr. Bal Krishna Oli	Pawati	Trader

District: Ramechhap

Name of participants

SN	Name	Location	Major functions
1	Mrs Sita Karki	Manthali	Retailer
2	Mr Santosh Thapa	Manthali	Wholeseller
3	Mr Mukti Prasad Prasain	Pakhrebal	Retailer
4	Mr Sher Bahadur Shrestha	Manthali	Retailer
5	Mr. Bhakta Manandhar	Manthali – 5	Collector/Trader/Wholesaler/Retailer

District: Kavre

Name of participants

SN	Name	Location	Major functions
1	Mr. Dhan B. Bhujel	Banepa	Trader/Collector/Wholesaler/Retailer
2	Mr. Lal Kaji Lama	Banepa	Trader/Collector/Wholesaler/
3	Mr. Durga Narayan Shrestha	New Baneshwor	Trader/Collector/Wholesaler/Retailer
4	Mr. Tej Kumar Shrestha	Banepa	Collector
5	Mr. Kishan Shrestha	Banepa	Retailer
6	Mr. Om Krishnsa Shrestha	Banepa	Retailer
7	Ms. Reena Shrestha	Banepa	Retailer
8	Mr. Ishwor Thapa	Patlekhet	Collector/Trader

Annex 1.3: Consultations with Service Delivery Agencies

District: Ramechhap

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr. Tanka Kr. Shrestha	Bhanu & Nisha Vet. Shop	Manthali	Input Supplier
2	Mr. Narayan Poudel	Ramechhap Agro-Center	Manthali	Input Supplier
3	Mr. Mohan Kr. Shrestha	Junar Krishi Sahakari Sanstha	Okhreni	Input Supplier/ Financing/ Processing/ Marketing
4	Mr. Shree Kr. Shrestha	Jamarko Krishi Sahakari Sanstha	Kathjor	Input Supplier
5	Mr. Chabilal Ghimire	DADO	Manthali	Technical Support
6	Mr. Govinda Pokhrel	DADO	Manthali	Technical Support
7	Mr. Mohan Pd. Khatiwada	DADO	Manthali	Technical Support
8	Mr. Rishiraj Subedi	DADO	Manthali	Technical Support
9	Mr. Shiv Narayan Ran	DADO	Manthali	Technical Support

District: Dolakha

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr Shree Lal Baral	DADO	Charikot	Technical Support
2	Mrs Sangeeta Sunuwar	DADO	Charikot	Technical Support
3	Mr Tara Dahal	DADO	Charikot	Technical Support
4	Mr Parmeswor Mandal	DADO	Charikot	Technical Support
5	Mr Dal Bahadur Tamang	Cooperatives	Charikot	Input Supplier/Financing
6	Mr Vasu Thapa	Agro-Vet Shop	Charikot	Input Supplier

District: Kavre

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr. Ishowri Pandey	DADO	Dhulikhel	Technical Support
2	Mr. Surya B. Thapa	DADO	Dhulikhel	Technical Support
3	Mr. Ek Bhd. Tamang	Sankhu Saving and Credit Cooperative Society Limited	Sankhu	Input Supplier/Financing
4	Mr. Basu Dhital	Yuwa Krishi Sahakar Santha Limited	Patlekhet	Input Supplier/Financing
5	Mr. Dinesh Tiwari	Yuwa Krishi Sahakar Santha Limited	Patlekhet	Input Supplier/Financing
6	Mr. Kumar Neupane	Hanuman Agro-vet Pvt. Ltd	Patlekhet	Input Supplier/Technical Support

Annex 3.1: Cost of Cultivation of Cauliflower

A. Kavre

B. Unit: 1 ropani (0.05 ha)

Particulars	Unit	Quantity	Rate	Amount (Rs)	Remarks
Inputs					
Seeds	Gm	10	40	400	
Compost	Doko	50	50	2,500	
Urea	Kg	3	40	120	
Potash	Kg	5	40	200	
DAP	Kg	0	60	0	
Sub-total				**3,220**	
Labor					
Land preparation for seedling growing	Hr	2	300	600	
Seed sowing, covering with paral and irrigation	Hr	1	300	300	Female
Ploughing with tractor	No	1.5	500	750	
Land making, Dang preparation and sapling planting	No	3	300	900	
Weeding, earthing, manuring		2	300	600	
Irrigation (10 times)	No	3	300	900	Female
Weeding	No	1	300	300	Female
Picking and transporation	No	6	300	1,800	Female
Sub-total				**6,150**	
Total Expenses				**9,370**	
Sales	**Kg**	**1,050**	**15**	**15,750**	
Profit				**6,380**	

Inputs	**3.1**
Labour	**5.9**
Total cost	**8.9**
Sale	**15.0**
Profit	**6.1**
Profit margin	**68.1**

C. Ramechhap

Unit: 1 ropani (0.05 ha)

Particulars	Unit	Quantity	Rate	Amount (Rs)	Remarks
Inputs					
Seeds	Gm	10	52	520	
Sandy soil	Bhari	1	50	50	
Compost	Doko	51	50	2,550	
Urea	Kg	10	40	400	
Potash	Kg	4	40	160	
DAP	Kg	7	60	420	
Multiplex	Bottle	7	100	700	
Sub-total				**4,800**	
Labor					
Land preparation for seedling growing	Hr	1	37.5	37.5	Female
Seed sowing, covering with paral and irrigation	Hr	1	37.5	37.5	Female
Ploughing with oxen	No	1	1,000	1,000	
Land making, Dang preparation and sapling planting	No	2	500	1,000	
Irrigation (10 times)	No	6	300	1,800	Female
Weeding	No	1	300	300	Female
Picking	No	4	300	1,200	Female
Sub-total				**5,375**	
Total Expenses				**10,175**	
Sales	**Kg**	**1,200**	**14**	**16,800**	
Profit				**6,625**	

Inputs	**4.0**
Labour	**4.5**
Total cost	**8.5**
Sale	**14.0**
Profit	**5.5**
Profit margin	**65.1**

C. Dolakha

Unit: 1 ropani (0.05 ha)

Particulars	Unit	Quantity	Rate	Amount (Rs)	Remarks
Inputs					
Seeds	Gm	10	20	200	
Bamboo	No	1	100	100	
Poultry Compost	Bag	16	300	4,800	
Plastic	Ls	1	100	100	
Carbendism	Ls	1	10	10	
Vitamin & medicines	Ls	1	425	425	
DAP	Kg	15	40	600	
Urea	Kg	11	30	330	
Potash	Kg	5	30	150	
Pesticide	Ls	1	100	100	
Sub-total				**6,815**	
Labor					
Bamboo preparation	Ls	1	100	100	
Seed sowing and irrigation Labor	No	1	300	300	Male
Oxen ploughing	No	1	600	600	
Land and dang preparation and seedling plantation	No	5	300	1,500	Male
Composting	No	5	300	1,500	Male
Weeding and Irrigation	No	4	300	1,200	
Irrigation (10 times)	Ls	1	550	550	
Labor for applying Vitamins/Pesticides	No	1	300	300	Male
Harvesting and carrying to roadhead	No	2	300	600	Male
Sub-total				**6,650**	
Total Expenses				**13,465**	
Sales	**Kg**	**1,400**	**14**	**19,600**	
Profit				**6,135**	

Inputs	**4.9**
Labour	**4.8**
Total cost	**9.6**
Sale	**14.0**
Profit	**4.4**
Profit margin	**45.6**

Annex 3.2: Cost and Margin of Collectors Operating at District Headquarters and Kathmandu

A. Districts

SN	Price (NRs.)		Districts			Basis		
		Ramechhap	Kavre	Dolakha	Average	Kavre	Dolakha	Ramechhap
1	Farm Gate	19	11.00	13	14.3			
2	Transport till road head	0.45	0.36	0.36	0.4	The cost of carrying 55 kg of cauliflower is Rs. 20	The cost of carrying 55 kg of cauliflower is Rs. 20	The cost of carrying 55 kg of cauliflower is Rs. 25
3	Load	0.09	0.09	0.09	0.1	Rs. 5 is loading charge for 55 kg	Rs. 5 is loading charge for 55 kg	Rs. 5 is loading charge for 55 kg
4	Transport till DHQ	0.86	0.53	1.00	0.8	Rs. 1600 for 3000 kg	Rs. 1 per kg	The cost of transporting 7000 kg is Rs. 6000
5	Unload	0.07	0.07	0.06	0.1	Rs. 4 for unloading 55 Kg	Rs. 8 for 55 kg	Rs. 4 for unloading 55 Kg
6	Sack	0.16	0.16	0.16	0.2	Rs. 8 per 50 kg of cauliflower sack	Rs. 8 per 50 kg of cauliflower sack	Rs. 8 per 50 kg of cauliflower sack
7	Wage	0.08	0.16	0.08	0.1	2 people working for one day @ Rs. 300 per day per person	2 people working for one day @ Rs. 250 per day per person	2 people working for one day @ Rs. 250 per day per person
8	Food expenses	0.04	0.04	0.04	0.0	Rs. 140 per two persons	Rs. 150 per two persons	Rs. 140 per two persons
9	Sub-total	20.75	12.41	14.78465	16.0			
10	Interest	0.01	0.0034	0.0040506	0.0			
11	Total	20.76	12.42	14.79	16.0			
12	Loss (3.5 percent)	0.726	0.435	0.518	0.6			
13	Overall Cost Price	21.48	12.85	15.31	16.5			
14	Sales price to Whole saler	22	13	16	17.0			
15	Profit Margin to collector	0.52	0.15	0.69	0.5			
16	Profit margin percent				22.7			

Unit: Rs/Kg

B. **Kathmandu**

SN	Price (NRs.)	Districts				Basis		
		Ramechhap	Kavre	Dolakha		Kavre	Dolakha	Ramechhap
1	Farm Gate	19	11.00	13	14.3			
2	Transport till road head	0.45	0.36	0.36	0.4	The cost of carrying 55 kg of cauliflower is Rs. 20	The cost of carrying 55 kg of cauliflower is Rs. 20	The cost of carrying 55 kg of cauliflower is Rs. 25
3	Load	0.09	0.09	0.09	0.1	Rs. 5 is loading charge for 55 kg	Rs. 5 is loading charge for 55 kg	Rs. 5 is loading charge for 55 kg
4	Transport till Kathmandu	1.7	1.00	1.50	1.4	It cost Rs. 1 per Kg to transport from Kavre to KTM	It costs about Rs. 15000 to carry 10 ton of Cauliflower to KTM	It costs about Rs. 17000 to carry 10 ton of Cauliflower to KTM
5	Unload	0.07	0.07	0.06	0.1	Rs. 4 for unloading 55 Kg	Rs. 8 for 55 kg	Rs. 4 for unloading 55 Kg
6	Tax	0.04	0.02	0.02	0.0	About Nrs. 150 per truck	About Nrs. 200 per truck	About Nrs. 350 per truck
7	Sack	0.16	0.16	0.16	0.2	Rs. 8 per 50 kg of cauliflower	Rs. 8 per 50 kg of cauliflower	Rs. 8 per 50 kg of cauliflower
8	Wage	0.15	0.16	0.15	0.2	2 people working for two days @ Rs. 300 per day per person	2 people working for one day @ Rs. 250 per day per person	2 people working for tw0 days @ Rs. 250 per day per person
9	Food expenses	0.07	0.04	0.07	0.1	Rs. 140 per two persons	Rs. 140 per two persons	Rs. 140 per two persons
10	Lodging	0.21	0.00	0.21	0.1	Rs. 800 for two persons	Rs. 800 per two persons	
11	Sub-total	21.96	12.90	15.63	16.8			
12	Interest	0.006	0.004	0.004	0.0			
13	Cost	21.97	12.90	15.63	16.8			
15	Margin by Wholeseller	2	1.28	1.44	1.6			
16	Total cost	23.97	14.18	17.07	18.4			
17	Sales price to wholeseller/Retailers	25	16	18	19.7			
18	Profit margin	1.03	1.82	0.93	1.3			
19	Profit margin percent				41.6			

Annex 3.3: Cost and Margin of Wholesalers Operating at District Headquarters and Kathmandu

Unit: Rs/Kg

SN	Price (NRs.)	Districts		Basis	
		Kavre	Kathmandu	Kavre	Kathmandu
1	Purchase from Collector	16.00	16.5		Rate is same as Kavre except Rs.0.5 additional expenses on transport
5	Unload	0.07	0.1	Rs. 4 for unloading 55 Kg	Rs. 5 for unloading 55 Kg
6	Shack	0.16	0.2	Rs. 8 per 50 kg of cauliflower basket	Rs. 8 per 50 kg of cauliflower basket
7	Wage	0.04	0.1	Month salary of Rs. 5000	Monthly salary per person is Rs. 7000
8	Food expenses	0.04	0.04	Rs. 140 per two persons	Rs. 140 per two persons
9	Storage	0.02	0.0	Rs. 2000 per month for storage rental	Rs. 2500 per month
10	Utility (electricity)	0.001	0.0	Rs. 60 per month	Rs. 90 per month
11	Sub-total	16.33	16.9		
12	Interest	0.00	0.00		
13	Total	16.34	16.90		
14	Loss (3.5 percent)	0.572	0.591		
15	Overall Cost Price	16.91	17.49		
16	Sales price to Retailer	19	20		
17	Profit Margin to collector	2.09	2.51		

Annex 3.4: Cost and Margin of Retailers Operating at District Headquarters and Kathmandu

Study districts

Unit: Rs/Kg

SN	Price (NRs.)	Districts				Basis		
		Ramechhap	Kavre	Dolakha	Average	Ramechhap	Dolakha	Kavre
1	Purchase from wholesaler, collector or farmer	22	15.00	16	17.7			
2	Retail Space	1.1	1.52	1.19	1.3	Daily 60 Kg sales; monthly rent of Rs. 2000	Daily 70 Kg sales; monthly rent of Rs. 2500	Monthly rental is Rs. 2500; Daily sales is about 55 kg
3	Packaging (Plastic)	0.15	0.15	0.15	0.2			
4	Wage	1.7	2.12	1.90	1.9	Month salary is about 3000	Month salary is about 4000	Month salary is about 3500
5	**Sub-total**	**24.93**	**18.79**	**19.25**	**21.0**			
6	Loss (5 percent)	1.25	0.94	0.96	1.0			
7	Total	26.17	19.73	20.21	22.0			
8	Sales	30	25.000	25.000	26.7			
9	Profit Margin	**3.83**	**5.27**	**4.79**	**4.6**			

Kathmandu

SN	Price (NRs.)	Kathmandu	Basis
1	Cost of Cauliflower	20	
2	Packaging Plastic Bag	0.15	
5	Room rent	0.91	Average room rent is about 1,500
6	Wage and Salary	2.12	Rs. 3,500 salary per month
7	Electricity	0.30	Rs. 500 spend per month
9	**Sub-total**	**23.48**	
10	Loss (10 percent)	2.35	
11	**Overall Cost of Retailer**	**25.83**	
14	Selling price of Retailer	30	
15	Margin for Retailer	4.17	

SN4.2: Dairy Value Chain Study

CHAPTER 1 INTRODUCTION

1.1 Background

The study aims to assess existing conditions of High Value Commodities (HVC) development along SRC aiming at reviewing development potential of the HVC, identifying potential commodities along their value chains, and testing their improvement through pilot project as a part of master plan development. In this pursuit, JICA study team intends to conduct detailed value chain assessment of selected 11 commodities (Table 1.1) which have commercialization potential in the SRC area. These commodities have been identified by following robust methodology along with wider consultations with the local, district and central level stakeholders.

Table 1.1: Commodities Selected for Value Chain Study

SN	Commodities	Districts			
		Kavre	Dolakha	Ramechhap	Sindhuli
1	Junar			✔	✔
2	Orange (Mandarin)	✔	✔		✔
3	Goat	✔	✔	✔	✔
4	Dairy	✔	✔	✔	✔
5	Cabbage	✔		✔	
6	Cauliflower	✔	✔	✔	
7	Potato	✔	✔	✔	✔
8	Tomato	✔	✔	✔	✔
9	Lapsi	✔	✔		
10	Turmeric		✔		✔
11	Pineapple				✔

The main purpose of the value chain study is to thoroughly understand the value chains of selected high value agriculture commodities from inputs to consumption as well as associated factors such as various support services and policy environments with a view to identify constraints and points of interventions in the chains so as to inform the preparation of Draft Basic Development Strategy.

This report is one of the 11 of series, which presents detailed value chain analysis of dairy while focusing on existing production and distribution system of all four districts of SRC.

1.2 Objective

The overall objective of the study is conduct detailed value chain analysis of dairy, while focusing on:

- Mapping of value chain actors and stakeholders operating at different level
- Analysis of cost and margin analysis of different value chain stakeholders
- Explore potentialities and constraints o
- Conduct the SWOT analysis and recommend potential strategy and interventions

1.3 Study Approach and Methodology

1.3.1 Conceptual Framework

The study will follow value chain approach in conducting the study. A value chain is defined as the full range of activities required to take a product or service from conception to final disposal after use, through the intermediary phases of production, processing and delivery to final consumers. The value chain approach (VCA) focuses on the interaction of actors along each step of the production system as well as the linkages within each set of actors. VCA considers trade relations as being part of a series of networks of producers, exporters, importers, processors and retailers, whereby knowledge and relationships are developed to gain access to markets and suppliers.

Value chain analysis is a process that requires four interconnected steps: data collection and research, value chain mapping, analysis of opportunities and constraints, and vetting of findings with stakeholders and recommendations for future actions. These four steps are not necessarily sequential and can be carried out simultaneously. Figure 1.1 shows simple graphic illustrating the analysis process and components. The value chain team collects data and information through secondary and primary sources by way of research and interviews. The collected data is analyzed using the value chain framework to reveal constraints within the chain that prevent or limit the exploitation of end market opportunities. The resulting analysis of opportunities and constraints should be verified with stakeholders through events such as workshops and focus groups discussions.

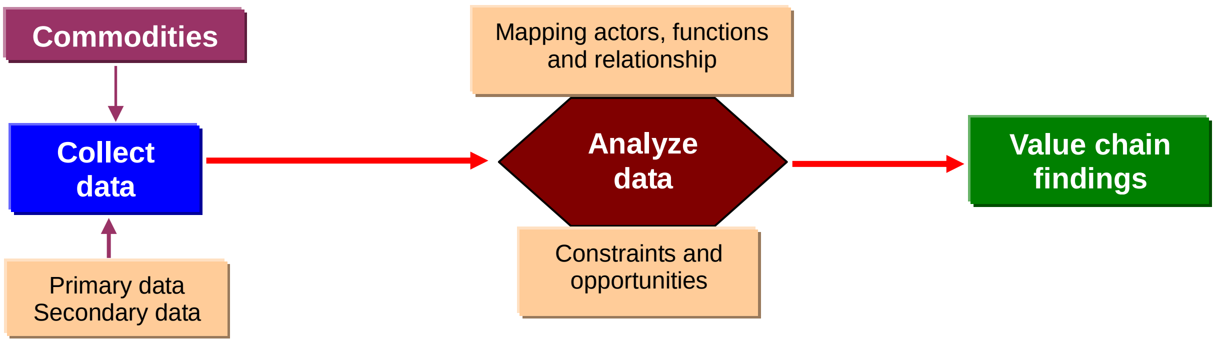


Figure 1.1: Value Chain Analysis Methods

1.3.2 Study Methods

Literature review: Available study reports, annual progress reports, statistical information on Nepalese agriculture were reviewed to collect information related with cultivars, area, production, yield, market price, sale quantity, production location, price, producer groups, etc

Literature review: Available study reports, annual progress reports, statistical information on Nepalese agriculture were reviewed to collect information related with cultivars, area, production, yield, market price, sale quantity, production location, price, producer groups, etc

Interaction with producers: Interaction with producers was carried out in key production zone of each district while focusing on:

- Production processes (Cropping calendar)

- Access to services/Mapping of service providers (Technical/technological, finance)
- Input suppliers and mechanism
- Market chain mapping (Place and actors)
- Transportation system and practices
- Grading and packing practices
- Cost of production
- Price and pricing mechanism
- Problems and constraints

Table 1.2 presents brief overview on consultations with producer groups with detailed on Annex 1.1. Consultations were carried out in four key production areas of two districts where 36 farmers have participated in the group discussions.

Table 1.2: Consultations with Producers

District	Study area/Location	Number of participants
Kavre	• Kuntabesi	12
Dolakha	• Sundrawati	7
Ramechhap	• Khimti	9
Sindhuli	• Khanyakharka	8
Total		**36**

Interaction with value chain stakeholders also focused on (a) core processes in the value chain, i.e. from input provision to retailers and (b) Identifying and mapping the main actors involved in above processes

Interaction with the value chain actors: After interaction with the producer groups, value chain actors operating at different level of value chains are mapped. After wards survey was carried out in selected market places within and outside district. Table 1.3 below number of value chain stakeholders, who are consulted for purpose of study while ***Annex 1.2*** presents name of stakeholders consulted for the purpose of study.

Table 1.3: Number of Value Chain Stakeholders Consulted

Actors	Kavre	Dolakha	Ramechhap	Sindhuli
Collectors	2	1	1	1
Chilling VAT/Collection centre	1	2	1	-
Dairy (Small)	4	2	2	1
Total	**7**	**5**	**4**	**2**

Interactions with value chain stakeholders was carried out to; (a) visualize networks in order to get a better understanding of connections between actors; (b) identify processes in value chain; (c) examine interdependency between actors and processes in the value chain and (d) enhance awareness of stakeholders to look beyond their own involvement in the value chain. Following issues were discussed during the interactions.

- Identifying and mapping the main actors
- Volume of products handled including distribution mechanism (Place and actors)
- Geographical flow of the product or service
- Relationships, linkages and business services between value chain actors
- Price and pricing mechanism
- Transportation system and practices, including mode of transport and cost of transport
- Quality control
- Problems and constraints

After mapping of the value chain, cost and margin analysis of the value chain stakeholders was carried out while focusing on:

- Costs and required investments
- Value added costs
- Estimation of revenues
- Estimation of relative financial position of actors in the value chain

Interactions with the processors (small processing industries) were also carried out which focused on:

- Production processes/Technology used
- Branding, packaging and labeling
- Price and pricing mechanism
- Market margin analysis
- Quality control, including personnel health and hygiene
- Problems and constraints

Interactions with service delivery/input suppliers' agencies: Consultations with the service delivery agencies such as District Agriculture Development Office, Agro-vets, private sector, cooperatives etc, non government agencies etc were carried out to understand:

- Nature and type of services
- Service delivery mechanism including cost of services
- Problems and constraints

Table 1.4 presents service delivery agencies consulted for the purpose of study with details in ***Annex 1.3.***

Table 1.4: Number of Service Delivery Agencies/Service Providers Consulted

Actors	Kavre	Dolakha	Ramechhap	Sindhuli
DLSO Officials	5	4	3	4
Agro vet	1	1	2	4
Cooperatives	4	3	5	-
Total	**10**	**8**	**10**	**8**

CHAPTER 2 MILK PRODUCTION AND MARKETING

2.1 Introduction

Milk is one of the most important livestock products for Nepalese people not only because livestock is an integral part of Nepalese farming system, but also its contribution to Agriculture Gross Development. Livestock farming being a major component of Nepalese farming system is becoming one of the important occupations in the rural area of Nepal.

Dairy farming is presently undergoing a transition phase from subsistence to commercial dairy farming. Dairy farming has been helping the farmers to earn cash income to fulfill their basic needs, at the same time they can get manure as by-product and draft power for agricultural production.

2.2 Dairy Animals and Breeds

Dairy animals include cow and buffalo. There are 7-indigenous breeds of cattle in Nepal namely Lulu, Achhami, Siri. Khaila, Yak, Terai and Pahadi. Besides indigenous cattle, there are three exotic (improved) cattle mainly Jersey, Holstein Frisian (HF) and Brown Swiss (BS). However, it is very difficult to find pure breed of both indigenous and exotic species in SRC area. The local breeds are crossed with improved variety either through natural mating or Artificial Insemination (AI). Milking cows available in the farmers shed is composed mainly of Pahadi x Jersey, Pahadi x Brownswiss, or Pahadi x HS. It is very difficult to identify breeds as well as quality. Hence, most of the breeds reared by farmers are cross breeds of either So, in absence of breed record, we have to rely on farmers saying where any cow that looks fawn said to be Jersey or Holstein Frisian.

There are 3-indigenous buffalo breeds in Nepal namely Gaddi, Lime and Parkot. There is other buffalo breed like Terai and Murrah, Buffalo breeds found in SRC is cross breeds between Murrah and local breeds. Milk buffalo traders import Murrah buffalo from India and sell all over Nepal including Sindhuli corridor, hence breed is easily distinguishable. However, it is very difficult to find a pure breed Gaddi, Lime and Parkote as they have got crossed mated by other breeds of buffalo.

2.3 Animal Husbandry Practices

2.3.1 Calendar of Operation

Table 2.1 presents calendar of operation of rearing dairy animals. Green grasses remain source of feed during from June to December while January to May are considered as dry seasons or food deficit seasons for livestock. During this seasons, dairy animals are fed with crop by-products, crop residues (rice straw etc.) and other fodder trees such as Badhar (*Artocarpus lakoocha*,), Kimbu (*Morus alba*), Ipil-ipil (*Leucaena leucocephala*) etc. Vaccination of animal is generally carried out during April to May for different diseases. Likewise, medications against parasite control are conducted twice a year.

There is seasonal fluctuation in milk production and collection which affects supply of milk in the market. Milk production is divided into seasons, flush and lean seasons based on amount of milk produced. During flush seasons, higher quantity of milk is produced while it is lower during the lean seasons. Production during lean seasons decreased up to three times compared to lean seasons. Flush season starts from July and continue to February, while rest of the months is considered as lean season.

Table 2.1: Animal Husbandry Practices

MILK (COWS AND BUFFALO)	Baisakh Apr-May	Jeth May-June	Asar June-July	Saun July-Aug	Bhadara Aug-Sep	Asoj Sep-Oct	Kartik Oct-Nov	Mangsir Nov-Dec	Push Dec-Jan	Magh Jan-Feb	Fagun Feb-Mar	Chait Mar-Apr
Green Feed Management												
Green grass available during summer months (rainy season)												
Feed deficit period												
Oat (Variety Kent or Swan)												
Crop residues												
Fodder Trees <1200 masl												
Badhar (Artocarpus lakoocha)						Badhar	Badhar	Badhar				
Ipil-ipil (Leucaena leucocephala)						Ipil-ipil						
Kimbu (Morus alba)						Kimbu						
Kavro (Ficus locar)	Kavro	Kavro	Kavro									Kavro
Tanki (Bauhinea varigata)						Tanki	Tanki	Tanki				
Vaccination												
Haemorragic septicimea (HS)	Vaccine											
Black quarter (BQ)	Vaccine											
Foot and Mouth Disease (FMD)	Vaccine											
Anthrax spore vaccine	Vaccine											
Parasite control												
External parasite (Lice and ticks)	Rub,dust or inject					Rub,dust or inject						
Internal parasite control by administration of broad spectrum anthelmentic	Administer					Adminis-ter						
Milk production		Lean seasons		**Flush seasons**							Lean seasons	

Source: Field Survey, 2012

2.3.2 Livestock Breeding

Nepal began Artificial Insemination (AI) by importing semen from abroad some 47 years ago to improve the stock of local breeds of cattle and raise their productivity. Livestock breeding is generally carried out through artificial insemination (AI) while the use of bull for natural mating has now almost declined. Despite of low success rate of AI, farmers still prefer this technology mainly to improve breed quality and increase milk productivity. Likewise, it has also reduced the chances of diseases transmissions.

AI is very much common in cows than in buffalo. Demand for Artificial insemination is increasing rapidly in the SRC districts as hybrid animals born out of the cross between local and exotic breeds yield more milk. Commercial farmers prefer artificial insemination while few are yet to understand importance. Majority of the farmers in SRC area are breeding livestock following AI in cattle while natural mating is carried out in case of buffalo.

AI services are provided either by veterinary technicians or village level animal health workers. Government service charge is Rs 30 however, farmers often have to pay high price because of unavailability of technicians at service center. Technicians generally charged Rs 300 top 500 for using services at a time which is more than 10 times higher than government price. Apart from this, farmers often complained about unreliability of services, mainly on conception. In natural mating, the chances of conception are around 80 per cent in cows and 54 percent in buffaloes while chances of conception in AI, are only 50 and 46 percent in cows and buffaloes, respectively.

Apart from this, poor detection on status of conception among animals often decreased of fertility rates. Use of artificial insemination (AI) is difficult as many farmers keep cows in remote locations. Likewise, farmers often faced problems in accessing services timely because of shortage of manpower and storage facility at production pockets.

The quality of animals is critical in determining its milk productivity and hence overall production. Currently, low productivity per animal hinders development of the dairy sector. This is mainly because of local breeds' quality. Nevertheless, crossing with the improved breeds has supported for increasing productivity. Local breeds are being almost replaced by cross-breeds. Low productivity is also because of ineffective cattle and buffalo breeding programmes, limited extension and management on dairy enterprise development,

Traditionally a cattle bull and buffalo bull as required by the villagers are let free in the village for natural mating. But with the introduction of artificial insemination (AI) program in Sindhuli corridor keeping a bull for natural service become out dated and expensive. Therefore, near road heads cattle bull and buffalo bull are not available. As a result silent heats are not detected and prolonged calving intervals.

2.3.3 Livestock Feed

Feeding cows and buffalo of all categories (milking and young animals) feeds on seasonally based feeds comprising of green grasses, legume leaves, tree fodders and crop residues mainly rice straw, finger millet straw and maize Stover. In general ruminants eat crop residues to survive during winter season as there is nothing green to forage. Tentative portion contribution by various feed resources based on field observation, farmers' discussion and review of available are given in Table 2.2.

Crop residues is the single largest bulk feed material available to farmers for feeding livestock, specifically ruminants. They include coarse straws, fine straws, leguminous straws, pulses straws. Famers also plant agriculture crops mainly maize, which is used to feed dairy animals. Likewise, they were using rice straw and green maize Stover to feed livestock. This has decrease cost of production by reducing the need to buy feed.

Fodder from common property resources, especially forests and grazing land is another major source of feed for animals. However, handing over of forests to local people under community forests often hindered free collection. Farmers are either moving to far distant or collecting grasses from own field. As a result of this, use of green grasses and fodder is declining rapidly among the farming households. Scarcity of fodder resources is likely to be a major constraint in the development of the dairy sector unless adequate measures are undertaken to augment them.

Table 2.2: Portion of Feeding Resources Hill Farmers Feeding their Milking Animals

Feed resources	Dry Matter (t/ha)	Total Digestible Nutrient (t/ha)	Carrying capacity (LSU/ha)*
A. Crop land area	**2.55**	**0.88**	**0.81**
1. Crop residue by products	1.85	0.53	0.49
2. Grasse weeds from crop land	0.36	0.2	0.18
3. Leaf fodder trees	0.16	0.09	0.08
4. Fallowing harvest grazing	0.17	0.06	0.06
B. Alpine Meadows			
1 Under existing ground vegetation cover	3.2	1.54	1.42
2. Differed rotational grazing	4	1.92	1.77
C. Steppe Grazing			
1 Under existing ground vegetation cover	0.12	0.06	0.06
2. Differed rotational grazing	0.15	0.07	0.06
3. Re-vegetation ground cover up to 30%	0.18	0.09	0.08
4. Management to revegetation up to 50 %	0.05	0.24	0.22
D. Open grazing in Mid hills			
1 Under existing ground vegetation cover	1.2	0.58	0.54
2. Differed rotational grazing	2	0.96	0.89
3. Enclosure and hand cutting	3	1.44	1.33
4. Partial re-seeding and management	4	1.92	1.77
5. Complete re-seeding and management	5	2.48	2.22
E. Forest grazing	**0.7**	**0.34**	**0.31**
F. Waste land grazing	**0.5**	**0.24**	**0.22**

Source: Rajbhandari & Shah, S.B. 1981.
Note: *1 Livestock unit (LSU) = 1 Buffalo = 2/3 Cow = 1/10 goat

Farmers also used the concentrated feed for rearing livestock. Concentrates feeds used are coarse grains, such as maize, and other cereal by-products, such as rice bran/polish, mustard cake etc. coconut cake, soybean meal, cotton seed meal and sesame cake. Farmers less prefer the concentrate feeds available in the market mainly because of poor quality and sub-standards. The commercial feeds are poorly monitored by concerned authority. Despite of this, use of concentrate feed is expanding rapidly because of shortage of fodder as well as commercial production of milk.

Price of feed is rising rapidly while milk price remained fairly constant while the. Hence, higher production costs and relatively stable milk prices often hindered for expansion of dairy animal. Purchasing price of raw milk controlled by the Dairy Development Board and dispersed farm households have no bargaining power and are unable to negotiate higher prices.

2.3.4 Cattle Shed Management

Majority of the farms lacked cattle housing and feeding equipment. The cattle are constructed nearby homestead or kept with the own houses. Farmers generally remove feed and fodder left over every day and clean cattle sheds. However, cattle shed do not have enough space including facility for livestock feeding and water. They are feed on ground and use of feeding trough is very less. his might result into livestock diseases. Nevertheless, few farmers have improved their shed and maintained proper drainage for urine and manure collection. This practice is very rare. Damp and narrow sheds resulted in overcrowding of calves, making them vulnerable to diseases

Likewise, free movement of animal is not allowed, too. Condition of animal shed is not very good and characterized by lack of proper ventilation, soiled and probable ground for breeding flies and mosquito particularly during rainy seasons. They are made of mud and mortar, some time bricks and tin roofed. Space provided to individual animal is less than 5 square meters as milk animals tied most of the times in a shed. Animal are prevented from voluntary movement and conditioned to stay in shed in most the times.

Some farmers let animal for free grazing only after the harvesting of field crops such as paddy, maize or millet. Few farmers practice walking animal to water resources (Pond or river) for drinking water. Milk animals are mostly tied by the neck with a string attached to strong wooden peg.

2.3.5 Livestock Care and Management

Major activities performed by farmers livestock care and management includes:

- **Supply of feed/fodder and grasses:** Farmers generally supply fodder and grasses three times a day. During the early morning, crop residue especially rice straw is feed together with few concentrate feeds. During the mid day, grasses are provided depending upon seasons and availability. In the evening, concentrate feed mixed with water together with rice straw are provided.
- **Animal cleaning:** Cattle is cleaned if fly or dung are attached to the body while buffalo is taken to nearby stream or river for bathing. However, such practice is declining because of shortage of manpower.
- **Vaccinations:** Vaccinations and parasites control are carried out depending upon seasons and need.

Parasite control is carried out generally two times a year (April/May and Sept/Oct while vaccination is conducted once (April/May).

- **Medical treatments:** Farmers immediately approach Veterinary technicians and animal health workers whenever animal become ill. Though farmers have high believe and faith on advices provided by government technical staffs, they had to rely on private veterinary practitioners for medical treatments. This is mainly because of limited number of staff available at service center.

2.3.6 Credit

Huge investment is required for purchasing dairy animal as well as maintaining cattle shed. Lack of access to credit to expand the herd is a critical problem for farmers. Farmers mostly rely on cooperatives for credit. There is little access to formal credit, especially with financial institutions. Farmers mostly rely on cooperatives for taking loan for expanding dairy enterprises. However, less capital available among these cooperatives often hindered for providing required investment. Likewise, loan provided by them is inadequate and loans may or may not be linked to dairy activity

Low or non-availability of credit as a primary constraint in livestock sector activity, Hence, commercial banks are not favorably disposed to providing credit to livestock farmers and the cooperative credit system is very weak, resulting in excessive dependence of livestock farmers on informal sources.

Dependency of farmers on formal financial institutions does not exists or diminishing. Farmer's often complained about cumbersome processes which need to follow for obtaining loan. Hence, they preferred local cooperatives for credit compared to financial institutions. Nevertheless, few private dairy companies are establishing linkages with the financial institutions for providing loan for purchase of cattle. For example, Dolakha Dugdha Udyog of Dolakah districts has made Agreement with KIST BANK and Surya development Bank for purchase 200 cattle. Cattles are supplied to farmers with a pre-condition that they should sale milk to dairy. Dairy will repay loan in installments by deducting farmers' income from sale of milk. Hence efforts have already been initiated for linking small holder producer's with financial institutions.

2.3.7 Technical Services

Farmers mostly rely on Agro-vets, DLSO and village animal health worker for technical knowledge and services. However, access of farmers to DLSO is very limited, mainly because of distance as well as less number of staff. Hence, farmers often consult with their peers and agro-vets for technical advices. Apart from this, Dairy Development Corporation is also building capacity of milk producer cooperatives on milk production.

2.3.8 Insurances

None of the regulated insurance companies have insured agriculture, and any livestock or crop insurance. However, livestock insurance has been implemented by the non-regulated or informal sector, especially farmer groups and cooperatives. Cooperatives are offering livestock insurance to their members. The government of Nepal provides fixed 50 percent premium subsidies to the cooperatives.

Cooperatives are promoting livestock insurance in Kavre while it is yet to be implemented in other SRC districts. Cooperatives of Kavre are charging 12.5 percent of premium on price of cow and buffalo. The premium covers full risk against death; however price of cow should not exceed Rs 25000 and Rs 50000 for buffalo. Farmers often complained that price set by cooperative is far below the market price. Likewise, it does not cover insurance against infertility. Inadequate capital of cooperatives is main reasons for settling low price of animals. Apart from this, there has been no reinsurance of livestock in Nepal. These programs are very exposed to catastrophic losses because of limited capital reserves.

2.3.9 Livestock Herd Size

Rearing of diary animal is still subsistence. Large number of farmers is having 1-2 lactating cross breeds. This situation remains similar across all the study districts, even in commercial production pockets. Most of the farmers had kept dairy animals for self consumption of milk followed by production of manure for farming. Most of the farmers sell their surplus milk to collectors and hoteliers. Hence, commercial cultivation still remains less priority.

Quality milk production is one of the major concerns. It is very difficult for making supervision of milk production since most of the households had been rearing of less than two cattle. Likewise, there is great difference among the households in technical and management skills, sanitary conditions and quality awareness. Current quality problems in raw milk include: i) variable protein levels due to the influence of different feeding regimes; ii) high bacteria count; and iii) high levels of antibiotic substances due to farmers' lack of knowledge. Often when dairy animals are given antibiotic substances, the farmers, due to economic interests or lack of knowledge, do not stop milking them.

2.4 Livestock Population, Production and Yield

2.4.1 Population

SRC area provides home to 6.2 percent and 5.6 percent of national population of buffalo and cattle respectively. Table 2.3 presents number of dairy animals in SRC. Of the total dairy animals land of the SRC districts, populations high in Kavre district (2.2 percent), followed by Sindhuli (1.4 percent) and Ramechhap (1.2 percent).

Table 2.3: Population of Dairy Animals

Districts	Buffalo		Cattle	
	No	%	No	%
Kavre	130,999	2.7	134,255	1.8
Dolakha	46,579	1.0	76,632	1.1
Ramechhap	60,109	1.2	85,466	1.2
Sindhuli	63,068	1.3	110,340	1.5
SRC	300,755	6.2	406,693	5.6
Nepal	4836984	100.0	7,199,260	100.0

Source: MoAC, 2010/11

Table 2.4 presents annual growth of dairy animals over last year with details in Annex 2.1. The number of dairy animals increases marginally in SRC area (1.4 percent per annum) as well as in Nepal (2.6 percent per annum). Population of dairy animal is increasing in the all districts except in Dolakha. Increase is relatively high in Ramechhap district (2.5 percent) and Kavre (2.3 percent).

Table 2.4: Annual Growth of Dairy Animals Over Last Seven Years (2003/04 – 2009/10)

Unit: percent

	Cattle	Buffalo	Overall
Kavre	0.9	3.7	2.3
Dolakha	1.5	1.1	0.7
Ramechhap	3.2	1.7	2.5
Sindhuli	0.1	2.3	0.9
SRC	**0.5**	**2.6**	**1.4**
Nepal	0.6	3.4	1.7

Source: MoAC, 2010/11

Very few proportions of animals are milking in SRC and Nepal. Table 2.5.presents ratio of milking animals to total cattle population. This shows that large animals reared by farmers were unproductive in 2008/09.

Table 2.5: Ratio of Milking Animal to Total Population

Districts	Cattle Population			Buffalo Population		
	Total	Milking	%	Total	Milking	%
Kavre	134,255	21,692	16.2	130,999	56,148	42.9
Dolakha	76,632	11,307	14.8	46,579	11,210	24.1
Ramechhap	85,466	9,889	11.6	60,109	12,998	21.6
Sindhuli	110,340	11,640	10.5	63,068	15,446	24.5
SRC	**406,693**	**54,528**	**13.4**	**300,755**	**95,802**	**31.9**
Nepal	7,199,260	954,680	13.3	4,836,984	1,252,770	25.9

Source: MoAC, 2010/11

Table 2.6 presents annual growth of productive dairy animals over last seven year with details in ***Annex 2.2.*** The number of milk producing animals increases marginally in SRC area (4.7 percent per annum) as well as in Nepal (2.4 percent per annum). Nevertheless, the rate of growth or increment is relatively high in SRC area compared to national average Population of dairy animal is increasing in the all districts except. Annual rate of increment is high in Kave district (2.5 percent) while lowest in Dolakha (0.4 percent). In case of productive cattle number, annual rate of growth animal is highest in Ramechhap while lowest in Sindhuli. Likewise, annual growth of productive buffalo number is highest in Kavre while lowest in Dolakha.

Table 2.6: Annual Growth of Productive Dairy Animals over Last Seven Years (2003/04 – 2009/10)

Unit: percent

	Cattle	Buffalo	Overall
Kavre	0.5	12.0	8.4
Dolakha	0.6	0.1	0.4
Ramechhap	2.1	1.8	1.9
Sindhuli	0.0	1.5	0.9
SRC	**0.7**	**7.2**	**4.7**
Nepal	1.1	3.5	2.4

Source: MoAC, 2010/11

Table 2.7 presents average number of dairy animal and productive animal population per households in the SRC districts and Nepal with details in Annex 2.3. At the SRC districts, each household own around 3 dairy animals while less than one is productive. This situation remains similar in all the districts. Many of the households kept dairy animal for manure purpose as well as religious value and are hence least bothered with the productivity of cattle. As a result of this, productivity as well as cost of cultivation of farmers increases rapidly. Hence commercialization of the dairy animal has not taken place in study districts as well as in Nepal.

Table 2.7: Average Number of Livestock per HHs

	Total Population per HHs			Productive animal per HHs		
	Cattle	Buffalo	Total	Cattle	Buffalo	Total
Kavre	1.5	1.6	3.1	0.3	0.6	0.9
Dolakha	1.0	1.6	2.5	0.2	0.2	0.5
Ramechhap	1.3	1.9	3.2	0.2	0.3	0.5
Sindhuli	1.1	1.9	3.0	0.2	0.3	0.5
SRC	**1.3**	**1.7**	**3.0**	**0.2**	**0.4**	**0.6**
Nepal	0.9	1.3	2.1	0.2	0.2	0.4

Source: MoAC, 2010/11

2.4.2 Production

Total production of milk in the country is 1,497,429 metric liters per year in 2009/10 of which SRC contributed to 7.9 percent. Sizable amount of milk is produced in Kavre while production amount is very small in rest of SRC districts.

Table 2.8 Production of Milk in 2009/10

Districts	Buffalo		Cattle		Percent	
	Amount (000 liter)	%	Amount (000 liter	%	Amount (000 liter	%
Kavre	11,521	2.7	57,138	5.3	68,659	4.6
Dolakha	5,353	1.2	9,190	0.9	14,543	1.0
Ramechhap	3,984	0.9	12,189	1.1	16,173	1.1
Sindhuli	4,810	1.1	12,626	1.2	17,436	1.2
SRC	**25,668**	**5.9**	**91,143**	**8.5**	**116,811**	**7.9**
Nepal	429,129	100.0	1068,300	100.0	1497,429	100.0

Source: MoAC, 2010/11

Table 2.9 presents annual growth on production of milk over last 7 years with details in Annex 2.4. Production of milk is increasing in Nepal 3.2 percent per annum whereas rate of increase in SRC area is 6.5 percent. Production of milk increases at 10.2 percent per annum in Kavre while it increases by 0.9 percent per annum in Dolakha.

Table 2.9: Production of Milk over Last Seven Years (2003/04 – 2009/10)

Unit: percent

	Cattle	Buffalo	Overall
Kavre	2.3	12.0	10.2
Dolakha	2.1	0.1	0.9
Ramechhap	4.1	1.8	2.3
Sindhuli	1.9	1.5	1.6
SRC	**2.4**	**7.2**	**6.5**
Nepal	2.4	3.5	3.2

Source: MoAC, 2010/11

2.4.3 Yield

Table 2.10 presents average yield of milk per milking animal in the 2008/09. Currently, low productivity per animal hinders development of the dairy sector. The quality of animals is critical in determining its milk productivity and hence overall production. Productivity per animal is very low, at 678 kg per lactation, compared with the global average of 2 038 kg per lactation. Limited extension and management on dairy enterprise development, traditional feeding practices that are not based on scientific feeding methods, and limited availability and affordability of quality feed and fodder.

Table 2.10: Average Yield of Milk per Milking Dairy Animal

Unit: percent

	Cattle	Buffalo	Overall
Kavre	531	983	882
Dolakha	473	1,220	646
Ramechhap	403	1,066	707
Sindhuli	413	1,223	644
SRC	**471**	**1,051**	**777**
Nepal	450	1,173	678

Source: MoAC, 2010/11

Table 2.11 presents annual growth on yield of milk over last 7 years with details in Annex 2.7. Yield of milk is increasing in Nepal 0.8 percent per annum whereas rate of increase in SRC area is 1.9 percent. Yield of milk increases at 2.1 percent per annum in Kavre while it increases by 0.5 percent per annum in Dolakha and Ramechhap. Shortage of both fodder and compound feed, in terms of quality and quantity is one of the major factors affecting milk production.

Table 2.11: Annual Growth on Yield of Milk over Last Seven years (2003/04 – 2009/10)

Unit: percent

	Cattle	Buffalo	Overall
Kavre	1.8	0.0	2.1
Dolakha	1.5	0.0	0.5
Ramechhap	2.0	0.0	0.5
Sindhuli	1.9	0.0	0.8
SRC	**1.7**	**0.5**	**1.9**
Nepal	1.3	0.0	0.8

Source: MoAC, 2010/11

2.5 Production Locations

2.5.1 Production Area

During the consultative meeting, DLSO officials were requested to classify VDCs into three classes while considering extent of milk production and commercialization. This exercise was carried out for all districts of SRC Production is highly scattered and fragmented and confined in few VDCs only.

- ***Fully commercial***, large quantity of milk is produced and sold at market
- ***Semi-commercial*** – relatively high amount of milk is produced and sold in market
- ***Subsistence*** –small quantity of milk is produced, mainly sold on local markets or sufficient for self consumption only

Map 2.1 shows results of consultative meeting to map milk production area by VDCs where detailed value chain assessment has been carried out. The map reveals that milk is produced commercially in 44

VDCs; semi commercially in 32 VDCs. Likewise, milk is produced at subsistence level on 175 VDCs.

2.5.2 Production Pockets

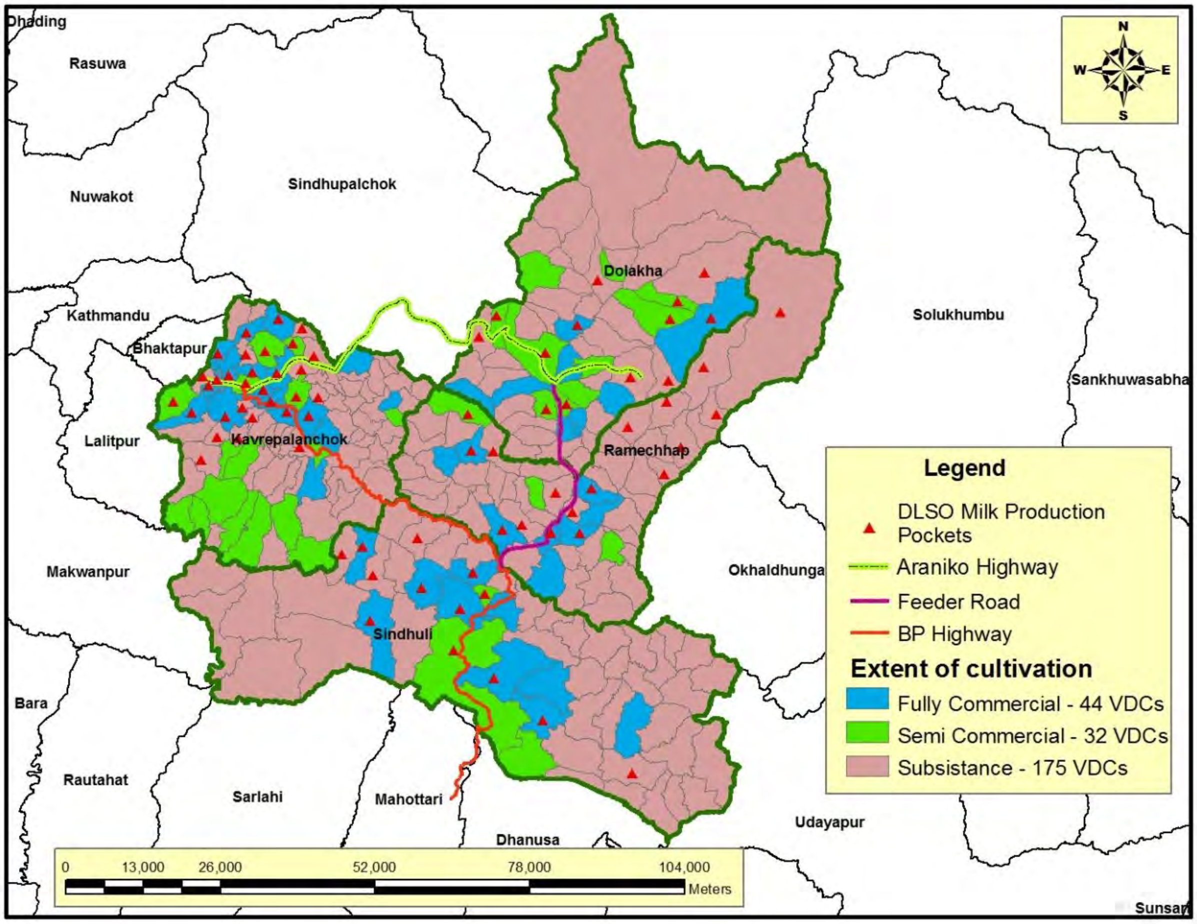
DLSO has not designated specific area as production pockets of milk, however. Table 2.12 presents production pockets of milk in the study districts. Number of production area varies by districts from 33 in Kavre, 13 in Sindhuli, 15 in Ramechhap and 8 in Dolakha. Map 2.1 also shows production pockets of DLSO.

Table 2.12: Milk Production Pockets of DLSO

Districts	Production Pockets (VDCs/locations)	Number
A. Cattle		
Kavre	Panauti N.P, Sarada Batase, Panchkhal, Mahadevsthan, Chandeni Mandan, Anaikot, Raviopi, Dhulikhel N.P., Ugrachandi Nala, Janagal, Sanga, Sankhupatichaur, Mahendrajyoti, Banepa N.P.	14
Dolakha	Boch, Bhirkot, Bhimeshwar N.P., Sunkhani, Sushmachyamawati, Pawati, Laduk, Lakuridanda	8
Ramechhap	Bamti, Gumdel, Those, Chuchure, Rasnalu, Priti, Bhuji, Doramba, Dadhuwa, Goshwara	10
Sindhuli	Kamalamai N.P. area	1
Buffalo		
Kavre	Kushadevi, Panauti N.P., Anaikot, Dhungkharka, Nayagaon, Panchkhal, Chalal, Jyamdi, Mahadevsthan, Patlekhet, Chandeni Mandan, Raviopi, Devbhumi Baluwa, Kharelthok, Jaisithok, Sarada Batase, Hokse, Kavre, Ugrachandi Nala, Mahendrajyoti, Khanalthok, Methinkot, Devitar, Tukucha Nala, Phulbari, Likhel, Balthali, Ryale	28
Dolakha	Boch, Bhirkot, Bhimeshwar N.P., Sunkhani, Sushmachyamawati, Pawati, Laduk, Lakuridanda	8
Ramechhap	Khimti,Gelu, Tilpung, Manthali, Kathjor, Bhaluwajor, Bhattauli, Pakarbas, Ramechhap, Okhreni	10
Sindhuli	Kamalamai N.P. area, Ranichuri, Sithauli, Belghari, Jalkanya, Bhadrakali, Majhuwa, Netrakali, Amale, Tamajor, Jhanghajholi Ratmate, Rampur, Mahadevsthan	13

Source: Computed from annual progress report of DLSO of respective districts, 2011

Map 2.1: Cultivation Area and Production Pockets of Milk



2.6 Marketing and Distribution System

2.6.1 Production and Sale

Milk is produced throughout the year. Each lactating animals gives around 240 days to 330 days of milk depending upon variety. Cross breeds cattle give milk around 300 to 330 days while local cattle give milk between180 to 240 days. Hence, most of the farmers are doing artificial inseminations for increasing milking days as well as productivity. Table 2.13 presents milk production and sale.

During the consultative meeting with farmers/producer groups, were requested to assign score on scale of 0- 10 to show production and market arrival of milk. There is seasonal fluctuation in milk production and collection which affects supply of milk in the market. Flush season; August-September to January-February; lean season; rest of the months). The ratio of lean to flush season production is about 1:3 in most of the country and 1:1.5 in areas where the feed supply is better. Seasonal breeding pattern and availability of green forages in monsoon season are the main reasons for increasing milk production during flush seasons while shortage of green grass during the spring and summer dry months, substantially reduces milk production.

Table 2.13: Trends on Milk Production and Sale

	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	B	J	A	S	Bh	As	K	M	P	Mag	F	C
Production	3	3	5	8	10	10	8	8	7	7	6	4
Sale	2	2	4	6	8	8	6	7	5	5	3	3

Source: Field Survey

Note: 0 for lowest and 10 for highest; Nepalese Calender months (B- Baisakh; J – jestha, A – Ashad, S – Shrawan, Bh – Bhadra, As – Ashwin, K – Kartik, M- Mangshir, P - Poush M – Magh, F - Falgun, C – Chaitra)

2.6.2 Market Arrival

Table 2.14 presents market arrival of milk from study districts. Of the total production of milk in the study districts, famers consumed almost one fourth at household level while rest is brought to the market (56.7 percent) to the market. Majority of the milk produced in all the districts is either consumed by farmers or sold locally except in Kavre. Nearly one tenth of milk produce in Kavre are sold/

Table 2.14: Market Arrival of Milk

Unit: Percent

District	Kavre	Dolakha	Ramechhap	Sindhuli	Overall
Self consumption	15	40	60	50	41.3
Brought to market	85	60	40	50	56.7

Source: Field Survey

2.6.3 Marketing Practices

Milk marketing in Nepal is a government regulated market. The Dairy Development Corporation (DDC) is one of the key players in the marketing channel in milk marketing in Nepal. A large proportion of the produce is collected and distributed by the DDC; however, private sector is also emerging with rapid pace in the last few years. Also, most of the farmers from nearby market area sell milk directly to the consumers. Therefore, the marketing channels and market intermediaries involved in milk marketing in Nepal can be summarized as:

- Farmers –Consumers (households, institutions/hotel business)
- Farmers –Collectors –Consumers
- Farmers –Collectors –Cooperatives (Chilling VAT) – Dairy – Consumers
- Farmers –Chilling center –Dairy

Major marketing practices followed by different marketing agents

- ***Producers/ Farmers:*** Farmers mostly sell milk to local collectors or consumers directly. Farmers prefer to sale milk to consumer directly because they are able to get higher price compared to collection center or cooperatives
- ***Collectors:*** They are operating in the milk producing areas. More than 2-3 collectors' area are operating in key production area. They collect milk from farmers and supply to chilling vat or diary operating at different places. Few collectors are also involved in direct selling of milk to

cooperatives. They get money from cooperatives within a month from sale of produce. Apart from purchasing milk, they also sale livestock feed and medicines on credit to farmers by operating small shops. Most of the collectors have made informal agreement with concerned cooperatives or dairy to supply milk. Collectors don't face any problems to sale because of short supply in market. Demand is quite high compared to supply.

- ***Cooperatives:*** Farmers are organized into milk producer cooperatives or groups. Each cooperative have established different collection center within the milk production area. They collect milk from collection center and do chilling of milk. After chilling of milk, they sale milk to Diary Development Corporation (DDC) or Private Dairies. They had made agreement with the DDC or private dairies on daily quantity of milk supplies, especially with DDC. Cooperatives too don't face any problems to sale because of high demand and supply gap.
- ***Dairies:*** Dairies receive milk either from collectors or cooperatives. They either sale whole milk or processes milk. Most of the dairy operated in the SRC area are small dairies and involved in selling whole milk, curd, paneer etc etc. They are operating at district head quarters such as Sindhulimadi, Manthali, Chairkot or in major urban areas such as Banepa etc

2.6.4 Transportation Mechanism and Costs

Farmers bring milk for sale on small tin can of around 5 to 10 liter and deposit on collection center. Collection center are mainly operating at the road head. There is no transportation cost association with the transportation of milk at farmers' level.

Milk brought by farmers are filled in big cans (40 liter capacity) and transported in milk cans. Milk can is brought to cooperatives through power tillers, tractors, Tata mobile and mini trucks depending upon the production and road conditions. Generally, Cooperatives or private dairy had made agreement with the transporters for bringing milk. They provide service either once or twice a day depending upon daily quantity of milk at given locations. Transporter drive vehicles to each collection center and bring to cooperatives and Dairy. Transportation cost of milk varies by the distance travelled. Generally it cost around Rs 0.5 to Rs 2 per litre based on distance, quantity and road condition.

The cost of transportation of milk is very high because of less production and limited number of vehicle operated at the district. Apart from this, each diary or cooperative is renting different vehicles to bring milk from collection center despite of low supply of milk. Vehicles are operating within the less transport efficiency or far below the capacity. This has also contributed to increase transportation cost of milk. Use of public transportation for milk is almost nonexistent.

Milk brought by cooperatives are chilled and stored on chilling VAT. Milk cooled on the farm or cooling centre are transported on bulk tankers. Bulk tankers are insulated, so the milk will remain cold until it reaches the plant or diary center. Dairy companies send tanker to with chilling point or cooperatives. Diaries companies brought transportation cost, which generally varies from Rs 0.1 to Rs 1 per litre depending upon the distance.

Table 2.15 reveals that renting truck is main mode of transportation followed by trucks and foot. However, mode of transportation varies by districts, which is mainly governed by production volume. Use of small tractors, mini trucks and small Tata mobile trucks is quite common in Kavre for transporting milk from collection center to chilling center. Use of public transport is almost negligible for transportation of milk.

Table 2.15: Mode of Transport to Different Market

District	Collection Center	Chilling center	Dairy
Kavre	Foot	Tractor, Trucks	Insulated tanker
Sindhuli	Foot	-	Truck, Buses
Ramechhap	Foot	-	Truck/Buses
Dolakha	Foot	Trucks	Truck/Insulated tanker

Source: Field Survey

2.7 Pricing Mechanism and Prices

2.7.1 Price Determination Methods

Dairy Development Corporation (DDC) controlled price of milk in Nepal. DDC set minimum price of milk while considering cost of production at the farmers level together with Dairy Development Board. DDC determine price of milk based on content of fat, solids-not-fat (SNF) and total solids (TS) in the milk. DDC Pay Rs 3.20 per fat, Rs 1.83 for SNF % and Rs 21.85/kg for total solid. This will result into average milk price of Rs 30 at farmer level, varying from Rs 29 to Rs 34 per liter. The private diary pay slightly higher than the price set by DDC, which varies by dairy to dairy. Average price of private dairy is generally 10 percent higher than that of DDC. Despite of high price given by private dairy, farmers of Kavre are reluctant to sale to private dairy. This is mainly because of less faith with them (high risk), untimely received of money together no other support and services are available. DDC also gave priority for building capacity of producers and their organizations while private are more concerned with milk.

Table 2.16 presents criteria set by different stakeholders in setting price of milk. Table reveals that farmers and collectors have no controlled over setting their price, which is often government by dairies or companies.

Table 2.16: Criteria for Price Determinations

Farmers	Collectors/Chilling center	Dairy
• No controlled on setting prices • Price are fixed by Chilling center/collectors based on price set by	• No controlled on setting price • Price are fixed by DDC and private dairy companies	• Minimum price of standard milk set by the DDC

Source: Field Survey

Government policy of fixing the producer and retail prices is a major deterrent to the development of the dairy industry. Prices are set under a climate of political influence with no relevance to general market conditions inside Nepal or to border prices. Average cost of production of fresh milk is as high as the price that farmers are get for a liter of milk from dairy producers.

2.7.2 Market Price of Milk

Table 2.17 presents average price of milk at different market places in study districts. Market price of milk varies by study districts and marketing agents Farm gate price of milk varies from Rs 30 – 35 per liter based on fat percentage while retailing price also varies from Rs 44 to Rs 50.

Table 2.17: Market Price of Milk

Unit:Rs/Litre

	Kavre	Dolakha	Ramechhap	Sindhuli
Farmers/Farm gate	30	30	34	32
Collection Center	31	33		
Chilling center	32		42	36
Consumers	40	42	50	45

Source: Field Survey

The table reveals that farmers of Ramechhap and Sindhuli are getting better price for their produce. This is mainly because of less production and mostly consumed at local level.

2.8 Value Addition and Processing

2.8.1 Quality Control

Milk quality should be maintained by maintaining the cold chain from the point of production until the point where the milk reaches the processing plant. Milk must be kept cool during transportation until it is pasteurized because the process of chilling retards bacterial growth.

Poor milk quality a persistent problem in the dairy industry. This is associated with the lack of farmer awareness in clean milk production. Unhygienic milk production starts with the farmer and causes loss of income along the milk chain. It often take around 10-15 hrs to reach to chilling center from farmers. Farmers do milking twice a day. They often mix morning milk with the last night milk. There will be bacterial growth as a result of this. Apart from this, they often don't clean vessels properly, resulting into contamination and bacterial growth. This also increased fermentation of milk.

The problem of milk quality worsens furthers when deliberate attempts are made reduce milk quality made with the intention of monetary gains. At some units, raw milk is exposed to various kinds of adulteration; substances are added to change the chemical composition of the milk to increase payments. At each point in the chain, quality control and monitoring activities are not performed effectively.

2.8.2 Collection, Storage and Chilling

Milk is collected at collection points which are stored in closed vessels of around 40 liter. Likewise, few collectors are using plastic tanks for collection of milk. At the collection center, no facilities are available for chilling. It has high possibility of fermentation because of temperature as well as supply of old milk by farmers. This problem is quite pertinent in summer. Hence, collectors often put chemicals to avoid chances of fermentations. This results into poor quality of milk. Chilling center or small refrigeration equipments should be provided at collection center to avoid chances of fermentations. Keeping of milk at refrigerators may avoid chances of milk fermentations.

Cooperatives together with support from Dairy Development Corporation and District Livestock Service Office have established Chilling VAT in those areas having good facility of road access and nearby the key production zones. Majority of such VAT are not operational or operating at under capacity even in the key milk production pockets. This is mainly because high demand of milk in local market as well as less volume of production. Farmers prefer to sale directly to consumers and hoteliers since they get high price as well as can alter volume of milk by adding water. However, it is impossible at collection and chilling center, since they make payment based on FAT and SNF etc. Apart from this, high shortage of fuel in local market and load shedding problems further hinders chilling of milk. Hence, chilling center too uses different chemicals to reduce chances of milk fermentations.

2.8.3 Value Addition and Processing

Consumption is mainly in unprocessed form in homes and restaurants. In the SRC area, more than 80 percent of milk production is consumed as fluid milk. About 10 percent is processed into butter or ghee; about 3 percent is processed into Paneer (cottage cheese) and other cheeses, and the balance is used for other products such as yoghurt and sweet. Milk processing and preparation of the milk products like Ghee and cheese are the common form of product diversification. It is being carried out in the households especially to those farmers where they do not have access to market or collection centers. Likewise, small scale dairy industries are also involved into production of ghees. These dairy brought condensed milk (Khuwa) from remote area and convert into ghee.

Dairy Development Corporation together with the private dairy is processing milk and producing different products such as yoghurt, milk cream, butter, paneer in the study districts, especially from milk of Kavre while in other districts it is involved in collection of milk and bringing to nearest Dairy Development Corporation unit, Kavre in case of Dolakha, Ramechhap and Kavre; and Dalkehbar/Janakpur in case of Sindhuli. However, milk arrival from Dolakha, Sindhuli and Ramechhap is almost negligible. Table 2.18 presents number of dairy related enterprises established in SRC area.

Table 2.18: Number of Dairy Enterprises in SRC

S.N.	Particulars	Kavre	Dolakha	Ramechhap	Sindhuli
1	Feed Industry*	10	NA	2	NA
2	Chilling Vat/Centre*	5	NA	NA	NA
3	Dairy*	11	6	9	19
4	Milk Cooperative**	266	14	1	15

Note: NA Information not available

Source: * Computed from annual progress report of DLSO of respective districts, 2011***Department of cooperative, 2011, Statistical Information on Nepal's Cooperative*

CHAPTER 3 VALUE CHAIN ACTORS MAPPING AND ANALYSIS

3.1 Value Chain Analysis

3.1.1 Value Chain Map

Mapping of value chain actors was carried out to visualize networks in order to understand linkages between actors and processes in a value chain and assess interdependency between actors and processes in the value chain. Figure 3.1 presents core processes involved in value chain of dairy. It moves form production to consumers, passing through different stages and processes. The linkages are shown vertically from bottom to top. The left hand blocks represent the major functions of the chain. The functions, in this case, include production, collection, chilling, processing and retailing.

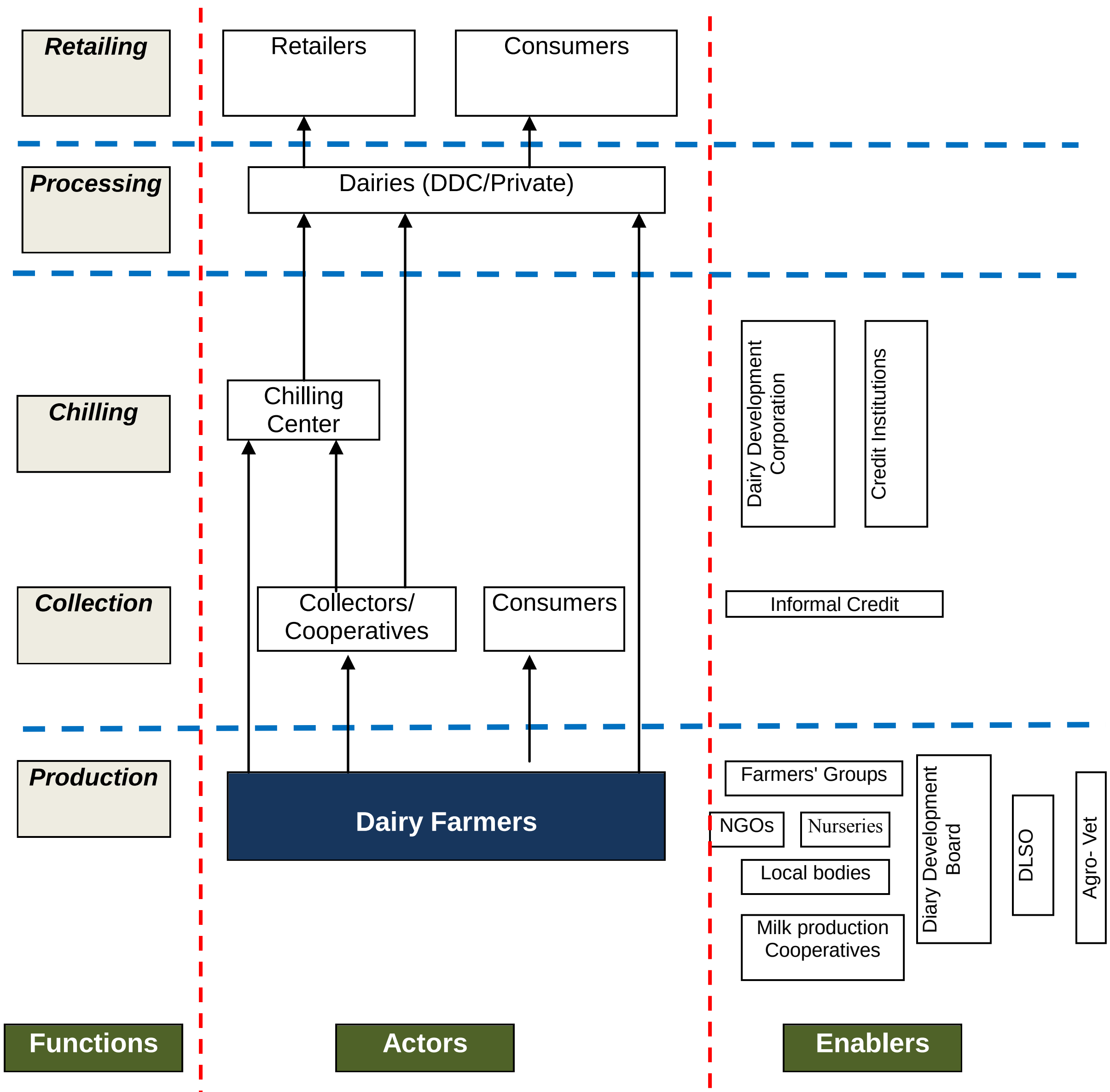


Figure 3.1: Dairy Value Chain Map

3.1.2 Value Chain Actors and Functions

Major actors involved in value chain of milk and their function are:

Producers: Producers are mainly involved in rearing of livestock and sale of milk. They have virtually no roles on fixing price of their produce. They supply milk to collectors or chilling center based on price fixed by the Dairy Development Corporation and private diaries. Major functions performed by producers include:

- Purchase of improved breeds and construction of livestock sheds and other equipments
- Livestock care and management, including feedings, veterinary treatments and cattle shed/barn sanitation, etc
- Bring milk to the collectors or chilling center
- Arrange finance required for purchase and rearing of livestock
- Provide milk in credit for one months to collection center

Collectors/contractors: They are generally involved in collection of milk and sale produce to chilling center or dairies. They are mostly present at road heads. They operate business throughout the year. They also establish small feed supplies shops in the village to supply feeds and medicines required to farmers in credit. Some of the collectors are commission agents of chilling center or dairy as well. Major functions performed by them include:

- ➢ Conduct preliminary testing of milk brought by farmers, especially FAT content and record data of each farmers
- ➢ Storage of milk in milk vessels and can
- ➢ Apply chemicals to avoid fermentations of milk, especially during summer seasons
- ➢ Provide livestock feed together with medicines required by farmers in credit
- ➢ Supply milk to Chilling center/Cooperatives and private dairies on credit (generally one month credit)
- ➢ Up-loading in transports (Tractor, truck) sent by chilling centers or private dairies
- ➢ Distribute money to farmers after receiving money from chilling center

Chilling Center: Chilling center are mainly involved in bulking of milk, chilling and selling of milk. They are mostly present at road heads and being operated or managed by milk producers' cooperatives. They mostly sell milk to Diary Development Corporation (DDC) or private dairies. They operate their business whole round the year. Major functions performed by them include:

- Collect milk from collection center and farmers
- Conduct preliminary testing of milk brought from collection centers and apply chemicals to avoid

fermentations of milk, especially during summer seasons

- Arrange transport for bringing milk from collection center to chilling center, by making contract with transporters (transport to chilling VAT)
- Chilling of milk by using appropriate technology and storage of milk on Chilling VAT
- Provide credit/loan to the farmers to purchase of livestock through cooperatives
- Supply milk to Dairy Development Corporation and private dairies as per the contract
- Distribute money to farmers/collection center after receiving money from dairies

Processors/Dairies: Processors or dairies are operating at the district head quarters, key production area and urban market such as Banepa, Dulikhel etc. They generally do value addition and processing of produce and sale to consumers and retailers. Major functions performed by them include:

- Fix price of milk considering cost of production of farmers
- Collection of milk from chilling center/collection center
- Conduct preliminary testing of milk to ensure quality and avoid adulterations
- Provide technical and technological support to farmers, especially in case of Dairy Development Corporation
- Conduct value addition and processing of milk and produce milk and milk produce
- Supply milk and milk products to retailers and commission agents

Retailers/Commission agents: Retailers are operating at district head quarters and key market centers in the urban areas, like Dulikhel, Banepa and Kathmandu. Retailers either purchase whole milk from farmers or dairy and sale produce to consumers. Dairies/processors fix prices of milk. Retailers sell milk and milk products on commission basis which vary from 5-15 percent depending on type of products. They generally get products on 7 days credit or make payment after selling of products. In case of milk, retailers had to immediately give cash after sale (daily basis) while they can get in credit for 7 days for milk products such as yoghurt, cheese and ghee, etc. Milk products are sold at sale outlets while milk are sold in road head, especially in Kathmandu, Dulikhel, and Banepa. Major functions of retailers include:

- ➢ Establish and operate sales outlets
- ➢ Sell produce to consumers
- ➢ Make payment of dairy/processors immediately after selling of product or within 7 seven days, whichever is earlier

Table 3.1 summarizes major functions performed by different value chain stakeholders and their involvement. Farmers are highly involved only in production and livestock management. Their involvement in marketing is very low. Only very few farmers are involve in marketing.

Table 3.1: Major Functions Performed by Value Chain Stakeholders

Functions	Farmer	Collector	Chilling center	Cooperatives / Association	DDC	Private Dairies	Retailers
Breeds	High	No	Low	Low	No	No	No
Livestock management	High	No	Medium	Medium	Low	No	No
Feed and medicines	High	Medium	Medium	Medium	No	No	No
Credit/ loan/ Finance	No	Low	High	High	No	No	No
Insurance	High	No	High	High	No	No	No
Technical support	No	Low	High	High	Medium	No	No
Collection	High	High	High	High	High	High	No
Processing	Low	No	High	High	High	High	No
Sale/ Marketing	Low	High	High	High	High	High	High

Local collectors are highly involved in marketing together with collection and providing feeds and medicines. Product based cooperatives are involved in livestock management, insurances and cooperatives. Chilling center are involved in technical support, insurances and feed management because it is being operated by cooperatives. Hence, function of cooperatives and chilling center often overlap with each other. Private dairy is involved in collection and sale of produce while public sector dairy, especially DDC is involved in providing technical services together with marketing.

3.1.3 Volume Handled

Figure 3.2 shows volume handled by different value chain stakeholders.

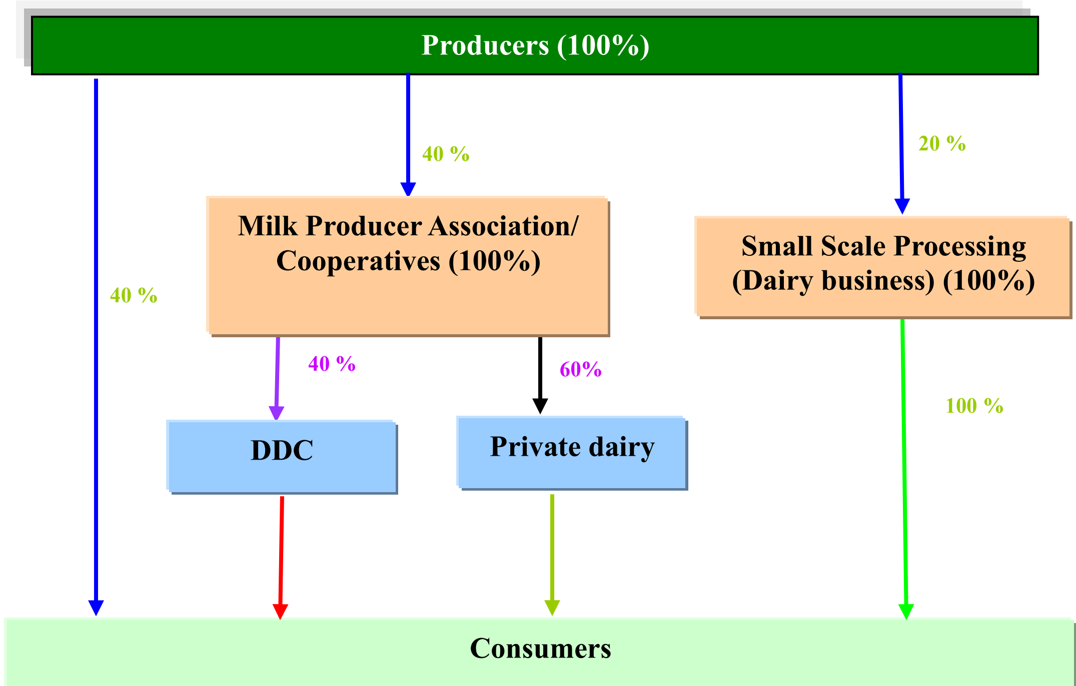


Figure 3.2: Volume Handled by Different Value Chain Stakeholders

Farmers close to the market center generally sale milk directly to the consumers. This system is quite common throughout the study districts, since the diary business is yet to get momentum, especially in Sindhuli, Dolakha and Ramechhap district. DDC has formed Milk Producers Associations and Cooperatives. These organizations are involved in collection of the milk and supply to the Chilling Centre of the Private or DDC. The milk is then pasteurized at the DDC and supply to the consumer. This practice is quite common in Kavre and whereas it is evolving in rest of the District. Few Cooperatives, where selling of milk directly is difficult, have been processing milk and selling milk products. Dairy Cooperatives of Charikot, Dolakha and Sindhuli are producing hard cheese, cheese, butter and ghee and selling to the local market.

Based on above figure, table 3.2 summarizes the key market chain stakeholders and volume handled by them. Out of the total product of milk in SRC area, majority of the product is sold by retailers (37.5.7 percent) followed by producer associations/cooperatives (35 percent) and collectors (27.5 percent). Majority of the product from Dolakha and Kavre goes to private dairies through cooperatives while it is through self retailing in Sindhuli and Ramechhap.

Table 3.2: Produce Handled by Different Market Chain Stakeholders Directly

Unit: Percent

Market agents	Kavre	Dolakha	Ramechhap	Sindhuli
Collectors	25	25	20	40
Producer Association/Cooperatives	60	40	25	15
Retailers directly (including farmers self retailing)	15	35	55	45
Private diaries (Direct collection)	Negligible	Negligible	Negligible	Negligible

Source: Field Survey

3.1.4 Places

Milk produced in the districts is sold locally as well as Kathmandu. Table 3.3 presents proportion of milk sold at different market places. Table reveals that most of the produce is sold in local market itself followed by district headquarters and neighboring districts. Milk of Kavre only arrives to Kathmandu while it is sold locally in rest of the districts.

Table 3.3: Produce Sold in Different Market Places

Unit: Percent

Market places	Kavre	Dolakha	Ramechhap	Sindhuli
Local markets (within district)	5	45	40	30
District head quarters	25	55	60	70
Teria market (Janakpur)	-	-	-	Negligible
Neighboring Districts	10	-	-	-
Kathmandu	60	-	-	-
Total	**100**	**100**	**100**	**100**

Source: Field Survey

Table 3.4 shows the market access of different value chain stakeholders. The table reveled that farmers and collector have access up to local market while chilling center/cooperative have access to district head quarters. Likewise diary has access to district head quarters and other market places. Retailers are operating at all market places except in local market.

Table 3.4: Market Access of Different Value Chain Stakeholders

Places	Farmer	Collector	Chilling Center	Cooperatives / Association	DDC	Private Dairies	Retailers
Local markets	Yes	Yes	Yes	Yes	No	No	No
District head quarters	No	No	Yes	Yes	Yes	Yes	Yes
Teria market (Janakpur)	No	No	No	No	Yes	Yes	Yes
Neighboring Districts	No	No	No	No	Yes	Yes	Yes
Kathmandu	No	No	No	No	Yes	Yes	Yes

Source: Field Survey

3.2 Value Chain Performance

The analysis of priced margins has been carried out by using a standard format that shows major costs, losses, margins and prices along the chain and the share of each players as the product moves from production to local collectors, traders, wholesale market and finally up to the consumers. The information is based on the information obtained from the districts and Kathmandu market.

3.2.1 Producers

Table 3.5 presents cost and margin of milk producers with details in Annex 3.1. The cost of rearing of livestock is estimated while considering

- Farmers will purchase first time lactating cattle or buffalo which will be reared for next ten years or up to 11 times of breeding. It will become infertile afterwards
- Farmers spend around 4 hrs a day for rearing one livestock including feed collection, manuring, milking and sale
- Both the milk and other input price will remain constant for another 10 years
- Improved variety of cattle/buffalo give milk around 270 to 330 days, hence the study took 300 lactating day for each cattle
- From total production costs, other income such as sale of calf and manure was deducted to estimate cost of milk production

Table 3.5 presents cost and margin of farmers. The study found that cost of livestock rearing differs by districts. This is mainly because of differences on wage rates, quantity of feeds uses, farm gate price and yield etc. Farmers are having loss in milk production in all the study districts which varies from 29.1 percent in Kavre to 19.8 percent in Ramechhap.

Table 3.5: Cost and Margin of Producers

	Unit	Kavre	Dolakha	Ramechhap	Sindhuli
Input use	Rs/litre	29.9	31.2	33.4	30.7
Labor	Rs/ litre	12.4	10.5	9.0	9.7
Total expense (Cost)	Rs/ litre	42.3	41.7	42.4	40.4
Sale price	Rs/ litre	30.0	30.0	34.0	32.0
Loss	Rs/ litre	12.3	11.7	8.4	8.4
Profit percent	%	29.1	28.1	19.8	20.9

Source: Field Survey

Farmers are having loss in milk production because labor cost and feed cost are taken into accounts. Farmers generally use own feeds and grasses, hence purchase of feed is very minimal. Likewise, farmers mainly use their own family members and don’t take account of labor cost. Direct production cost is very minimal. When these costs are not taken into account, farmers will get profit high profit from sale of milk. Apart from this, most of the farmers are still involved in milk production because of cultural/religious values, less production inputs costs, for manure purposes and is also considered as integral part of Nepalese farming system.

3.2.2 Collectors

Collectors are collecting small quantity of milk daily which varies from 100 liter to 200 liter depending upon seasons and places. Collectors supply milk to either to Chilling Center/Cooperatives or private dairies. Collectors enjoy more profit if they directly sale to private dairy. However, most of the collection centers are selling to cooperative or chilling center because majority of farmers are members of cooperatives. Majority of collectors are collecting milk from farmers and supply to cooperatives. The collectors get salary from cooperative if it is managed by cooperatives itself. Few dairies give commission to collectors for collecting milk, which vary from Rs 0.5 to Rs 1.5. Collectors also purchase milk from farmers and sell to dairies, chilling center or collectors.

Table 3.6 presents cost and margin of collectors under assumptions that they purchase milk and sold to Chilling center or private traders with details in ***Annex 3.2.*** Profit margin is high in Kavre while lowest in Sindhuli.

Table 3.6: Cost and Margin of Collectors

	Unit	Kavre	Dolakha	Ramechhap	Sindhuli
Input use	Rs/litre	30.1	30.1	34.1	32.1
Labor	Rs/ litre	0.7	0.8	1.0	1.0
Total expense (Cost)	Rs/ litre	30.8	30.9	35.1	33.1
Sale price	Rs/ litre	32.0	32.0	36.0	34.0
Profit	Rs/ litre	1.2	1.1	0.9	0.9
Profit percent	%	3.9	3.6	2.6	2.7

Source: Field Survey

3.2.3 Chilling Center

Chilling centers are mostly being managed by farmers cooperative. They sell milk to both private dairies as well as DDC. Chilling center generally prefer to sale milk to DDC despite of high price provided by private dairy. This is mainly because DDC provides trainings, exposure visits, equipment, technical supports, and also bear cost of Artificial Insemination (Rs 250 per animal). Likewise, farmers don't rely on private dairy because they don't get money timely as well as associated high risk. Apart from this, Chilling Centers had made formal agreement with DDC to provide certain quantity of milk per day. If chilling center did not provide the agreed quantity, they don't get chilling cost of milk for that particular day. DDC provides 65 paisa/liter for chilling of milk. Hence, chilling center first priority remains to supply agreed quantity to DDC and then sale to other private dairies.

Table 3.7 presents cost and margin of chilling center operating at district head quarters with details in **Annex 3.3**. Profit margin enjoyed by chilling center varies by districts as well with the sector whom they supplied. Chilling center is getting less profit if supplied to DDC while they get more profit if they supplied to private dairy. This is mainly because of high price offered by private dairy. Profit margin of chilling center is highest in Ramechhap (Rs 3.2 per liter) followed by Sindhuli Rs (2.8/liter), Dolakha (Rs 1.8/liter) and Kavre (Rs1.3 per liter).

Table 3.7: Cost and Margin of Chilling Centers

	Unit	Kavre		Dolakha	Ramechhap	Sindhuli
		DDC	Private	Private	Private	Private
Input use	Rs/litre	30.1	31.1	35.1	30.1	32.1
Labor	Rs/ litre	0.6	0.6	1.8	1.1	1.1
Total expense (Cost)	Rs/ litre	30.7	31.7	36.9	31.2	33.2
Sale price	Rs/ litre	31.0	33.0	40.0	33.0	36.0
Profit	Rs/ litre	0.3	1.3	3.2	1.8	2.8
Profit percent	%	1.0	4.1	8.5	5.7	8.4

Source: Field Survey

3.2.4 Small Dairies

These dairy collect milks either from collectors or chilling center. They generally sell whole milk or extract fat and sale milk. Likewise, few are also involved in processing but scale of economy is very less. Majority of dairy surveyed districts were mainly collecting milk and selling to district residents. Value addition and processing is very less. They often operate below the capacity because of shortage of milk. Realizing this, this section analyze profit margin of small dairy taking milk as a main products. They also perform as retailers too.

Table 3.8 presents cost and margin of small dairies with details in ***Annex 3.4***. Profit margin enjoyed by small dairy is highest in Ramechhap (Rs 6.9/liter) followed by Dolakha (Rs 6/liter), Kavre (Rs 4.9/liter) and Sindhuli (Rs 4.8/liter). Profit margin on selling whole milk is less than processed milk but still small dairies prefer to sale whole milk because of high demand of whole milk compared to other milk products in the district.

Table 3.8: Cost and Margin of Small Dairies

	Unit	Kavre	Dolakha	Ramechhap	Sindhuli
Input use	Rs/litre	32.0	33.0	40.0	36.0
Labor	Rs/ litre	3.1	3.0	3.1	4.2
Total expense (Cost)	Rs/ litre	35.1	36.0	43.1	40.2
Sale price	Rs/ litre	40.0	42.0	50.0	45.0
Profit	Rs/ litre	4.9	6.0	6.9	4.8
Profit percent	%	13.9	16.7	16.1	12.0

Source: Field Survey

3.2.5 Dairies/Processors

Dairies are also involved in processing of milk and selling of milk products. Major milk products produced by these dairies include skim milk, paneer and yoghurt. However, majority of dairies are involved in separation of cream from milk and selling of cream. Table 3.9 presents cost and margin of dairies products with details in ***Annex 3.5***. High profit margin is on panner followed by Yoghurt, whole milk and milk without cream. Despite of high profit on value added products, production amount is very less. This is mainly because of less demand of these products at local market. Paneer are yet preferred in local area while most of the consumers prefer to consume homemade yoghurt.

Table 3.9: Cost and Margin of Dairy Processing Different products

	Unit	Skim milk	Yoghurt	Paneer	Whole milk
Input use	Rs/litre	40.2	40.9	43.1	38
Labor	Rs/ litre	10.2	13.2	13.3	4.7
Total expense (Cost)	**Rs/ litre**	**50.4**	**54.1**	**56.4**	**42.7**
Sale price	Rs/ litre	56	73.6	80	50
Profit	Rs/ litre	5.6	19.5	23.6	7.3
Profit percent	%	11.1	36.0	41.8	17.1

Source: Field Survey

3.3 Analysis of Service Providers/Enablers

Table 3.10 presents different service providers together with their major functions, frequency and their limitation/weakness. Table reveals that farmers have been accessing services from different service providers. However most of them regularly access services from Agro-vets despite of their complained with the quality of services. Private as well as public sector service providers have not only inadequate technical knowledge and skills but also human resources required for effective and efficient delivery of services.

Table 3.10: Assessment of Service Providers

Name	Major functions	Frequency of Service	Limitations/ Weakness
DLSO	o Technical support for Dairy animal management o Forage development support o Animal health care and medicinal treatment o Vaccinations o Breeding services (AI) o Laboratory facilities	Regular	o Not enough staff at Livestock Service Centers and sub centers to support all farmers. o Livestock Service Centers staff do not have motorbikes for AI service o Inadequate budget and technical skills o Timely technical services and advices not available
Agro vets	o Technical services o Lab test o Artificial inseminations o Counseling while selling vet-medicines o Demonstration to use medicines o Medicinal treatment and vaccinations	Regular	o Quality not reliable o Limited technical knowledge o Un timely availability of services
Financial Cooperative	o Loan	Occasional	o Limited fund o No direct support for livestock rearing
DDC	o Formulate dairy policy o Survey on milk price fix minimum price o Technical and equipment support to farmer	Regularly	o Poor market assessment o Limited services o Less price than private sector
Producer Association/ Cooperative	o Collection and selling of milk o Technical advice and support o Establish linkages with different stakeholders	Regular	o Limited capacity to negotiate with price of milk o Political influences/political motive o Inadequate counseling and mentoring support
Livestock insurance cooperative	o Insurance of Dairy animals	Regular	o High premium price o Valuation of livestock far below market price
Feed industries	o Supply of concentrate feeds	Regular	o Poor quality o High price o Not available on required quantity
Dairy Development Board	o Extension of dairy business and quality dairy product diversification.	Rate	o Less focus on marketing o Political influences/political motive decisions

3.4 Opportunities and Challenges/Constraints Analysis

Table 3.11 analyzes on opportunities and constraints related to the value chain development of dairy sector. Major challenges or constraints includes availability of poor quality milk, poor quality breeds, small number of livestock holdings, inadequate technical knowledge and skills on livestock management poor conditions of road, inactiveness of producers' or farmers group etc. Nevertheless, there exists ample of opportunities as well. Farmers are organized into producer associations and well established network exists. Potentiality for increase on production and productivity by small support and operation of agro-vets at the production center further provides opportunities for the development of milk sub sector.

Table 3.11: Opportunities and Constraints

Category of Constraints	Constraints/Challenges	Opportunities
Technology/ Production processes	o Lack of forage seeds and seedlings and availability of poor quality sapling o Crop residues based feed o Small size of livestock holdings o Poor quality productions o Low quality breeds o Less lactating period of livestock o High dependency on crop residues and grasses o Lack of grazing and pasture land	o Available DLSO as service providers o Potentiality to increase productivity o High demand of milk in market o Large number of milk producer cooperatives o Increasing demand of AI services o High involvement of farmers
Technical skills/ human resources	o Inadequate training to farmers o Low motivation and high frequency of officials transfer o Shortage of livestock labor	o Operation of Agro-vets at the village level o Development and mobilization of village animal health worker for delivery of services
Management/ Production and organization	o Inactive farmers groups o Poor coordination of stakeholders, o Farmers are not poorly organized o Poor technical knowledge on livestock rearing, especially on cattle shed management and breeding o Animal treatment and vaccination not properly done/ challenging o No follow up of recommendations made by different agencies, mainly on use of balanced diet	o Dairy cooperatives functions o Farmers as producers are functional and active
Marketing	o Milk is a highly perishable and need chilling after milking based on local temperature. o Distance and scattered farms o Lack of right market information to farms o Poor transport infrastructure o High transportation cost from field to market access o Price controlled by dairies o Losses of milk quality during transportation o Seasonality of production	o Set up of minimum base price o Public private partnership for production and marketing o Contract for purchase of milk with cooperatives o High demand of milk o Established market network and large number of market stakeholders operational
Policy/ Institutional issues	o No incentives to support promote milk production o Lack of financial support	o High priority on dairy sub-sector

Category of Constraints	Constraints/Challenges	Opportunities
	o Lack of insurance of milk animals	
Finance	o Lack of interest to provide loan for long time o High interest rate of cooperatives o Limited amount, not sufficient for purchase of livestock	o Easy availability from local cooperatives
Infrastructure	o Inadequate chilling facility and not operated on full capacity o Lack of information center o Poor road conditions to rural areas o Electricity problems	o Chilling center are established and operational o Farmers have knowledge and skills on management of chilling center o Contribution by local bodies on establishment of chilling and processing facilities
Input supply (Feed and medicines)	o Poor quality forage seedlings/saplings also not available in time o High prices of inputs such as feeds, vet medicines etc o low quality/Unreliable quality o Unavailability of required inputs, especially seeds and medicines o Un timely availability of feeds o Limited technical knowledge	o Agro-vets and cooperatives operational at village level o High demand of services from cooperatives

CHAPTER 4 CONCLUSIONS AND RECOMMENDATIONS

4.1 SWOT Analysis

Table below summarizes strengths, weakness, opportunities and threats of milk production based on findings of value chain analysis. Strengths and weakness are mainly related with the internal factors while opportunities and threats are external.

Strengths	Weakness
• High involvement of farmers, farmer group and cooperatives on production of milk, especially poor and marginalized farmers • Relatively good infrastructure including road, chilling center, electricity and market access • High demand of milk in market • Self-sufficiency in fodder and grasses, farmers often did not need to purchase • Easy access to services, especially feeds and technical services • No marketing complexity, establish marketing channel helps to meet the demands of the urban consumer • Very large number of animals and huge scope to enhance productivity	• Lack of advance knowledge about production • Poor availability of health and breeding services • Extension support from public sector is almost non-existent • High cost of services, especially on artificial inseminations and animal treatment • Poor quality milk production, less awareness on quality milk production • High transportation costs • Loss of quality during transportations • Shortage of chilling facilities at collection center • Inadequate capacity utilization of chilling center • High cost of production, unprofitable • Very large number of indigenous animals with low productivity and a small portion of

• Increase use of concentrate feeds for enhancing productivity • Animal insurance scheme being promoted by cooperatives • Small farmers organized into farmers groups and cooperatives for producing milk • Involvement of farmers organization on capacity building, especially cooperatives • Farmers are experienced on livestock rearing practices • Improved transportation facilities for movement of milk and milk products, including animal health and hygiene • Cooperatives are providing loan for establishment, operation and expansion of dairy business	cross-breeds • Low productivity of animal • Poor quality of feed, very poor awareness of quality feed, which hinders productivity • Poor cattle shed management • Very poor organizational and managerial capacity of farmer cooperatives • Increasing chemical contaminants as well as residual antibiotics in milk • Species-wise variation (buffalo, cow) in milk quality received by collection center • Excessive grazing pressure on marginal and small community lands • Skills related to processing and value addition of milk, including availability of trained manpower • Milk production is scattered over a large number of farmers producing small quantities
Opportunity	**Threats**
• Large number of dairies are operational in the study districts • High demand of milk in domestic market, high export potential for milk products • Well established govt. organizations network, NGO and other service providers available for technical support • Agro-vets and other service providers available • Loan facility provided by saving and credit co-operatives • Increasing affordability among consumers • Livestock insurance services being provided by cooperatives • Vast pool of highly trained and qualified village level animal health worker • Country's vast natural resources offer immense potential for growth and development of dairying	• Seasonal fluctuations in milk production pattern, Ensuring regular supply of milk during off-seasons (April – May) • Rapidly increase price of improved breeds and feeds • Labor intensive, shortage of human labor; new generations/ young people less attracted towards farming • Increasing number of quality conscious consumers • Extinction of the indigenous breeds of cattle due to indiscriminate use of crossbreeding program to enhance milk production • Regular supply of electricity • Less cost recovery on amount spent on production,(very less profit) • Cultural practices and belief of keeping infertile animal, especially cattle

4.2 Recommendations

Based on the above SWOT analysis and findings of value chain analysis, the study recommended on following actions with a view to increase milk production and productivity. The focused should be on (a) improving livestock rearing practices to increase production and productivity of farmers (b) improvement on marketing and distribution of milk, including quality assurances and (c) improve and strengthen service delivery mechanism, especially related to technical support, finance and insurances and (d) reduce cost of production.

With a view to increase production and productivity of farmers by improving farming practices, following suggestions are made:

- Identify economic unit of dairy animal per households and support households to keep required number of livestock, such that it can be operated as enterprise
- Identify key milk production zones and provide incentives for increasing productivity of livestock on key production zones
- Support farmers on cultivation of forages and grasses in their farm land such that dependency on natural resources can be reduced
- Develop animal husbandry practices/calendar of operation and disseminate with farmers
- Produce milk in the lean season through appropriate calving strategy and adequate feeding with incentive mechanisms of premium prices for the lean season
- Support farmers to acquire more improved breeds at subsidized prices
- Support for ensuring timely available of good quality concentrate feeds
- Train agro-vets and other input suppliers on livestock rearing practices
- Establish a revolving fund/loan at the cooperatives to provide loan to farmers who are on immediate need of cash
- Sensitize and build capacity of farmers to effectively vet AI and animal health services
- Orient farmers on balance use of nutrients/diets, including timely vaccinations and health treatments
- Strengthen capacity of farmers' on livestock rearing practices, especially on cattle shed management, animal health and hygiene
- Provide loan/credit/finance for farmers to buy improved breeds and livestock feeds
- Conduct research for changing the calving pattern of dairy animals such that flush season can be minimized.

Following actions are suggested for improving marketing and distribution of milk, including quality assurances

- ➢ Aware farmers and other marketing agents on quality milk production, including care
- ➢ Improve cooling facilities at collection centers to tap evening milk and avoid milk losses and adulterations
- ➢ Link with the dairy industries to provide cooler on loan, lease, grant or under specific terms and conditions similar to arrangements used by Coca Cola for using its fridges

- Support for construction of Milk chilling centers having transportation facility for effectively expanding the collection areas of milk produced in the rural areas in partnership with local bodies especially district development committee and village development committee
- Mobilize farmers co-operatives to function input suppliers along with technical advice for milk production
- Organize farmers into group and cooperatives for collective marketing and support to form a co-operative
- Initiate consumer education about the negative health impacts of unpackaged products
- Implement milk collection and processing code of practice at the milk chilling centers and dairy processing factories
- Collection and dissemination of information on market prices, demand-supply conditions, market destinations by using mobile network system etc
- Organize interactions between farmers and processors/dairy strengthen linkages and communications with each others
- Train transporter and collectors on type of vehicle which need to be used for transportation of milk along with developing appropriate carrying structures such that transportation losses could be minimized and freshness of milk could be maintained
- Strengthen laboratories at different levels for ensuring quality of milk and dairy products
- Develop resource centers by mobilizing cooperatives, groups and private entrepreneurs for increasing the production of improved breed animals through breed improvement, and conservation and promotion of the improved as well as productive local breed animals

Following actions are suggested for improve and strengthen service delivery mechanism, especially related to technical support, finance and insurance

- Provide timely and quality extension services by mobilizing village animal health workers
- Develop and mobilize local resource persons for providing support services to farmers.
- Mobilize farmers' group to provide feeding, breeding and health package along with management on training for clean milk production, storage, processing and marketing of milk and milk products.
- Work in partnership with different agencies on delivery of inputs and services
- Provide easy and convenient credit to the farmers for purchasing milking animals by motivating financial institutions
- Introduce and strengthen livestock insurance schemes in partnership with milk produce cooperatives;

Following actions are suggested to reduce cost of production by improving management through better feeding, breeding and health care.

- Supply of suitable improved dairy stock
- Ensure adequate supply of feed and fodder throughout the year with emphasis given to nutritive balanced fodder-based feeding systems
- Use of buffaloes should be given priority
- Produce and collect milk in low cost producing area along the road corridor
- Provide cash and non cash incentives to farmers to rear economic unit of animal, such that it can be operated as profitable enterprises
- Increase marketing efficiency through cooperative movements

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Annex 1.1: Consultations with Producers Group

District: Ramechhap

Location: Khimti – 1

Name of participants

SN	Name of persons met
1	Mr Indra Bahadur Khadka
2	Mr Bhoj Prasad Pokhrel
3	Mr Tanka Khatri
4	Mr Mukunda Prasad Kadariya
5	Mr Yadav Prasad Dahal
6	Mr Khadka Bahadur Khadka
7	Mr Balram Kadariya
8	Mr Kumar Dahal
9	Mr Bhoj Raj Kadariya

District: Dolakha

Location: Sundrawati-2

Name of participants

SN	Name of Persons Met
1	Mr Durga Prasad Mainali
2	Mr Sundar Khadka
3	Mr Ganesh Thami
4	Mr Santosh Giri
5	Mr Ram Bahadur Thani

District: Kavre

Location: Kuntabesi-10

Name of participants

SN	Name of Persons Met
1	Mr Hari Prasad Sapkota
2	Mr Achyut Prasad Sapkota
3	Mr Ganga Lal Shrestha
4	Mr Murli Prasad Poudel
5	Mr Maheswor Dahal
6	Mr Kheel Prasad Timilshina
7	Mr Ram Sapkota
8	Mr Hari Sigdel
9	Mr Kharka Bahadur Hamal
10	Mr Murli Prasad Poudel
11	Mrs Ambika Hamal
12	Mr Yagya Prasad Sapkota

District: Sindhuli

Location: Khanyakharka-5

Name of participants

SN	Name of Persons Met
1	Mr Sitaram Thapa
2	Mrs. Sabitri Thapa
3	Mr Manoj Sapkota
4	Mr Bharat Sapkota
5	Mrs. Indra Bhattarai
6	Mr Yadav Prasad Neupane
7	Mrs. Durga Dhakal
8	Mr Chiranjivi Dhakal

Annex 1.2: Consultations with Value Chain Stakeholders

District: Dolakha

Name of participants

SN	Name	Location	Major functions
1	Mr Durga Prasad Mainali	Charikot	Collector
2	Mr Sundar Khadka	Charikot	Dairy (Small)
3	Mr Akal Bahadur Shrestha	Charikot	Dairy (Small)
4	Mr. Pradip Siwakoti	Charikot	Chilling VAT
5	Mr. Akal B. Bohara	Charikot	Chilling VAT

District: Ramechhap

Name of participants

SN	Name	Location	Major functions
1	Mr Indra Bahadur Khadka	Manthali	Dairy (Small)
2	Mr Bhoj Prasad Pokhrel	Manthali	Dairy (Small)
3	Mr Tanka Khatri	Manthali	Collector
4	Mr. Bhanu Shrestha	Manthali	Chilling VAT/Collection Center
5	Mr. Shyam Shrestha	Tilpung	Chilling VAT/Collection Center

District: Sindhuli

Name of participants

SN	Name	Location	Major functions
1	Mr Manoj Sapkota	Khanyakharka	Dairy (Small)
2	Mr Bharat Sapkota	Khanyakharka	Dairy (Small)
3	Mrs. Indra Bhattarai	Khanyakharka	Dairy (Small)

District: Kavre

Name of participants

SN	Name	Location	Major functions
1	Mr Hari Prasad Sapkota	Kuntabesi	Dairy (Small)
2	Mr Achyut Prasad Sapkota	Kuntabesi	Dairy (Small)
3	Mr Ganga Lal Shrestha	Kuntabesi	Collector
4	Mr Kheel Prasad Timilshina	Kuntabesi	Dairy (Small)
5	Mr. Umesh Poudel	Kuntabesi	Collector
6	Mr. Deepak Poudel	Kuntabesi	Chilling VAT
7	Mr. Bipin Shrestha	Banepa	Dairy (Small)

Annex 1.3: Consultations with Service Delivery Agencies

District: Sindhuli

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr Rabilal Chaudhary	DLSO	Sindhulimadi	Technical Support
2	Mr Dr Amar Raya	DLSO	Sindhulimadi	Technical Support
3	Mr Tej Bikram Thapa	DLSO	Sindhulimadi	Technical Support
4	Mr Nabraj Devkota	DLSO	Sindhulimadi	Technical Support
5	Mr Ghani Raj Nuepane	Ratamata agro vet	Jhangjholi ratamata	Input Supplier
6	Mr. Bikram Raj Giri	Giri Agro-vet Centre	Sindhulimadi	Input Supplier
7	Mr. Om Prakash Shrestha	Kamalamai vet supplier	Sindhulimadi	Input Supplier
8	Mr. Bel Bdr. Badal	Sindhuli Vet Pharma	Sindhulimadi	Input Supplier

District: Ramechhap

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr. Tanka Kr. Shrestha	Bhanu & Nisha Vet. Shop	Manthali	Input Supplier
2	Mr. Narayan Poudel	Ramechhap Agro-Center	Manthali	Input Supplier
3	Mr. Shree Kr. Shrestha	Jamarko Krishi Sahakari Sanstha	Kathjor	Input Supplier
4	Mr Prakash Poudel	DLSO	Manthali	Technical Support
5	Mr Prakash Choudhary	DLSO	Manthali	Technical Support
6	Mrs. Nirmala Kandel	DLSO	Manthali	Technical Support
7	Mr Tek Bahadur Tamang	Collection Centre	Kathjor	Collector
8	Mr Sadhu Ram Dhungel	Cooperatives	Pakarbhas	Input Supplier
9	Mrs Sujata Sharma	Collection Centre	Manthali	Sales & Collects
10	Mr Mukund Prasad Kadariya	Cooperatives	Khimti	Input Supplier

District: Dolakha

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr Dal Bahadur Tamang	Cooperatives	Charikot	Input Supplier/Financing
2	Mr Vasu Thapa	Agro-Vet Shop	Charikot	Input Supplier
3	Mr Ram Prasad sha	DLSO	Charikot	Technical Support
4	Mr Rajendra Prasad Chaudhary	DLSO	Charikot	Technical Support
5	Mr Nabraj Dahal	DLSO	Charikot	Technical Support
6	Mr Sitaram Oli	DLSO	Charikot	Technical Support
7	Mr Durga Prasad Mainali	Cooperatives	B.N.P	Input Supplier
8	Mr Pradip Siwakoti	Cooperatives	B.N.P	Input Supplier

District: Kavre

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr. Ek Bhd. Tamang	Sankhu Saving and Credit Cooperative Society Limited	Sankhu	Input Supplier/Financing
2	Mr. Basu Dhital	Yuwa Krishi Sahakar Santha Limited	Patlekhet	Input Supplier/Financing
3	Mr. Dinesh Tiwari	Yuwa Krishi Sahakar Santha Limited	Patlekhet	Input Supplier/Financing
4	Mr. Sashi Raj Khadka	DLSO	Dhulikhel	Technical Support
5	Mr Ratna Adhikari	DLSO	Dhulikhel	Technical Support
6	Mr Shankar Sapkota	DLSO	Dhulikhel	Technical Support
7	Mr Achyut Sapkota	DLSO	Dhulikhel	Technical Support
8	Mr Kedar Nuepaney	DLSO	Dhulikhel	Technical Support
9	Mr Madhav Poudel	Kisan Agrovet	Dhulikhel	Input Supplier
10	Mr Ganga Ram Shrestha	Cooperatives	Kuntabesi	Input Supplier

Annex 2.1: Number of Dairy Animals over Last Seven Years

Cattle

Year	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	129,467	91,269	66,871	109,893	397,500	6,966,436
2004/05	129,514	91,797	66,973	109,890	398,174	6,994,463
2005/06	129,614	91,898	70,782	109,990	402,284	7,002,916
2006/07	134,007	93,114	70,782	110,100	408,003	7,044,279
2007/08	134,007	93,114	70,782	110,100	408,003	7,090,714
2008/09	136,266	93,752	71,747	110,180	411,945	7,175,198
2009/10	134,255	76,632	85,466	110,340	406,693	7,199,260
Annual Growth Rate (%)	0.9	-1.5	3.2	0.1	0.5	0.6

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Buffalo

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	894,79	38,931	50,274	53,114	231,798	3,952,654
2004/05	129,479	39,900	64,410	58,485	292,274	4,081,463
2005/06	129,624	49,001	64,538	58,595	301,758	4,204,886
2006/07	130,999	46,721	64,510	60,682	302,912	4,366,813
2007/08	130,999	40,721	64,510	60,682	296,912	4,496,507
2008/09	131,727	38,938	64,528	61,772	296,965	4,680,486
2009/10	130,999	46,579	60,109	63,068	300,755	4,836,984
Annual Growth Rate (%)	3.7	1.1	1.7	2.3	2.6	3.4

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Total

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	218,946	130,200	117,145	163,007	629,298	10,919,090
2004/05	258,993	131,697	131,383	168,375	690,448	11,075,926
2005/06	259,238	140,899	135,320	168,585	704,042	11,207,802
2006/07	265,006	139,835	135,292	170,782	710,915	11,411,092
2007/08	265,006	133,835	135,292	170,782	704,915	11,587,221
2008/09	267,993	132,690	136,275	171,952	708,910	11,855,684
2009/10	265,254	123,211	145,575	173,408	707,448	12,036,244
Annual Growth Rate (%)	2.3	-0.7	2.5	0.9	1.4	1.7

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Annex 2.2: Number of Productive Dairy Animals over Last Seven Years

Cattle

Year	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	21,260	10,711	8,178	11,615	51,764	888,190
2004/05	21,268	10,773	8,190	11,615	51,846	902,286
2005/06	21,426	10,785	8,656	11,626	52,493	903,376
2006/07	21,652	10,916	8,190	11,627	52,385	908,712
2007/08	21,652	10,773	8,190	11,615	52,230	915,411
2008/09	22,017	10,847	8,302	11,623	52,789	932,876
2009/10	21,692	11,307	9,889	11,640	54,528	954,680
Annual Growth rate %	0.5	0.6	2.1	0	0.7	1.1

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Buffalo

Year	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	25,538	9,790	10,806	13,497	59,631	1,015,727
2004/05	36,954	10,034	13,844	14,862	75,694	1,050,977
2005/06	36,995	12,323	13,872	14,890	78,080	1,084,764
2006/07	59,550	10,567	13,950	15,391	99,458	1,124,454
2007/08	59,550	9,800	13,950	14,862	98,162	1,158,300
2008/09	59,881	9,371	13,954	15,129	98,335	1,211,495
2009/10	56,148	11,210	12,998	15,446	95,802	1,252,770
Annual Growth rate %	12	0.1	1.8	1.5	7.2	3.5

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Overall

Year	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	46,798	20,501	18,984	25,112	111,395	1,903,917
2004/05	58,222	20,807	22,034	26,477	127,540	1,953,263
2005/06	58,421	23,108	22,528	26,516	130,573	1,988,140
2006/07	81,202	21,483	22,140	27,018	151,843	2,033,166
2007/08	81,202	20,573	22,140	26,477	150,392	2,073,711
2008/09	81,898	20,218	22,256	26,752	151,124	2,144,371
2009/10	77,840	22,517	22,887	27,086	150,330	2,207,450
Annual Growth rate %	8.4	0.4	1.9	0.9	4.7	2.4

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Annex 2.3: Average Number of Dairy Animals per HHs

Total Population

	Total HHs	Total			Population per HHs		
		Cattle	Buffalo	Total	Cattle	Buffalo	Total
Kavre	86,605	130,999	134,255	265,254	1.5	1.6	3.1
Dolakha	48,414	46,579	76,632	123,211	1	1.6	2.5
Ramechhap	45,036	60,109	85,466	145,575	1.3	1.9	3.2
Sindhuli	58,270	63,068	110,340	173,408	1.1	1.9	3.0
SRC	**238,325**	**300,755**	**406,693**	**707,448**	**1.3**	**1.7**	**3.0**
Nepal	5,659,984	4836984	7,199,260	12,036,244	0.9	1.3	2.1

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Milking animals

	Total HHs	Total			Population per HHs		
		Cattle	Buffalo	Total	Cattle	Buffalo	Total
Kavre	86,605	21,692	56,148	77,840	0.3	0.6	0.9
Dolakha	48,414	11,307	11,210	22,517	0.2	0.2	0.5
Ramechhap	45,036	9,889	12,998	22,887	0.2	0.3	0.5
Sindhuli	58,270	11,640	154,46	27,086	0.2	0.3	0.5
SRC	**238,325**	**54,528**	**95,802**	**150,330**	**0.2**	**0.4**	**0.6**
Nepal	5,659,984	954,680	1,252,770	2,207,450	0.2	0.2	0.4

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Annex 2.4: Production of Milk over Last Seven Years

A. cattle

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	10,382	4,733	2,998	4,374	22,487	368,531
2004/05	10,386	4,760	3,002	4,374	22,522	379,637
2005/06	10,463	4,765	3,173	4,378	22,779	385,290
2006/07	11,500	5,050	3,200	4,379	24,129	392,791
2007/08	11,500	5,100	3,300	4,600	24,500	400,950
2008/09	11,694	5,135	3,345	4,803	24,977	413,919
2009/10	11,521	5,353	3,984	4,810	25,668	429,129
Annual Growth rate %	2.3	2.1	4.1	1.9	2.4	2.4

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

B. Buffalo

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	26,001	8,026	10,134	11,033	55,194	863,322
2004/05	37,624	8,226	12,983	12,149	70,982	894,591
2005/06	37,666	10,103	13,009	12,172	72,950	926,850
2006/07	60,630	8,663	13,082	12,581	94,956	958,603
2007/08	60,600	8,034	13,082	12,149	93,865	987,780
2008/09	60,937	7,682	13,086	12,367	94,072	1,031,500
2009/10	57,138	9,190	12,189	12,626	91,143	1,068,300
Annual Growth rate %	12.0	0.1	1.8	1.5	7.6	3.5

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

C. Overall

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	36,383	12,759	13,132	15,407	77,681	1,231,853
2004/05	48,010	12,986	15,985	16,523	93,504	1,274,228
2005/06	48,129	14,868	16,182	16,550	95,729	1,312,140
2006/07	72,130	13,713	16,282	16,960	119,085	1,351,394
2007/08	72,100	13,134	16,382	16,749	118,365	1,388,730
2008/09	72,631	12,817	16,431	17,170	119,049	1,445,419
2009/10	68,659	14,543	16,173	17,436	116,811	1,497,429
Annual Growth rate %	10.2	0.9	2.3	1.6	6.5	3.2

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Annex 2.5: Average Yield of Milk

A. Cattle

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	488	442	367	377	434	415
2004/05	488	442	367	377	434	421
2005/06	488	442	367	377	434	427
2006/07	531	463	391	377	461	432
2007/08	531	473	403	396	469	438
2008/09	531	473	403	413	473	444
2009/10	531	473	403	413	471	450
Annual Growth rate %	1.8	1.5	2.0	1.9	1.7	1.3

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

B. Buffalo

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	982	1,220	1,066	1,223	1,080	1,177
2004/05	982	1,220	1,066	1,223	1,066	1,175
2005/06	982	1,220	1,066	1,223	1,070	1,170
2006/07	982	1,220	1,066	1,223	1,047	1,173
2007/08	983	1,220	1,066	1,223	1,046	1,173
2008/09	983	1220	1,066	1,223	1,045	1,174
2009/10	983	1,220	1,066	1,223	1,051	1,173
Annual Growth rate %	0.0	0.0	0.0	0.0	0.5	0.0

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

C Overall

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	777	622	692	614	697	647
2004/05	825	624	725	624	733	652
2005/06	824	643	718	624	733	660
2006/07	888	638	735	628	784	665
2007/08	888	638	740	633	787	670
2008/09	887	634	738	642	788	674
2009/10	882	646	707	644	777	678
Annual Growth rate %	2.1	0.5	0.5	0.8	1.9	0.8

Source: Computed from Statistical Information in Nepalese Agriculture (2003/04 to 2009/10), Ministry of Agriculture and Cooperatives

Annex 3.1: Cost of Livestock Production by Study District

A. Kavre

Particulars	Monthly				Annual
	Unit	Rate (Rs)	Quantity	Amount (Rs)	
Capital expenditure					
Cow	No	30,000	1		30,000
Cattle shed construction	No	15,000	1		15,000
Utensils	Lumpsum	2,000	1		2,000
Sub total					**47,000**
Operating expenditure					
Inputs					
Grasses	Bhari	50	1	50	18,250
Straw	Kg/day	6	10	60	21,900
Livestock feed (Concentrate)	Kg/day	22	4	88	26,400
Vaccination, medicines	Lumpsum	200	1	200	200
Calcium	Lumpsum	500	1	500	500
A.I	Lumpsum	300	1	300	300
Sub total					**73,270**
Others					
Insurance premium (5% of value)				1,500	1,500
Medical treatment	Lumpsum	1	500	500	500
Land rents	Ropani	0.5	500	250	250
Wage	Lumpsum	200	109.5		21,900
Sub total				**2,698**	**24,150**

Total income		Per day	Days	Quantity	Sale price	Total
Milk	Liter	6.5	300	1,950	30	58,500
Manure	Bhari	1	360	360	35	12,600
Calf	Per Year		1	1	7,000	7,000
Sub total						**78,100**

Projected Income and Expenditure

Expenses	Capital (Rs)			Operating (Rs)	Total (Rs)
	Assets	Inputs	Total		
Year I	47,000	73,270	120,270	24,150	144,420
Year II		73,270	73,270	24,150	97,420
Year III		73,270	73,270	24,150	97,420
Year IV		73,270	73,270	24,150	97,420
Year V		73,270	73,270	24,150	97,420
Year VI		73,270	73,270	24,150	97,420
Year VII		73,270	73,270	24,150	97,420
Year VIII		73,270	73,270	24,150	97,420
Year IX		73,270	73,270	24,150	97,420
Year X		73,270	73,270	24,150	97,420
Total	**47,000**	**732,700**	**779,700**	**241,500**	**1,021,200**

Income	Milk			Other income (Rs)		
	Litre	Rate Rs)	Amount	Manure	Calf	Total
Year I	1,950	30	58,500	12,600	7,000	19,600
Year II	1,950	30	58,500	12,600	7,000	19,600
Year III	1,950	30	58,500	12,600	7,000	19,600
Year IV	1,950	30	58,500	12,600	7,000	19,600
Year V	1,950	30	58,500	12,600	7,000	19,600
Year VI	1,950	30	58,500	12,600	7,000	19,600
Year VII	1,950	30	58,500	12,600	7,000	19,600
Year VIII	1,950	30	58,500	12,600	7,000	19,600
Year IX	1,950	30	58,500	12,600	7,000	19,600
Year X	1,950	30	58,500	12,600	7,000	19,600
Total	**19,500**	**30**	**585,000**	**126,000**	**70,000**	**196,000**

Cost	Expense (Rs)	Other income (Rs)	Total (Rs)
Inputs	40.0	10.1	29.9
Operating	12.4		12.4
Total cost			**42.3**
Sale price			30.0
Loss			12.3
Loss percent			29.1

B. Dolakha

Particulars	Monthly				Annual (Rs)	
	Unit	Rate (Rs)	Quantity	Amount (Rs)		
Capital expenditure						
Cow	No	30,000	1		30,000	
Cattle shed construction	No	20,000	1		20,000	
Utensils	Lump sum	3,500	1		3,500	
Sub-total					**53,500**	
Operating expenditure						
Inputs						
Grasses	Bhari	50	1	50	18,250	
Straw	Bhari	150	0.25	37.5	13,688	
Livestock feed (Concentrate)	Kg/day	20	4	80	29,200	
Vaccination, medicines	Lumpsum	50	1	50	50	
Vitamin	Lumpsum	800	1	800	800	
A.I	Lumpsum	300	1	300	300	
Sub-total				**1,955**	**62,288**	
Others						
Land rents	Rapoani	300	0.5	150	150	
Medical treatment	Lumpus	1	500	500	500	
Wage	Day	200	91		18,250	
Sub-total					**18,900**	
Income		**Per day**	**Days**	**Quantity**	**Sale price**	**Total**
Milk	Liter	6	300	1,800	30	54,000
Manure	Bhari	0.5	360	180	30	5,400
Calf	Per Year		1	1	6,000	6,000
Sub-total						**65,400**

Projected Income and Expenditure

Expenses	Capital (Rs)			Operating (Rs)	Total (Rs)
	Assets	Inputs	Total		
Year I	53,500	62,288	115,788	18,900	134,688
Year II		62,288	62,288	18,900	81,188
Year III		62,288	62,288	18,900	81,188
Year IV		62,288	62,288	18,900	81,188
Year V		62,288	62,288	18,900	81,188
Year VI		62,288	62,288	18,900	81,188
Year VII		62,288	62,288	18,900	81,188
Year VIII		62,288	62,288	18,900	81,188
Year IX		62,288	62,288	18,900	81,188
Year X		62,288	62,288	18,900	81,188
Total	**53,500**	**622,875**	**676,375**	**189,000**	**865,375**

Income	Milk			Other income (Rs)		
	Litre	Rate (Rs)	Amount (Rs)	Manure	Calf	Total
Year I	1,800	30	54,000	5,400	6,000	11,400
Year II	1,800	30	54,000	5,400	6,000	11,400
Year III	1,800	30	54,000	5,400	6,000	11,400
Year IV	1,800	30	54,000	5,400	6,000	11,400
Year V	1,800	30	54,000	5,400	6,000	11,400
Year VI	1,800	30	54,000	5,400	6,000	11,400
Year VII	1,800	30	54,000	5,400	6,000	11,400
Year VIII	1,800	30	54,000	5,400	6,000	11,400
Year IX	1,800	30	54,000	5,400	6,000	11,400
Year X	1,800	30	54,000	5,400	6,000	11,400
Total	**18,000**	**30**	**540,000**	**54,000**	**60,000**	**114,000**

Cost	Expense (Rs)	Other income (Rs)	Total (Rs)
Inputs	37.6	6.3	31.2
Operating	10.5		10.5
Total cost			**41.7**
Sale price			30.0
Loss			(11.7)
Loss percent			(28.1)

C. Ramechhap

Particulars	Unit	Monthly Expenses			Annual Expenses (Rs)	
		Rate (Rs)	Quantity	Amount (Rs)		
Capital expenditure						
Buffalo	No	40,000	1		40,000	
Cattle shed construction	No	20,000	1		20,000	
Utensils	Lumpsum	2,000	1		2,000	
Sub-total					**62,000**	
Operating expenditure						
Grasses	Bhari	25	1	25	9,125	
Straw	Bhari	40	0.5	20	7,300	
Livestock feed (Concentrate)	Kg/day	20	4	80	29,200	
Rice Barn	Kg/day	10	3	30	10,950	
Oil Cake	Kg/day	25	1	25	9,125	
Vaccination, medicines	Lumpsum	280	1	280	280	
A.I	Lumpsum	300	1	300	300	
Sub total					**66,280**	
Others						
Land rents	Rapoani	500	0.5	250	250	
Medical treatment	Lumpsum	1	500	500	500	
Wage	Days	170	91		15,513	
Sub-total				**1,550**	**16,263**	
Income		**Per day**	**days**	**Quantity**	**Sale price**	**Total**
Milk	Liter	6	300	1,800	34	61,200
Manure	Bhari	0.5	360	180	30	5,400
Calf	Per Yar		1	1	7,000	7,000
Sub-total						73,600

Projected Income and Expenditure

Expenses	Capital Expenses (Rs)			Operating (Rs)	Total (Rs)
	Assets	Inputs	Total		
Year I	62,000	66,280	128,280	16,263	144,543
Year II		66,280	66,280	16,263	82,543
Year III		66,280	66,280	16,263	82,543
Year IV		66,280	66,280	16,263	82,543
Year V		66,280	66,280	16,263	82,543
Year VI		66,280	66,280	16,263	82,543
Year VII		66,280	66,280	16,263	82,543
Year VIII		66,280	66,280	16,263	82,543
Year IX		66,280	66,280	16,263	82,543
Year X		66,280	66,280	16,263	82,543
Total	**62,000**	**662,800**	**724,800**	**162,625**	**887,425**

Income	Milk			Other income (Rs)		
	Litre	Rate (Rs)	Amount (Rs)	Manure	Calf	Total
Year I	1,800	34	61,200	5,400	7,000	12,400
Year II	1,800	34	61,200	5,400	7,000	12,400
Year III	1,800	34	61,200	5,400	7,000	12,400
Year IV	1,800	34	61,200	5,400	7,000	12,400
Year V	1,800	34	61,200	5,400	7,000	12,400
Year VI	1,800	34	61,200	5,400	7,000	12,400
Year VII	1,800	34	61,200	5,400	7,000	12,400
Year VIII	1,800	34	61,200	5,400	7,000	12,400
Year IX	1,800	34	61,200	5,400	7,000	12,400
Year X	1,800	34	61,200	5,400	7,000	12,400
Total	**18,000**	**34**	**612,000**	**54,000**	**70,000**	**124,000**

Cost	Expense (Rs)	Other income (Rs)	Total (Rs)
Inputs	40.3	6.9	33.4
Operating	9.0		9.0
Total cost			**42.4**
Sale price			34.0
Loss			(8.4)
Loss percent			(19.8)

D. **Sindhuli**

Particulars	Monthly				Annual Expenditure (Rs)
	Unit	Rate (Rs)	Quantity	Amount (Rs)	
Capital expenditure					
Buffalo	No	40,000	1		40,000
Cattle shed construction	No	10,000	1		10,000
Utensils	Lumpsum	2,000	1		2,000
Sub-total					**52,000**
Operating expenditure					
Grasses	Bhari	40	1	40	14,600
Straw	Bhari	150	0.5	75	27,375
Livestock feed (Concentrate)	Kg/day	20	4	80	29,200
Vaccination, medicines	Lumpsum	280	1	280	280
A.I		300	1	300	300
Sub-total				**1,560**	**71,755**
Others					
Medical treatment	Lumpsum	500	1	500	500
Land rents	Rapoani	500	0.5	250	250
Wage	Days	200	91.25		18,250
Sub-total					**19,000**

Income		Per day	days	Quantity	Sale price	Total
Milk	Liter	6.5	300	1,950	32	62,400
Manure	Bhari	0.7	360	252	40	10,080
Calf	Per Year		1	1	7,000	7,000
Sub-total						**79,480**

Projected Income and Expenditure

Expenses	Capital expenses (Rs)			Operating (Rs)	Total (Rs)
	Assets	Inputs	Total		
Year I	52,000	71,755	123,755	19,000	142,755
Year II		71,755	71,755	19,000	90,755
Year III		71,755	71,755	19,000	90,755
Year IV		71,755	71,755	19,000	90,755
Year V		71,755	71,755	19,000	90,755
Year VI		71,755	71,755	19,000	90,755
Year VII		71,755	71,755	19,000	90,755
Year VIII		71,755	71,755	19,000	90,755
Year IX		71,755	71,755	19,000	90,755
Year X		71,755	71,755	19,000	90,755
Total	**52,000**	**717,550**	**769,550**	**190,000**	**959,550**

Income	Milk			Other income (Rs)		
	Litre	Rate (Rs)	Amount (Rs)	Manure	Calf	Total
Year I	1,950	32	62,400	10,080	7,000	17,080
Year II	1,950	32	62,400	10,080	7,000	17,080
Year III	1,950	32	62,400	10,080	7,000	17,080
Year IV	1,950	32	62,400	10,080	7,000	17,080
Year V	1,950	32	62,400	10,080	7,000	17,080
Year VI	1,950	32	62,400	10,080	7,000	17,080
Year VII	1,950	32	62,400	10,080	7,000	17,080
Year VIII	1,950	32	62,400	10,080	7,000	17,080
Year IX	1,950	32	62,400	10,080	7,000	17,080
Year X	1,950	32	62,400	10,080	7,000	17,080
Total	**19,500**	**32**	**624,000**	**100,800**	**70,000**	**170,800**

Cost	Expense (Rs)	Other income (Rs)	Total (Rs)
Inputs	39.5	8.8	30.7
Operating	9.7		9.7
Total cost			**40.4**
Sale price			32.0
Loss			(8.4)
Loss percent			(20.9)

Annex 3.2: Cost and Margin of Collectors

SN	Price (NRs.)	Districts				Basis			
		Kavre	Dolakha	Sindhuli	Ramechhap	Kavre	Dolakha	Sindhuli	Ramechhap
1	Farm Gate	30.00	30	32	34	Average price for milk is between Rs. 30-35; Monthly collection volume 6000 liter	Average price of milk is about Rs. 30 - 35; Montly handled volume is about 5000 liter	Average price for milk is between Rs. 32-35; Monthly collection volume 4000 liter	Monthly collection is about 2000 liter
2	Wage	0.50	0.58	0.75	0.75	1 people are employed; Monthly salary is Rs. 3000 per person	1 people are employed; Monthly salary is Rs. 3500 per person	1 people are employed; Monthly salary is Rs. 3000 per person	1 person is employed; Monthly salary is 1500
3	Preservatives/Chemicals	0.05	0.05	0.05	0.05	About 5 paise per litre	About 5 paise per litre	About 5 paise per litre	About 5 paise per litre
4	Rent	0.17	0.17	0.25	0.25	Rs. 1000 per month	Rs. 1000 per month	Rs. 1000 per month	Rs. 1000 per month
5	Total	**30.72**	**30.80**	**33.1**	**35.1**				
	Sale price	32.0	32.0	34.0	36.0				

Input cost	**30.1**	**30.1**	**32.1**	**34.1**
Labor cost	0.7	0.8	1.0	1.0
Total cost	30.7	30.8	33.1	35.1
Sale price	32.0	32.0	34.0	36.0
Profit margin	1.3	1.2	1.0	1.0
Profit percent	4.2	3.9	2.9	2.7

Annex 3.3: Cost and Margin of Chilling Center

SN	Activities	Unit	Kavre		Dolakha		Sindhuli		Ramechhap		Basis			
			Govt	Private	Govt	Private	Govt	Private	Govt	Private				
			Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Kavre	Dolakha	Sindhuli	Ramechhap
1	Purchase price (Farmers)	Rs	30	31	-	30	-	32	-	35				
1.1	Transportation	Rs	0.5	0.5		1.1		1.1		1.3		Rs. 45 per 40 Lit cane	Rs. 45 per 40 Lit cane	Rs. 50 per 40 Lit cane
1.2	Collector's commission	Rs	0.5	0.5										
1.2	Salary	Rs	0.1	0.1		0.50		0.5		1		Rs. 8,000 per month; montly handling of 4,500 liter	Rs. 10,000 per month; monthly handling of 3,000 liter	Rs. 3,000 per month; 3,000 liter per month
1.3	Operating expenses (Electricity, water oil)	Rs	0.1	0.1		0.1		0.1		0.1		Monthly Rs. 10000 for chilling and heating	Rs. 8,000 per month	Rs. 9,000 per month for chilling and heating
1.4	Chemicals	Rs	0.1	0.1		0.1		0.1		0.1		Rs. 1,000 per month	Rs. 750 per month	Rs.700 per month
1.5	Repair maintenance of equipments	Rs	0.05	0.05		0.1		0.1		0.1				
	Total		**31.35**	**32.35**		**31.9**		**33.9**		**37.55**				

			Kavre		**Dolakha**		**Sindhuli**		**Ramechhap**					
			Govt	**Private**	**Govt**	**Private**	**Govt**	**Private**	**Govt**	**Private**	**Basis**			
SN	**Activities**	**Unit**	**Rs**	**Rs**	**Rs**	**Rs**	**Rs**	**Rs**	**Rs**	**Rs**	**Kavre**	**Dolakha**	**Sindhuli**	**Ramechhap**
	investments													
2	Chilling cost (Provided by dairy)		0.65	0.65		0.70		0.70		0.70				
			30.7	**31.7**		**31.2**		**33.2**		**36.8**				
4	Selling price (Dairy)		31	33		33		36		40.00				
5	Profit margin		0.3	1.3		1.775		2.8		3.15				
6	Profit percent		1.0	4.0		5.6		8.2		**8.4**				

A	Input cost	Rs	30.1	31.1		30.1		32.1		35.1
B	Labor costs	Rs	1.3	1.3		1.8		1.8		2.5
C	Chilling support	Rs	0.65	0.65		0.70		0.70		0.70
D	Other cost (B-C)	Rs	0.6	0.6		1.1		1.1		1.8
E	Total cost (A+D)	Rs	30.7	31.7		31.2		33.2		36.9
F	Sale price	Rs	31.0	33.0		33.0		36.0		40.0
G	Profit margin	Rs	0.3	1.3		1.8		2.8		3.2
H	Profit percent	Rs	1.0	4.1		5.7		8.4		8.5

Annex 3.4: Cost and Margin of Small Dairy (selling whole milk)

SN	Activities	Unit	Kavre	Dolakha	Sindhuli	Ramechhap	Basis			
			Rs	Rs	Rs	Rs	Kavre	Dolakha	Sindhuli	Ramechhap
1	Purchase price (Farmers)	Rs	32	33	36	40				
1.2	Salary	Rs	1.43	1.39	1.67	1.25	Rs 3,000 per month with handling of 70 liter per day	Rs 2,500 per month with handling of 60 liter per day	Rs. 2,500 monthly salary; Daily handling volume 50 liter	Rs 1,500 per month with handling of 40 liter per day
1.3	Operating expenses (Electricity, water oil)	Rs	0.10	0.07	0.13	0.13	Rs. 200 per month	Rs. 180 per month	Rs. 200 per month	Rs. 150 per month
	Chilling cost	Rs	0.65	0.70	0.70	0.70				
1.4	Space	Rs	0.95	0.83	1.67	1	Rs 2,000 per month	Rs. 1,500 per month	Rs. 1,500 per month	Rs. 1,200 per month
	Total investments		35.13	35.99	40.17	43.08				
4	Selling price (Dairy)		40	42	45	50				
5	Profit margin		4.87	6.01	4.83	6.93				
6	Profit percent		13.9	16.7	12.0	16.1				

	Input cost		**32.0**	**33.0**	**36.0**	**40.0**
	Labour cost		3.1	3.0	4.2	3.1
	Total cost		35.1	36.0	40.2	43.1
	Sale price		40.0	42.0	45.0	50.0
	Profit margin		4.9	6.0	4.8	6.9
	Profit percent		13.9	16.7	12.0	16.1

Annex 3.5: Cost and Margin of Different Processed Products

(a) Skim milk

		Rate	Quantity	Amount	Basis
Milk Price	**Rs**	**38**	25	950	
Transportation	Rs	2	25	50	
Acids/Chemicals				0.75	Need 10 ml - 25 liter (where
Heating (Gas)				53	1 cylinder gas can boil 700 - 800 liter of milk
Manpower	Days	300	0.5	150	(2 hrs for boiling milk)
Rental				25	Rs 1 per liter per day
Others				25	Equipments and machine rentals
				1,253.8	
Sale					
Milk	Rs/liter	50	20	1,000	
Cream	Rs/kg	1	400	400	
				1,400	

Input cost	40.2
Value added cost	10.2
Total cost	**50.3**
Sale price	56.0
Profit	5.7
Profit margin	**11.2**

(b) Yoghurt

		Rate	Quantity	Amount	Basis
Milk Price	**Rs**	**38**	25	950	
Transportation	Rs	2	25	50	
Yeast/Seeds	Rs			10	(Rs 10 for 25 liter)
Acids/Chemicals				0.75	Need 10 ml - 25 liter (where
Heating (Gas)				72	1 cylinder gas can boil 700 - 800 liter of milk
Manpower	Days	300	0.75	225	(2 hrs for boiling milk)
Rental				25	Rs 1 per liter per day
Others				25	Equipments and machine rentals
				1,357.8	
Sale					
Curd	Rs/liter	80	18	1,440	
Cream	Rs/kg	1	400	400	
				1,840	

Input cost	40.9
Value added cost	13.2
Total cost	**54.1**
Sale price	73.6
Profit	19.5
Profit margin	**36.0**

(c) Paneer

	Unit	Rate	Quantity	Amount	Remark
Citric acid	Lump sum			125	
Milk		40	40	1,600	
Labour		300	1	300	
Rental	Lump sum			25	
Machinery and equipment rental				205	
Total cash investment				2,255	
Paneer	kg	8	400	3,200	

-

Input cost	43.1
Value added cost	13.3
Total cost	56.4
Sale price	80
Profit	23.63
Profit margin	41.9

Collectors and sale function

Activities	Unit	Amount	Basis
Purchase price	Rs/litre	38	Purchase price
Activities	**Unit**	**Amount**	**Basis**
Transportation	Rs/litre	1	Rs 1 per liter
Collector commission	Rs/litre	1	Rs 1 per liter
Misc expenses	Rs/litre	0.75	Rental, wage, chemicals
Loss	Rs/litre	1.8	5% of purchase amount
Purchase price		**42.7**	
Sale price	Rs/litre	50	

Input cost	38.0
Value added	4.7
Total cost price	**42.7**
Sale price	50.0
Profit margin	7.4
Profit percent	**17.2**

SN4.3: Junar Value Chain Study

CHAPTER 1 INTRODUCTION

1.1 Background

The study aims to assess existing conditions of High Value Commodities (HVC) development along SRC aiming at reviewing development potential of the HVC, identifying potential commodities along their value chains, and testing their improvement through pilot project as a part of master plan development. In this pursuit, JICA study team intends to conduct detailed value chain assessment of selected 11 commodities (Table 1.1) which have commercialization potential in the SRC area. These commodities have been identified by following robust methodology (See volume 1 of report) along with wider consultations with the local, district and central level stakeholders.

Table 1.1: Commodities Selected for Value Chain Study

SN	Commodities	Districts			
		Kavre	Dolakha	Ramechhap	Sindhuli
1	Junar			✔	✔
2	Orange (Mandarin)	✔	✔		✔
3	Goat	✔	✔	✔	✔
4	Dairy	✔	✔	✔	✔
5	Cabbage	✔		✔	
6	Cauliflower	✔	✔	✔	
7	Potato	✔	✔	✔	✔
8	Tomato	✔	✔	✔	✔
9	Lapsi	✔	✔		
10	Turmeric		✔		✔
11	Pine apple				✔

The main purpose of the value chain study is to thoroughly understand the value chains of selected HVCs from inputs to consumption as well as associated factors such as various support services and policy environments with a view to identify constraints and points of interventions in the chains so as to inform the preparation of Draft Basic Development Strategy.

This report is one of the 11 of series, which presents detailed value chain analysis of Junar while focusing on existing production and distribution system of two districts of SRC, namely Ramechhap and Sindhuli.

1.2 Objective

The overall objective of the study is conduct detailed value chain analysis of Junar, while focusing on:

- Mapping of value chain actors and stakeholders operating at different level
- Analysis of cost and margin analysis of different value chain stakeholders
- Explore potentialities and constraints of the selected commodities
- Conduct the SWOT analysis and recommend potential strategy and interventions

1.3 Study Approach and Methodology

1.3.1 Conceptual Framework

The study followed value chain approach in conducting the study. A value chain is defined as a full range of activities required to take a product or service from conception to final disposal after use, through the intermediary phases of production, processing and delivery to final consumers. The value chain approach (VCA) focuses on the interaction of actors along each step of the production system as well as the linkages within each set of actors. VCA considers trade relations as being part of a series of networks of producers, exporters, importers, processors and retailers, whereby knowledge and relationships are developed to gain access to markets and suppliers.

Value chain analysis is a process that requires four interconnected steps: data collection and research, value chain mapping, analysis of opportunities and constraints, and vetting of findings with stakeholders and recommendations for future actions. These four steps are not necessarily sequential and can be carried out simultaneously. Figure 1.1 shows simple graphic illustrating the analysis process and components. The value chain team collected data and information through secondary and primary sources by way of research and interviews. The collected data was analyzed using the value chain framework to reveal constraints within the chain that prevent or limit the exploitation of end market opportunities. The resulting analysis of opportunities and constraints was verified with stakeholders through events such as workshops and focus groups discussions.

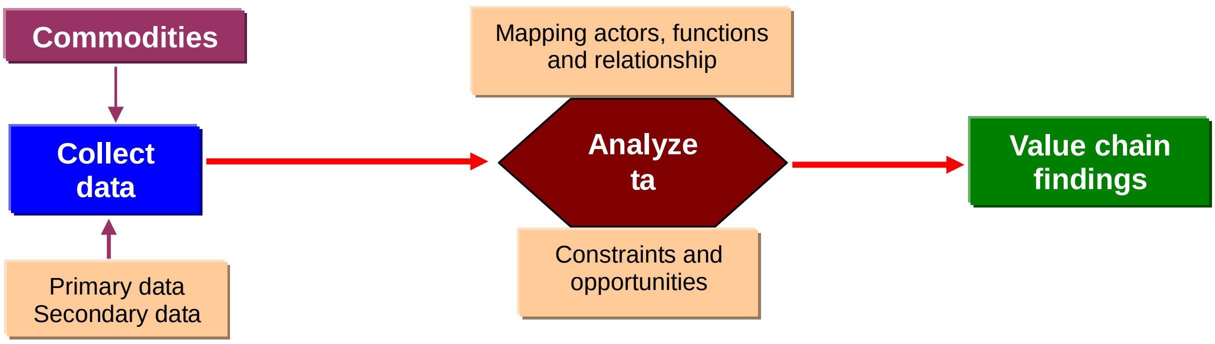


Figure 1.1: Value Chain Analysis Methods

1.3.2 Study Methods

Literature review: Available study reports, annual progress reports, statistical information on Nepalese agriculture were reviewed to collect information related with cultivars, area, production, yield, market price, sale quantity, production location, price, producer groups, etc

Interaction with producers: Interaction with producers was carried out in key production zone of each district while focusing on:

- Production processes (Cropping calendar)
- Access to services/Mapping of service providers (Technical/technological, finance)
- Input suppliers and mechanism
- Market chain mapping (Place and actors)

- Transportation system and practices
- Grading and packing practices
- Cost of cultivations
- Price and pricing mechanism
- Problems and constraints

Table 1.2 presents brief overview on consultations with producer groups with detailed on Annex 1.1. Consultations were carried out in four key production area of two districts where 21 farmers have participated in the group discussions.

Table 1.2: Consultations with Producers

District	Study area/Location	Number of participants
Sindhuli	• Nakajholi, Baseshwar - 6	14
Ramechhap	• Bhalukhop, Okhreni – 8	7
Total		**21**

Interaction with value chain stakeholders also focused on (a) core processes in the value chain, i.e from input provision to retailers and (b) Identifying and mapping the main actors involved in above processes

Interaction with the value chain actors: After interaction with the producer groups, value chain actors operating at different level of value chains are mapped. After wards survey was carried out in selected market places within and outside district. Table 1.3 below number of value chain stakeholders, who are consulted for purpose of study while ***Annex 1.2*** presents name of stakeholders consulted for the purpose of study.

Table 1.3: Number of Value Chain Stakeholders Consulted

Actors	Ramechhap	Sindhuli	Other area
Collector	7	1	-
Traders	6	1	1
Wholesaler	-	1	2
Retailers	6	6	2
Processors	7	2	-
Total	**26**	**11**	**5**

Interactions with value chain stakeholders was carried out to (a) visualize networks in order to get a better understanding of connections between actors; (b) identify processes in value chain (c) examine interdependency between actors and processes in the value chain and (d) enhance awareness of stakeholders to look beyond their own involvement in the value chain. Following issues were discussed during the interactions

- Identifying and mapping the main actors
- Volume of products handled including distribution mechanism (Place and actors)
- Geographical flow of the product or service

- Relationships, linkages and business services between value chain actors
- Price and pricing mechanism
- Transportation system and practices, including mode of transport and cost of transport
- Quality control
- Problems and constraints

After mapping of the value chain, cost and margin analysis of the value chain stakeholders was carried out while focusing on:

- Costs and required investments
- Value added costs
- Estimation of revenues
- Estimation of relative financial position of actors in the value chain

Apart from this, interactions with the processers and small processing industries focused on:

- Production processes/Technology used
- Branding, packaging and labeling
- Price and pricing mechanism
- Market margin analysis
- Quality control, including personnel health and hygiene
- Problems and constraints

Interactions with service delivery/input suppliers' agencies: Consultations with the service delivery agencies such as District Agriculture Development Office, Agro-vets, private sector, cooperatives etc, non government agencies etc were carried out to understand:

- Nature and type of services
- Service delivery mechanism including cost of services
- Problems and constraints

Table 1.4 presents service delivery agencies consulted for the purpose of study with details in ***Annex 1.3.***

Table 1.4: Number of Service Providers Consulted

Actors	Ramechhap	Sindhuli
DADO Officials	5	5
Agro-vet	2	3
Cooperatives	2	1
Junar Producer Associations	-	1
Total	**9**	**10**

CHAPTER 2 JUNAR PRODUCTION AND MARKETING

2.1 Introduction

Junar is a perennial fruits belonging to citrus species, scientifically known as Citrus Sinensis. It is cultivated in altitudes of 800 to 1300 meter along the Mahabharata range. Junar is a juicy fruit with yellow to orange reddish color with rich in flavor. The shape of the fruit is globose or ovate and sub-globose but it is normally an apex round with slightly depressed in base round.

Sindhuli and Ramechhap are famous as Junar producing districts of Nepal. Junar has been growing traditionally in these districts. However, the Junar cultivation received a high importance after declaration of "A National Priority Programme for Junar Production" by the Government of Nepal during mid of 1980s. Afterwards area expanded drastically with the support from Government of Nepal and Japan International Cooperation Agency (JICA). Government introduced subsidy scheme on planting materials and equipments while the JICA supported on strengthening technical knowledge and skills of farmers on orchard management. Different Japanese volunteers and counterparts made big contribution on expansion of Junar, especially in Ramechhap and Sindhuli districts by providing support on (a) improving planting stock quality, especially by introducing Trifoliate (Poncirus trifoliate) plants for budding of Junar plants, (b) supported on orchard management, especially on use of balanced nutrients, and pruning measures, (c) improvements on storage and transportation system and (d) campaign for foot root diseases.

2.2 Production Practices

2.2.1 Cropping Calendar

Table 2.1 presents the cropping calendar for the first year of plantation. Junar is a perennial fruits crop, which sapling plantation starts during early rainy season (May/June/Aug) while the land preparation of cultivation starts six months before that (January/February). During the land preparation, farmers dig a pit of 1 cubic meter and put compost manure from own sources. Generally farmers put around 30 kg of farm yard (1 to 2 doko) manure in each pit. Afterwards they fill a pit with mud and put a small bamboo stick on center of pit to identify pit during plantation. Some of the farmers may also put chemical fertilizers on pit but very small quantity. After land preparation, plantation starts from late May to mid-July subject to availability of first rain. After plantation, farmers apply fungicides and pesticides on once month interval. Likewise, weeding/thinning (unwanted shoots removal) is carried out during Jan/Feb. Prior to the irrigation, fertilizers, Bordeaux-paste application and mulching is carried out and irrigation is conducted. However, due to scarcity of water, famers mostly rely on rain. Few farmers having small orchards utilize waste water from tap water for irrigation. Availability of irrigation facilities is very poor. This sequential practice remains similar till the third year of orchard establishment. Farmers follow similar practices but they do causality replacement during the second and third year depending upon survival rate of saplings planted in the first year.

Table 2.1: Calendar and Practices of Planting Junar Sapling (Year I - III)

	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	B	J	A	S	Bh	As	K	M	P	Mag	F	C
Land Preparation												
Planting sapling/ Replacement plantation												
Fungicides/ Insecticide application (once a month)												
Thinning												
Weeding & Fertilizer application												
Bodo-paste application												
Mulching												
Irrigation												

Note: Nepalese Calender months (B- Baisakh; J – jestha, A – Ashad, S – Shrawan, Bh – Bhadra, As – Ashwin, K – Kartik, M- Mangshir, P - Poush M – Magh, F - Falgun, C – Chaitra)

Junar tree starts bearing flowers in March/April, and the fruit is ready from November/December and are sold in the market till March/April. However farmers do early harvesting, i.e. from October onwards, because farmers need cash to celebrate festivals. Likewise, commodities have market demand during this period. Table 2.1 shows cropping calendar of Junar of matured stand. Thinning, pruning of plants started after the harvesting of fruits while bordeaux-paste is applied during two times, in April/May and after harvest. Late harvesting of Junar often affects on thinning and pruning of plants as well as other operations such as manure, etc. Farmers apply fungicides to fruits and plants also during rainy seasons.

Table 2.2: Cropping Calendar of Junar of Matured Stand (4 years onwards)

Practices	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	B	J	A	S	Bh	As	K	M	P	Mag	F	C
Harvesting												
Thinning and Weeding												
Application ofBordeaux-mixture/d bodo paste												
Mulching												
Manure (Compost and Chemical fertilizers												
Application of Micro nutrient												
Fungicide application of fruits												
Application of fungicide and insecticide (once a month)												
Top dressing (Urea, DAP and Potash)												

2.2.2 Product Input Use and Sources

Saplings: Farmers are planting nearly a year old sapling produced in local nurseries. None of the farmers are planting seeds or seed plants.

Local nurseries are using trifoliate plant to produce seedlings. District Agriculture Development Office (DADO) provides 50% of subsidy on saplings. As subsidy is available only from selected nursery, farmers go to those nurseries to purchase saplings despite concerns on the quality of saplings. High mortality rate and conversion of saplings into weeds are some of the common problems associated with these saplings. Farmers are compelled to buy such saplings as there is high demand of saplings during planting seasons, and farmers have no alternative sources of getting such saplings as such saplings do not come from outside districts or other Junar producing districts. Apart from this, nursery operators too have limited knowledge and skills on high quality sapling productions. They rely either on their traditional knowledge or on skills which they have acquired in the past. Capacity building of nursery people is very poor in both districts.

Farmers generally plant 320 – 400 saplings per ha (16 -20 plants per Ropani or 1/20 ha) at spacing of around (5m X 5 m). This is mainly because Junar are cultivated in terrace/sloppy land.

Fertilizers: Farmers mainly rely on farm yard manure or compost for fruits while use of chemical fertilizers is very limited. Farmers mainly apply fertilizers during two times; (a) first immediately after the harvest and (b) top dressing during rainy seasons. They use very smaller amount of fertilizers than recommended (Table 2.3). This is not only because of limited knowledge and skills but also because of limited availability of fertilizers in the nearest road head. Farmers mostly rely on Agro-vets for purchase of chemical fertilizers. Likewise very few cooperatives are also providing support on supply of production inputs specially on chemical fertilizers but not specifically targeting to Junar production.

Table 2.3: Use of Fertilizers per Plants

Unit: kg/plant

	Recommended dose (Per plant)**	Current use (Per plant)**	Remark
Farm yard manure	40-50 kg	15 – 25 kg	30 - 50 kg during planting of saplings
Urea (46:0:0)#	557 gram	60 – 125 gram	
DAP Di Ammonium Phosphate (18:46:0) #	750 gram	150 – 250 gram	
MoP (Murate of Potash) (0:0:60) #	1000 gram	75 – 150 gram	

Figure in Parenthesis denote Nitrogen, Phosphorus and Potash content
Source: * Annual Report of Horticulture Center, Kritipur, 2000/2001. Kathmandu, Nepal; ** Field Study, 2012

Though the farmers of Ramechhap reported the use of chemical fertilizers but large majority of the farmers are not using chemical fertilizers, even for top dressing and mulching. They mostly rely on farm yard manure or compost.

Farmers are using different fungicides and pesticides for controlling of tip dying, mealy from bugs, scales, fruit flies and Gummosis. The bordeaux – mixture spray at the time of new twig coming is done for controlling of tip dying, and spraying and pasting bordeaux -paste for controlling of

Gummosis. Likewise application of Dimethoate (Rogor) and Endosulfan (Thiodan), Kerathin, etc. during the time of new shoots coming and then after fruit setting is quite common. However, the frequencies of use depend on intensity of problems. Farmers are not aware of the recommended dose as well as use amount. They mainly rely on their own traditional knowledge and skills.

2.2.3 Orchard Care and Management

Major activities performed by farmers for the care and management of orchard include:

- **Weeding/Mulching:** It is done during Jan-Feb. FYM/compost is applied in the periphery of citrus plant and weeds are removed. Likewise watering of plants is carried out subject to availability of water.
- **Training/Pruning:** Dried and diseased stems are removed generally in Jan-Feb immediately after the harvest of fruits.
- **Chemical Treatment:** Rogor is used to control bugs. Use of bordeaux-paste and mixture to control other pathogen is common.
- **Top dressing:** Top dressing by fertilizers is carried out during rainy seasons (Urea, DAP and Potash)

2.2.4 Credit

Majority of farmers don't need credit for establishing orchards or for management of orchards. Most of their family members work on orchard establishment and management. Initial orchard establishment costs are either maintained from their own sources, or loans are taken from local saving and credit cooperatives. Interest rate generally varies from 12 – 15 percent per annum. Apart from this, DADO provides subsidy on sapling purchase.

Farmers who have well established orchard do not need credit or finance for management of orchards. Instead, traders, especially Indian origin provide them with advance money for purchase Junar. Hence, farmers don't access the formal financial sources for credit.

2.2.5 Technical Services

Farmers mainly rely on Agro-vets and DADO for technical knowledge. Access of farmers to DADO is very limited, mainly because of distance as well as availability of staff. Hence, farmers often consult with their peers and agro-vets for technical advices. Role of DADO has been mainly confined on providing subsidy for saplings and other equipments.

2.3 Area, Production and Yield

2.3.1 Area

SRC area covers half (2573 ha) of the Junar cultivated area of the country (5145 ha). Sindhuli and Ramechhap district alone accounts nearly half of the Junar production area of the country. Table 2.4 presents extent of cultivation of Junar in SRC districts.

Table 2.4: Extent of Cultivation of Junar in SRC Districts

SN	District	Total Cultivated land (ha)	Area under Junar cultivation (2009/10)		% Junar cultivated area to total cultivated area
			Area (ha)	%	
1	Kavre	36,442	75	1.5	0.2
2	Dolakha	29,423	78	1.5	0.3
3	Ramechhap	40,050	1,047	20.4	2.6
4	Sindhuli	39,485	1,373	26.6	3.5
	SRC total	**145,400**	**2,573**	**50.0**	**1.8**
	Nepal	3,052,900	5,145	100.0	0.2

Source: MoAC, 2010/11

Junar is cultivated at very small area (0.2 percent) when compared with the total cultivated area of the country. Nevertheless, Junar is being cultivated at 1.8 percent of total cultivated land of the SRC area. Of the total cultivated land of the districts, cultivation is relatively high in Sindhuli district (3.5 percent), followed by Ramechhap (2.6 percent), Dolakha (0.3 percent) and Kavre (0.2 percent).

Table 2.5 compares the trend on area under Junar cultivation over last seven years. Area under Junar is declining in SRC as well as Nepal but rate is relatively high outside of SRC. Area under Junar is decreasing in the entire district except in Sindhuli. In Sindhuli district, area increased by 5 percent per annum while it declined by 4.9 percent in Ramechhap, 4.3 percent in Dolakha and 3.4 percent.

Table 2.5: Area under Junar Cultivation over Last Seven Years (2003/04 – 2009/10)

Unit: ha

Year	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	84	65.6	1,301	1,070	2,520	5,071
2004/05	90	67.6	1,331	1,082	2,570	5,255
2005/06	95	241.7	1,343	1,095	2,774	5,582
2006/07	99	71	1,357	1,108	2,635	5,524
2007/08	70	73	1,024	1,329	2,496	4,866
2008/09	75	75	1,039	1,359	2,548	5,031
2009/10	75	78	1,047	1,373	2,573	5,145
Annual Growth Rate (%)	-3.4	-4.3	-4.9	5.0	-0.2	-0.6

Source: MoAC, 2010/11

Table 2.6 compares total productive area of Junar by districts and in Nepal. Out of the total cultivated area of Junar, more than three fourth of area is producing junar. This remains almost similar across all districts.

Table 2.6: Production Area of Junar

Districts	Total area (ha)	Productionarea (ha)	Percent
Kavre	75	60	80.0
Dolakha	78	58	74.4
Ramechhap	1,047	808	77.2
Sindhuli	1,373	1,060	77.2
SRC	**2,573**	**1,986**	**77.2**
Nepal	5,145	3,972	77.2

Source: MoAC, 2010/11

Table 2.7 presents annual trend on expansion of productive area of Junar. Productive area of Junar increases in all districts varying from 17.9 percent per annum in Dolakha to 2.2 percent in Ramechhap. Likewise productive area of Junar at SRC increases by 6.7 percent per annum against national growth of 6.3 percent per annum.

Table 2.7: Production Area under Junar Cultivation over Last Seven Years (2003/04 – 2009/10)

Unit: ha

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	35	24	730	670	1,459	2,857
2004/05	39	25	755	683	1,502	2,970
2005/06	39	25	755	683	1,502	3,015
2006/07	42	26	765	691	1,524	3,072
2007/08	43	25	925	1,264	2,257	3,799
2008/09	58	58	800	1,047	1,963	3,874
2009/10	58	60	808	1,060	1,986	3,972
Annual Growth Rate (%)	8.8	17.9	2.2	10.2	6.7	6.3

Source: MoAC, 2010/11

Data presented in Table 2.5 to 2.7 reveal that productive area is expanding while cultivation area is decreasing.

2.3.2 Production

Total production of Junar in the country is 50,518 MT per year in 20009/10 of which more than half of production (55.7 percent) is from SRC area. Two districts namely Ramechhap (23.7 percent) and Sindhuli (30.8 percent) account for more than half of Junar production of the country.

Table 2.8 Production of Junar

SN	District	Production (Mt)	Percent
1	Kavre	730	1.4
2	Dolakha	613	1.2
3	Ramechhap	11,964	23.7
4	Sindhuli	15,577	30.8
	SRC area	**28,154**	**55.7**
	Nepal	50,518	100.0

Source: MoAC, 2011

Table 2.9 presents production of Junar over last 7 years. Production of Junar is increasing in Nepal as well as in SRC districts at 7.8 percent and 8.8 percent per annum respectively. This is mainly because of expansion of productive area. Production of Junar increases at 14.1 percent per annum in Sindhuli and 3.1 percent per annum in Ramechhap. Annual growth rate of production is high in Sindhuli, which might be mainly because of implementation of “One Village One Product Programme” in four key production VDCs of Sindhuli district.

Table 2.9: Production of Junar over Last Seven Years (2003/04 – 2009/10)

Unit: ha

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	396	252	10,220	8,040	18,908	33,813
2004/05	454	268	10,684	8,290	19,696	35,474
2005/06	455	269	10,715	8,314	19,753	36,024
2006/07	490	277	10,882	8,425	20,074	36,736
2007/08	538	250	12,950	17,692	31,430	48,408
2008/09	728	591	11,840	15,279	28,438	49,331
2009/10	730	613	11,964	15,577	28,884	50,518
Annual Growth Rate (%)	10.8	17.0	3.1	14.1	8.8	7.8

Source: MoAC, 2011

2.3.3 Yield

Table 2.10 presents yield of Junar over last seven years. In 2009/10, yield of Junar is 13076 kg/ha in SRC area, which is slightly higher than the national average yield of 12,719 kg/ha. In the same year, yield is highest in Ramechhap (14,807 kg/ha), while lowest in Dolakha (10217 kg/ha). Over the last seven years, yield has increased by 1.6 percent in SRC area, with highest in Sindhuli (4.0 percent per annum) while it has decreased by 0.9 percent per annum in Dolakha.

Table 2.10: Yield of Junar over Last Seven Years (2003/04 – 2009/10)

Unit: kg/ha

Year	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2003/04	11,314	10,500	14,000	12,000	11,954	11,835
2004/05	11,641	10,720	14,151	12,138	12,162	11,944
2005/06	11,667	10,760	14,192	12,173	12,198	11,948
2006/07	11,667	10,654	14,225	12,192	12,184	11,958
2007/08	12,512	10,000	14,000	13,997	12,627	12,742
2008/09	12,552	10,190	14,800	14,593	13,034	12,734
2009/10	12,586	10,217	14,807	14,695	13,076	12,719
Annual Growth Rate (%)	1.9	-0.9	0.9	4.0	1.6	1.5

Source: MoAC, 2011

2.4 Production Locations

2.4.1 Production Area

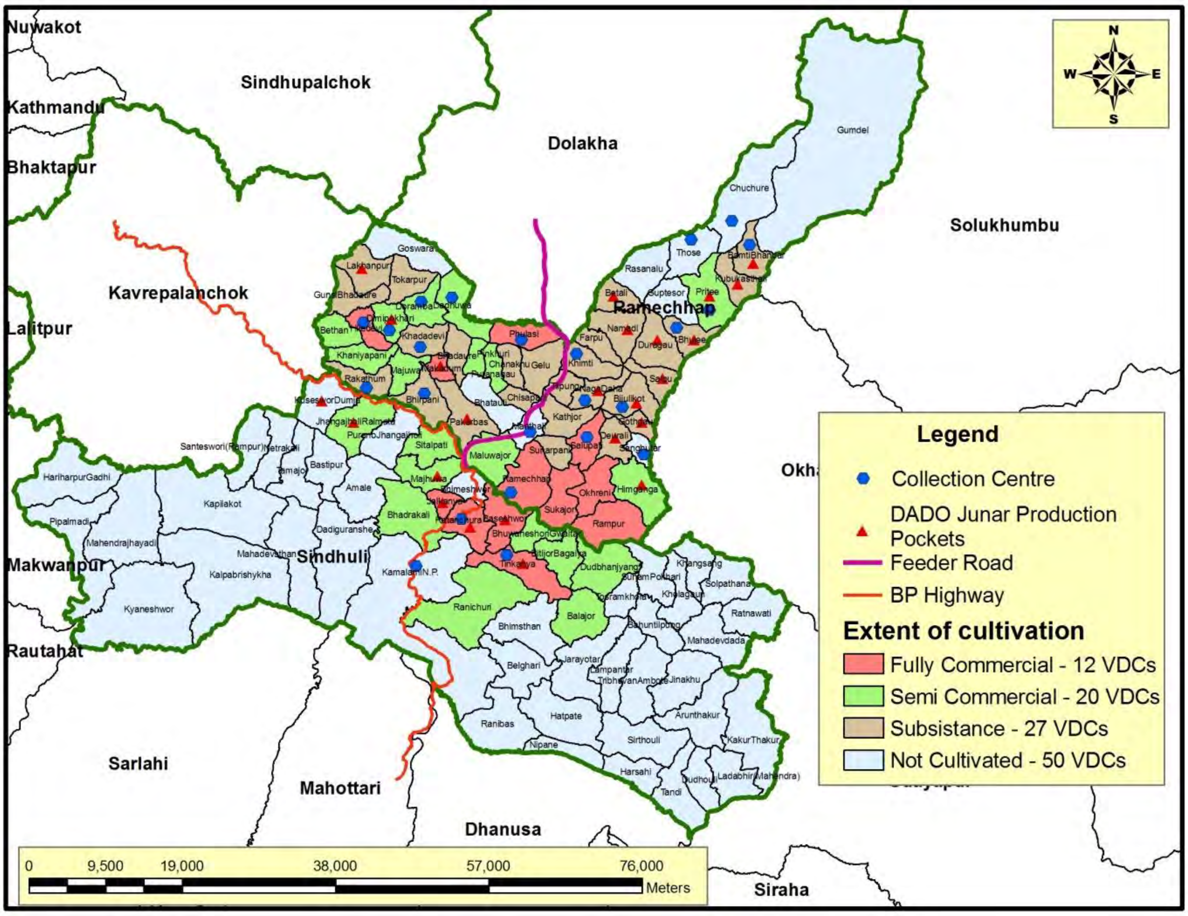
During the consultative meeting, DADO officials were requested to classify VDCs into four classes while considering extent of cultivation and commercialization. This exercise was carried out for Sindhuli and Ramechhap district since value chain study focuses on this two area only.

- ***Fully commercial***, large area under cultivation and produce are generally sold outside districts
- ***Semi-commercial*** – relatively high area under cultivation but produce are mostly sold in the local market
- ***Subsistence*** – area is very small and produce mainly come to the local markets

- ***Not cultivated*** –Junar is not either cultivated or cultivated for home consumption only

Map 2.1 shows the results of consultative meeting: The map reveals that Junar is grown commercially in 12 VDCs; semi commercially in 20 VDCs, subsistence in 27 VDCs while it is not cultivated in 50 VDCs of Ramechhap and Sindhuli districts.

Map 2.1: Cultivation Area and Production Pockets of Junar



2.4.2 Production Pockets

DADO has identified citrus production pockets considering road access and extent of cultivation. Table 2.11 presents production pockets of Citrus type fruits in the study districts. Number of production area varies by districts from 27 in Ramechhap to 8 each in Dolakha and Sindhuli. Map 2.1 also shows production pockets of DADO/DLSO

Table 2.11: Production Pockets Identified by DADO/DLSO

Districts	Production Pockets (VDCs/locations)	Number
Kavre	Sankhu, Saradabatase, Panauti N.P., Balthali, Chalal, Kusadevi, Ryale, Mahendrajyoti, Kavre, Patlekhet, Phulbari, Shyampati, Sanga, Janagal	14
Dolakha	Pawati, Phasku, Sunkhani, Sundrawati, Gairimudi, Mirge, Lamidanda, Laduk	8
Ramechhap	Ramechhap, Bhaluwajor, Okhreni, Salu, Phulasi, Dadhuwa, Hiledevi, Dimipokhari, Lakhanpur, Makadum, Namdi, Betali, Bamti, Kubukasthali, Duragaon, Saipu, Bijulikot, Makadum, Nagdaha, Himganga, Deurali, Gothgaon, Dimipokhari, Pakarbas, Lakhanpur, Bhuji, Priti	27
Sindhuli	Tinkanya, Jalkanya, Baseshwar, Ratanchura, Underconstruction highway side, Dumja, Majhuwa, Jhangajholi ratmata	8

Source: Computed from annual progress report of DADO of respective districts, 2011

2.5 Marketing and Distribution system

2.5.1 Harvesting, Storage and Sale

During the consultative meeting with farmers/producer groups, they were requested to assign score on the scale of 0- 10 to show harvesting, market arrival and storage of Junar. Junar is available in the market for about six months from the last week of September (Ashwin) till the second week of March (Chaitra) though its harvesting season is from late November to late January. Farmers harvest two months before the actual harvest time because of high demand of fruits during the festivals. *Junar* produced in Sindhuli and Ramechhap is being sold during the time of Tihar/Chatt festival in green unripe form in the name of *Mosambi*, a different species. Traders from India start placing orders to the farmers from July/August for the reservation of green raw *Junar*. They give cash advances to the farmers and collect the green raw *Juna*r during festival time and supply to the Kathmandu and nearest Terai market.

Table 2.12: Trends on Harvesting and Market Arrival of Junar

	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	B	J	A	S	Bh	As	K	M	P	Mag	F	C
Harvesting	-	-	-	-	-	5	6	8	10	7	3	-
Storage	-	-	-	-	-	-	-	-	6	10	8	2
Sale	-	-	-	-	-	3	6	8	10	9	6	2

Source: Field Survey
Note: 0 for lowest and 10 for highest; Nepalese Calender months (B- Baisakh; J – jestha, A – Ashad, S – Shrawan, Bh – Bhadra, As – Ashwin, K – Kartik, M- Mangshir, P - Poush M – Magh, F - Falgun, C – Chaitra)

Also, Junar is stored for about three to four months by the farmers to get higher price in the market. Farmers start storing Junar in the cold storage from December such that produce can be brought to the market till end of March or early April. However, such practices are in declining trend mainly because of unavailability of electricity facilities. The cold storage of Junar did not come on operational last year because of electricity cut off (load shedding). Likewise, farmers or contractors are harvesting late to get higher price in the market. Many farmers complained that traders only start harvesting during the late February when there will be shortage of Junar in the market.

2.5.2 Market Arrival

Table 2.13 presents market arrival of Junar from the study districts (Ramechhap and Sindhuli). Out of the total production of Junar in the study districts, almost all the produce is brought to the market. Only negligible amount is kept for self consumption (less than 5 percent).

Table 2.13: Market Arrival of Junar

Unit: Percent

District	Sindhuli	Ramechhap	Overall
Self consumption	3	4	3.5
Brought to market	97	96	96.5

Source: Field Survey

2.5.3 Marketing Practices

The study showed the following distribution system of Junar in SRC area:

- Farmers – Contractors – Consumers
- Farmers – Contractors – Wholesalers – Retailers - Consumers
- Farmer – Junar Association– Departmental Store – Consumers
- Farmer – Junar Association–Consumers
- Farmer – Collectors/Contractors – Wholesalers– Retailers – Consumers
- Farmer –Retailers – Consumers
- Farmer –Consumers
- Producers – Processors

Major marketing practices followed by different marketing agents

- ***Producers/ Farmers:*** Farmers directly bring Junar to district head quarters or local *Haat bazaars (weekly market)* and sale to the local traders (Retailers/wholesalers) and consumers directly.
- ***Contractors/Collectors:*** Contractors and collectors purchase whole orchard of farmers by fixing prices just after fruiting, mainly during August/September. Collectors/contractors bring produce to District head quarter and nearby Terai markets. They sale produce to wholesalers and retailers. They are operating at production center, district head quarters and nearby Terai market.
- Most of the farmers sell Junar to the local collectors, who are generally from Terai. They are supplied to the different market centre and are sold to the consumers through retailers, mainly by being mixed with Mandarin.
- ***Junar Producer Association*** is also involved in Junar trading and post harvest handling. The association collects the *Junar* and redistributes to other collectors and traders. They have carried out grading and packing of Junar and supplied to the Departmental stores of Kathmandu and Biratnagar. Likewise, the association has constructed a cold storage under support of the Japanese Embassy in Nepal.

- Junar Association, through OVOP program, is promoting the grading and packing of Junar. They sell "Grade A Junar" to the Departmental stores of Kathmandu, Naranghat and Lalitpur, whereas grade B Junar are sold to the traders and consumers. Grade C Junar is sold to the local processing industry. Apart from this, they are running the mobile shop/stalls in major urban cities and towns to push sales of Junar.

- ***Wholesalers:*** Wholesalers also purchase whole orchard of farmers at fixed prices just after fruiting or purchase fruit from collectors/contractors. They also visit in nearby weekly *haat markets* to bring produce. They are mostly operating at district head quarters, urban cities and Kathmandu. There are very few wholesalers in Ramechhap district head quarter.

- ***Retailers:*** Retailers purchase Junar from wholesalers or from producers directly in nearby weekly *haat markets*. They are operating at district head quarters, urban cities and Kathmandu.

2.5.4 Transportation Mechanism and Costs

Depending upon the volume of produce handled, different mode of transportation exists. Almost all production pockets/areas are now connected with the earthen vehicle pliable roads. Farmers/Traders generally bring produce up to the nearest road head in a bamboo basket or a plastic crate. If the amount is very small, they use jute sack or plastic bag. Transportation cost varies from Rs 0.1 to 0. 75 per Kg depending upon distance to the road head. This situation remains similar in both the districts.

After bringing to the road head, Junar are either loaded in a small lorry, which carry 3 to 5 MT or in the public bus. People generally use local bus if the quantity is very small. Local buses generally charge Rs 1 to 5 per kg depending upon the distance. If farmers/traders bring produce to district head quarter, they generally pay Rs 1 per kg while they pay Rs 5 if they bring produce to Terai market or Kathmandu.

Use of small truck (popularly known as Tata mobile or Mini truck) is quite common nowadays to transport Junar. Traders hire small trucks/lorries with capacity of 3 to 5 Mt. They collect the produce at road head and then bring them to the market. The transporter charges about Rs 2500 – Rs 5500 per load to bring produce to the District head quarters depending upon the capacity of truck. Likewise, transportation cost varies by distance/places and the capacity of the truck. For example, a truck with capacity of 10 MT charges Rs 25,000 – Rs 35,000 for bringing produce to Kathmandu market either from Sindhuli or Ramechhap.

Table 2.16 reveals that the public buses are main mode of transportation, followed by trucks and labor. Farmers still carry their produce in a bamboo basket/jute bags and bring to the nearest markets, however such practice is now declining. Instead, farmers use public transport means to bring their produce to the market.

Table 2.16: Mode of Junar Transportation

Unit: Percent

Mode of transport to market	Ramechhap	Sindhuli
Porter (Labor)	20	20
Public transport (Passenger bus/jeep)	55	40
Truck/Mini Truck/Tata mobile	25	40
Total	**100**	**100**

Source: Field Survey

2.6 Pricing Mechanism and Prices

2.6.1 Price Determination Methods

Prices of the products are affected by the different factors like market supply and demand, quality of the produce, speculative price based on situation and supply, previous day price, time, season, weather, ceremony, quantity disposed at the market, consultation/agreement with the farmers, availability of substitutes and bargaining based on quality. Besides these factors, previous days/week/month, seasonality and cyclic variation are important for price formation in specific markets.

Farmer/producer level price is determined on lump sum basis and have been already pre-contracted before ripening or the harvest. The market has fewer roles on determining prices at farmer level. Nevertheless, Producer Associations and Cooperatives have determined base- price prior to the harvest of Junar considering production situation in consultations with the producer groups and cooperatives member. Fixed farm gate price for this year was Rs 1.5 to Rs 2 per pieces (Around Rs 15 per kg) while it was Rs 1 per piece (Rs 10 – 15 per kg) last year.

At the wholesalers' level, the supply and demand of the market determines the price followed by a cartel of businessman; quality of the produce; speculative price based on situation and supply; purchased price; and bargaining based on quality. At retailer's level, the purchased price played key role in the retail price formation at all the retail markets followed by supply and demand of market; quality of the produce; previous day price; bargaining based on quality; and addition of profit. Table 2.17 presents different factors which play for determination of price.

Farmer’s consider last year price and urgency of cash need as main factors, which influences on determination of prices. Product quality; last year price and production amount plays important role in determining prices at producer associations or cooperatives. Wholesalers determine price based on the supply and demand situation together with the last day/week market price and associated risks. Retailers determine price based on the purchase price and associated costs, including risk associated with the products.

Table 2.17: Criteria for Price Determinations

Farmers	Producer Associations	Wholesalers	Retailers
• Last year price • Dealing with contractors • Need of immediate or urgency of cash • Base or minimum Price set by Association/ Cooperative • Production amount	• Production amount • Last year price • Product quality • Cost of productions • Demand and supply situation	• Supply and demand at market • Purchase price and associated costs • Last day/week market price • Quality of produce • Speculative price based on situation and supply • Risk associated with produce	• Purchase price and associated costs • Supply and demand at market • Last day price • Quality of produce • Bargaining based on quality • Risk associated with produce

Source: Field Survey

2.6.2 Market Price of Junar at Different Markets

Table 2.18 presents current price of Junar at different market places in the study districts. The market price of Junar varies by places and locations. The farm gate price of Junar at present is Rs 14 per kg while the wholesaling price at district head quarter is Rs 20/kg. The retailing price is Rs 25 kg at the district headquarters. The wholesale price of Junar increases by almost double if brought to the Kalimati market. Likewise "Grade A" Junar which is being sold under the OVOP program cost Rs 90 per kg.

Table 2.18: Market Price of Junar

Prices	Places		Bardibas (Terai)	Kathmandu
	Sindhuli	Ramechhap		
Farmers/Farm gate	14	14		-
Indian traders (Early harvest)	12	12	-	35
Wholesalers/ Commission agents	20	20	24	25
Retailers	25	25	30	50
Departmental stores (Mainly Kathmandu)				90

Source: Field Survey

For the products like Junar, seasonality is an issue because the domestic production is abundant in the short peak seasons (December to February) and the domestic supply is low at other times. The issue of seasonality is also important as this brings out problems and issues in the several related areas, e.g. storage, trade and industrial use. As the price of Junar is likely to fall from December onward, many farmers, particularly poor and small start harvesting from October too when the fruits are not matured enough and not achieved the color of the skin. Hence producers often do not receive reasonable prices within the districts.

2.7 Post Harvest Handling

2.7.1 Grading

Farmers don't either harvest or grade their produce, since they sell Junar on wholesale basis. Traders and collectors themselves harvest Junar by employing labor. Depending upon the targeted market, the traders/collectors do grading. Grading is generally done if the produce is sold outside the districts.

Junar is generally graded into three classes based on the size, shape and color. Grade A product are generally targeted to Kathmandu and other urban centers while grade B and C product are sold in the local market. There is no scientific method adopted by the traders on grading. Visual estimation is main methods of grading. Sometimes traders/collectors harvest the big sized Junar and leave smaller ones on the tree to be sold later.

Nevertheless, the OVOP program has introduced a scientific grading system based on the size. After preliminary screening of Junar based on their color and physical appearances, it is rolled through iron net having three different sizes. The smaller ones are Grade C produce, medium size are grade B and large size ones are graded A. The Graded A products are packaged, labeled and sold in the Super Market, while the Grade B and C produce are sold locally or in the urban markets.

2.7.2 Packaging, Labeling and Branding

Crate, jute sack, bamboo basket and paper cartoon are used for packing. Farmers use different materials depending upon the amount of product harvested, place and mode of transportation. Use of paper cartoons and jute sacks are the most common methods. Large quantity of Junar (Above 80 percent) is sold without proper packaging, branding and labeling. Junar even loses its identity when brought to the Kathmandu market.

Nevertheless, the Government of Nepal together with the Federation of Nepalese Chamber of Commerce is promoting proper branding, packaging and labeling of Junar. Junar is being packed in the 10 kg cartoon boxes with proper labeling and branding as OVOP products. Junar is sold at the major departmental stores in Kathmandu, especially at the Bhatbateni super market. However, the price of Junar increases by more than 4 times, which often remain beyond the purchase capacity of medium income families.

2.7.3 Storage

Farmers/Traders often do late harvest of Junar in order to lower losses due to perishability and minimizing quality deterioration due to storage. Farmers are less worried on storage because they either sell produce right after the harvest or on pre-contractual basis. Traditional methods of storage such as digging pits, keeping in the cold places is now almost non-operational. Traders too don’t prefer to store products considering the electricity problems. Hence, the solecold storage constructed at Sindhuli with JICA support was not operational last year.

2.7.4 Value Addition and Processing

Value addition and processing of Junar is being carried out locally and on seasonal basis. Nearly a dozen of private Junar processing industries are operational at Ramechhap and Sindhuli districts. They have been mainly involved in production of juice, jam, jelly and candy. Local wines/liquor is being produced as by-products. However, economy of scale is very small. It is not being marketed outside the district, mainly because of poor produce quality and lack of fulfilling health and hygienic requirement. Thus produce is sold only within the district headquarters.

CHAPTER 3 VALUE CHAIN ACTORS MAPPING AND ANALYSIS

3.1 Value Chain Analysis

3.1.1 Value Chain Map

Mapping of value chain actors was carried out to visualize networks in order to understand linkages between actors and processes in a value chain and assess interdependency between actors and processes in the value chain. Figure 3.1 presents core processes involved in value chain of Junar. It moves form production to consumers, passing through different stages and processes. The linkages are shown vertically from bottom to top. The left hand blocks represent the major functions of the chain. The functions, in this case, include production, collection, trading, processing and marketing.

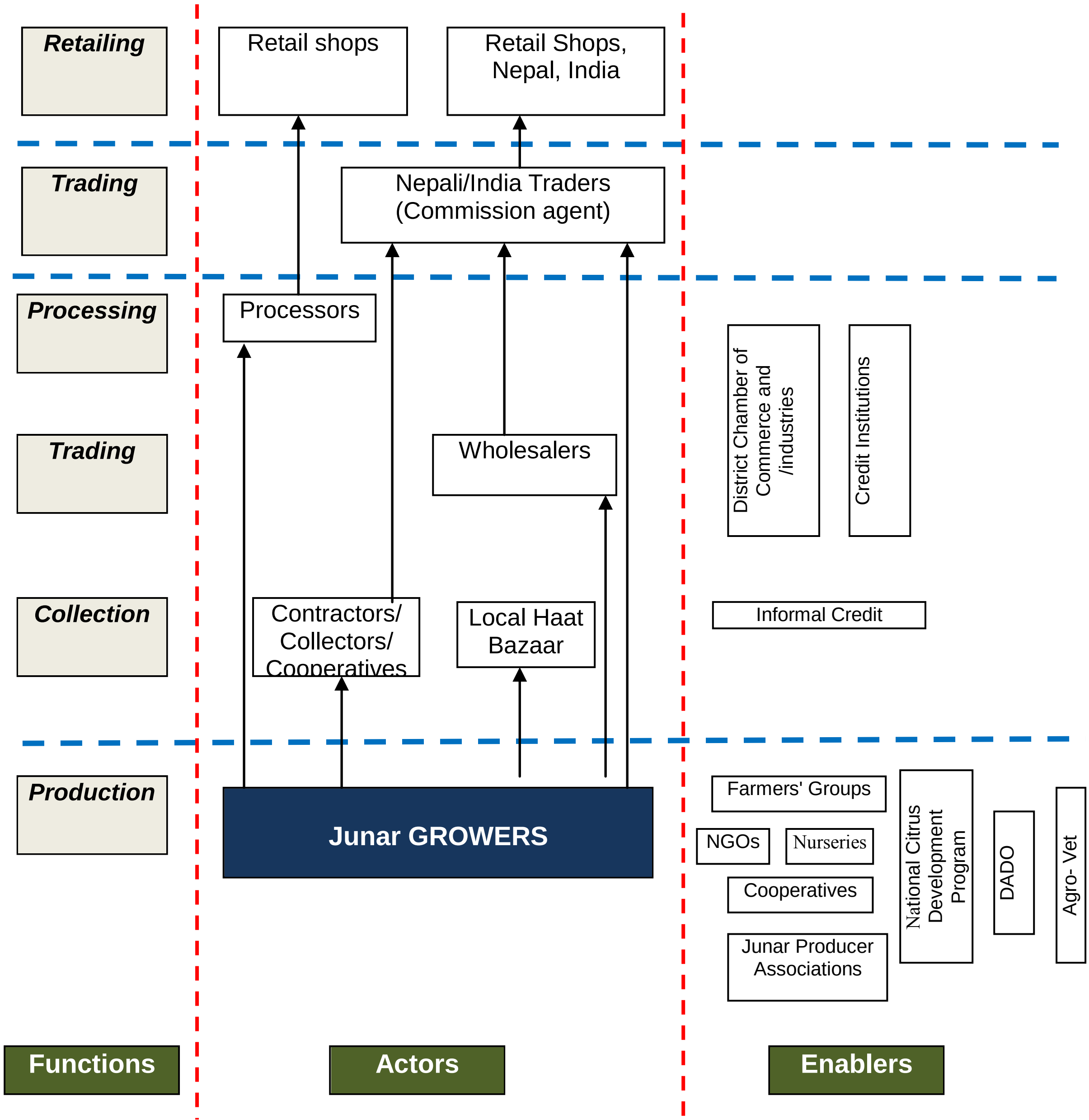


Figure 3.1: Junar Value Chain Map

3.1.2 Value Chain Actors and Functions

Major actors involved in value chain of Junar and their function are:

Producers: Producers are mainly involved in cultivation and sale of Junar. They generally don't harvest their produce. Major functions performed by producers include:

- Planting of Junar saplings along with its care and management
- Orchard care and management, including application of fertilizers, pesticides, weeding, irrigation, training/pruning etc
- Negotiation with traders (Collectors/contractors/wholesaler/retailers) on price and sale of produce

Contractors/Collectors: Contractors/Collectors are generally involved in sale of produce. They are either present at production pockets or come from nearby Terai market. They mostly sell produce in outside districts nearby Terai, urban market or Kathmandu. They operate their business mainly during Junar production seasons but might be involved in other fruit crops as well. Major functions performed by them include:

- ➢ Negotiation with farmers on price of produce, while considering the quality and quantity of produce
- ➢ Provide credit or advance to the farmers prior to harvest (pre-contractual agreement)
- ➢ Harvesting, grading and packaging of produce
- ➢ Transportation to market center
- ➢ Sale of producers to wholesalers/traders

Traders/Commission agents: Traders and commission agents are operating at the wholesale market center, mainly in Hetauda, Janakpur, Kathmandu, Narayanghat, Pokhara, Biratnagar etc. They sale produce brought by collectors/contractors on commission basis. They generally take commission of 7-8 percent to sale produce. They are least bothered with the purchase price of collectors/contractors but fix prices considering market demand and supply situation. Likewise, they operate annually but commodities traded by them might differ by seasons. They generally operate business for about 6-8 hours a day. Major functions performed by them include:

- Determine price of Junar considering market demand and product supply situation
- Sale produce wholesalers, retailers and consumers on bulk quantity (at least 50 kg)
- Provide interest free loan to contractors/collectors to purchase produce

Wholesalers: Wholesalers are operating at the district head quarters and key market centers, especially in urban areas. They purchase Junar either directly from the collectors, especially in the district head quarters or from the traders and commission agents in the market centers. They sell produce to the retailers or consumers. Wholesalers fix prices based on their purchase price along with the market demand. Major functions performed by wholesalers include:

- Determine price of Junar considering market demand, product supply situation, quality and their profit margin
- Sale produce retailers and consumers on small quantity (at least 5 kg)
- Adjust prices considering volume of sale and quality of produce
- Provide goods to retailers on credit for a period of 2-3 days for selling of produce

Retailers: Retailers are operating at road head, weekly markets, and district head quarters as well as in key market centers in the urban areas. Retailers operating on production districts purchase Junar from farmers or collectors. Likewise, they purchase from traders/commission agents or wholesalers in case of market centers. Retailers sale produce to consumers. Retailers fix prices based on their purchase price along with market demand. Major functions performed by wholesalers include:

- Determine price of Junar considering demand, quality and their profit margin
- Sale produce consumers as per their need
- Bargaining on price with consumers based on quality of produce

Cooperative/Producer Associations: Producer farmers are organized into cooperatives and producer associations. Producer association is mainly involved in following activities:

- Determine base price of Junar considering production, cost of cultivation and last year price
- Provide business counseling and marketing support to farmers
- Build capacity of farmers on Junar cultivation and marketing
- Regulate Junar supply in the market to control price fluctuations

Processors: Processors are operating in key production areas and district head quarters. These are the small value addition and processing industries operating seasonally, mainly during Junar harvesting seasons. Major functions performed by processers include:

- Purchase and transportation of Junar to processing industries
- Value addition and processing of Junar
- Sale of processed products at local market and retail shops

Table 3.1 summarizes major functions performed by different value chain stakeholders and their involvement. Major functions of farmers include cultivation and orchard management. Their role on harvesting, grading/packaging and marketing is very low. This might be because most of the farmers sell their product on ad-hoc basis or counting numbers to local collectors or DHQ/Terai traders. Role of local collectors in harvesting and marketing is high, nevertheless they also play role of producer, input suppliers and money lenders to farmers. Producer Association/ Cooperative are mostly involved in input supply such as fertilizers, saplings together with marketing of the products. Wholesalers and retailers perform the role of grading and marketing.

Table 3.1: Major Functions Performed by Value Chain Stakeholders

Functions	Farmer	Collector	Traders	Cooperatives / Association	Processor	Wholesalers	Retailers
Production/ Cultivation	High	Medium	No	No	No	No	Very Low
Input supply	-	Medium	No	High	No	No	No
Credit/ loan/Finance	-	Medium	Medium	Medium	No	Very Low	No
Plant/ orchard care/management	High	No	No	Low	No	No	No
Technical support	Low	Low	No	Low	No	No	No
Harvesting	Low	High	Low	Medium	Medium	Low	Low
Processing	Very Low	No	No	Medium	High	No	No
Grading	Very Low	Medium	Medium	Low	Low	High	Medium
Packaging	Very Low	Medium	Medium	Low	High	High	Medium
Sale/Marketing	Low	High	Low	High	No	High	High

3.1.3 Volume Handled

Discussions with producers groups and other value chain stakeholders were carried out to map the produce handled by them. Table 3.2 summarizes key market chain stakeholders and volume handled by them. Of the total produce of Junar in SRC area, majority of the produce is being retailed by farmers in the local weekly markets followed by collection of produce from Indian traders/contractors and collectors and producer associations. Processing and wholesaling of produce is very minimal. This reveals that farmers have direct access to local level retail markets.

Table 3.2: Produce Handled by Different Market Chain Stakeholders

Unit: Percent

Market agents	Ramechhap	Sindhuli
Collectors	5	35
Indian Traders /Contractors	35	15
Producer Association/Cooperatives	15	10
Processors	5	5
Wholesalers	-	10
Departmental stores (Mainly Kathmandu)	-	5
Retailers directly (including farmers self retailing)	40	20
Total	**100.0**	**100.0**

Source: Field Survey

Figure 3.2 shows volume handled by different value chain stakeholders. Figure reveals that majority of produce by collectors/agents followed by cooperatives/associations and consumers.

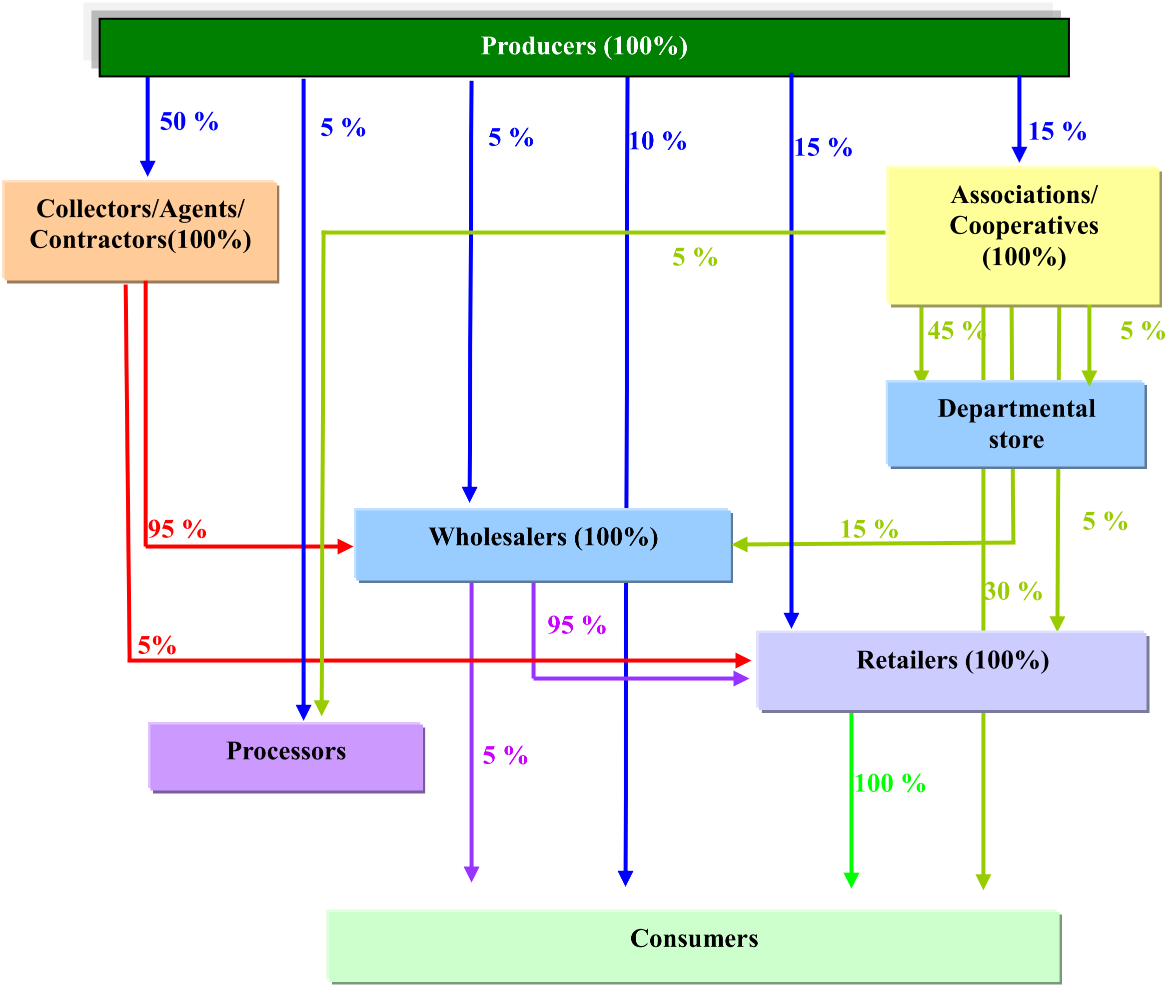


Figure 3.2: Volume Handled by Different Value Chain Stakeholders

3.1.4 Places

Junar produced in the district are sold locally as well in nearest Terai market and Kathmandu (see map 3.1). Table 3.3 presents proportion of Junar sold at different market places. Table reveals that most of the produce is sold locally in the districts, especially in the district head quarters and local weekly market followed by Terai markets, Kathmandu and India.

Map 3.1: Market of Junar

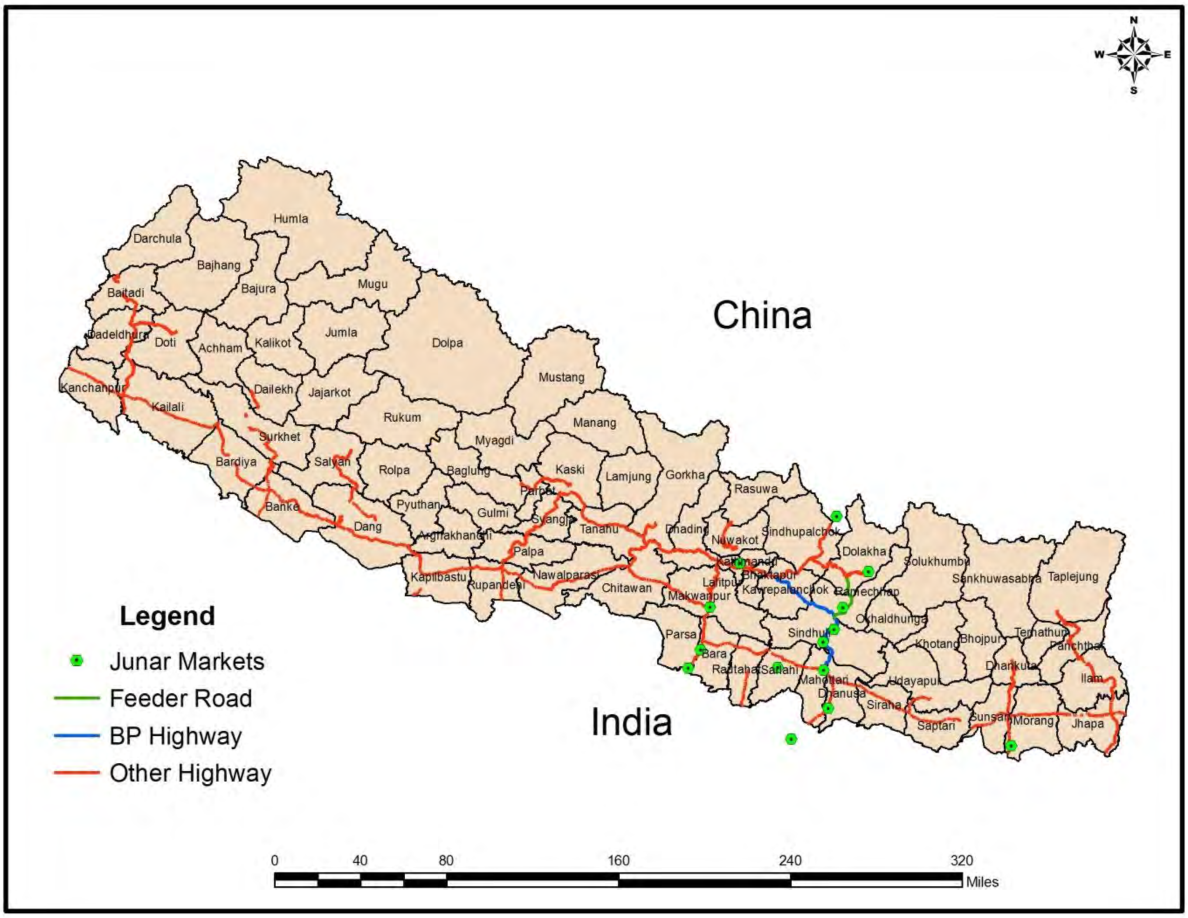


Table 3.3: Produce Sold in Different Market Places

Unit: Percent

Market places	Ramechhap	Sindhuli
Local markets (weekly haat bazaars)	40	20
District head quarters	30	40
Terai market (Birgung, Janakpur, Biratnagar etc)	20	20
Other urban market (Narayanghat, Pokhara, Hetauda etc)	-	10
Neighboring districts	5	Negligible
Kathmandu	3	5
India (Bordering cities)	2	5
China	Negligible	-
Total	**100.0**	**100.0**

Source: Field Survey

Table 3.4 shows the market access of different value chain stakeholders. Table revealed that farmers can access market only up to their respective district headquarter. They do not have access to the markets of bigger cities such as Hetauda, Janakpur, Biratnagar and Kathmandu. Collector and retailers have their presence in all market places. Likewise, traders and wholesalers do also have their presence in all market places except road head markets along highway. Presence of processor is only in farm gate and DHQ.

Table 3.4: Market Access of Different Value Chain Stakeholders

Places	Farmers	Collector	Traders/ Distributors	Wholesalers	Processors	Retailers
Farm Gate	Yes	Yes	-	Yes	Yes	Yes
Road head market (High way)	Yes	Yes	-	-	-	Yes
DHQ	Yes	Yes	Yes	Yes	Yes	Yes
Terai market	-	Yes	Yes	Yes	-	Yes
Urban market	-	Yes	Yes	Yes	-	Yes
Kathmandu	-	Yes	Yes	Yes	-	Yes
India	-		Yes	-	-	-
China	-		Yes			-

Source: Field Survey

3.2 Value Chain Performance

The analysis of priced margins has been carried out by using a standard format that shows major costs, losses, margins and prices along the chain and the share of each players as the product moves from production to local collectors, traders, wholesale market and finally up to the consumers. The information is based on the information obtained from the districts and Kathmandu market.

3.2.1 Producers

Farmers do inter-crop of maize, vegetables and spices with Junar. Produce has been mainly used for household consumptions, hence cost and income associated with inter cropping are not taken into account. Almost 50 percent of area becomes unusable as the tree gets matured, mainly because of shading. Table 3.5 presents costs and margin of producers from cultivation of Junar. Use of production inputs is very limited. Farmers realized higher income from cultivation of Junar, even when labor cost is taken into account. **Annex 3.1** and **Annex 3.2** present cost and income from cultivation of Junar. According to producers, economical life of a Junar tree is considered as 25 years. The farmers will get profit after 5 years of plantation. Plant should be cleared and new saplings should be planted after 25 years. However, farmers do not generally replace the plants until and unless they are destroyed by natural calamities, or diseases.

On an average, cost of production of Junar in the studied districts is Rs 7.3 per kg whereas they sell at Rs 14 per kg. Hence, their net income per kg is 6.7. Farmers are getting higher price than their cost because Junar Cooperative had fixed the farm gate price. Hence, Junar is highly profitable for farmers. Profit percent is ratio of profit to total expense. It shows margin made by entrepreneurs in terms of amount invested. There is very high profit margin on production of Junar.

Table 3.5: Cost and Margin of Producers

Activities	Unit	Amount (Rs)
Input use	Rs/kg	4.9
Labor	Rs/kg	2.4
Total expense	**Rs/kg**	**7.3**
Sale	Rs/kg	14.0
Profit	**Rs/kg**	**6.7**
Profit percent	**%**	**93**

Source: Field Survey

3.2.2 Collectors

Collectors act as a bridge between producer and markets. Collectors purchase the Junar on lump sum basis. Generally they pay small amount before harvest (generally 20-30% of produce value). Depending upon relationship with collectors, they sell in cash or credit. Farmers' don't sell their produce in credit if the collectors are outsider of villages. However, majority of local collectors purchase on credit and pay within fortnight. The major cost incurred by collectors include harvesting, loading, transporting, unloading. ***Annex 3.3*** presents details on cost associated with collectors and their income. Margin enjoyed by collectors is Rs 2.0 per kg if sold in districts and at the nearest road head. If collectors bring produce to the Kathmandu market, collectors enjoy profit margin of Rs 6.4 per kg. Profit margin percent is Rs 11.0 percent if traded locally and 34.4 percent if traded in Kathmandu. Despite of high profit in Kathmandu market, market arrival in Kathmandu is very limited. This is mainly because of low preference by people and difficulty in selling of produce.

Table 3.6: Cost and Margin of Collectors

Activities	Unit	District	Kathmandu
Input use	Rs/kg	14.0	14.0
Labor	Rs/kg	4.0	4.6
Total expense	**Rs/kg**	**18.0**	**18.6**
Sale	Rs/kg	20.0	25.0
Profit	**Rs/kg**	**2.0**	**6.4**
Profit percent	**%**	**11.0**	**34.3**

Source: Field Survey

3.2.3 Commission Agents /Wholesalers

These actors are available in Kalimati and Balkhu markets at Kathmandu as well as in wholesale market of major urban cities, especially in Hetauda, Narayanghat and Pokhara. They sell Junar in bulk quantities (wholesale) by charging commission. Commission is generally 5-8 % of sold quantity. In a whole value chain, commission agents possess the lowest risk while their margin is very high. They are least affected by price fluctuation.

According to the traders who bring Junar to Kalimati or Balkhu market, the market opens at 3 AM in the morning. Commission agents fix the high price in the morning and start reducing the price as the day proceeds, depending upon the quantity of sale. They cleared the place for next consignment at the end or mid of the day. If commission agents charges 8% commission on sale amount of collectors/contractors, they will make a profit margin of Rs 1.7 per kg while is almost six times higher than their investment. Profit margin is very high considering risk.

Table 3.7: Cost and Margin of Commission Agents/Wholesalers

Activities	Unit	Kathmandu
Rent	Rs/kg	0.0
Wage and other expense	Rs/kg	0.2
Interest (Advances)	Rs/kg	0.1
Value addition (Total cost/investment)	**Rs/kg**	**0.3**
Commission (Income)	Rs/kg	2.0
Net Margin (Profit)	**Rs/kg**	**1.7**
Profit margin percent	**%**	**566%**

Source: Field Survey

3.2.4 Wholesalers

These actors perform three roles; traders, wholesalers and retailers. They are situated in the districts as well as in urban maket centers. The study found that wholesalers of Junar are operating in Sindhulimadi, Manthali, Bhiman. Likewise, they are also operational at Kalimati, Janakpur, Hetauda, Bardibas, Narayanghat, Balkhu etc. Wholesalers don't fully rely on only Junar, but it is simply one of the seasonal fruits to them. Wholesalers operate business for whole year but products dealt by them vary by seasons. Kathmandu wholesalers are very reluctant to sale Junar because of less consumer preferences while local wholesalers don't face any problems in selling of produce.

Table 3.8 presents cost and margin of wholesalers operating at the district head quarters and Kathmandu, with details in **Annex 3.4**. Profit margin enjoyed by wholesalers operating at district and Kathmandu is Rs 1.3 and Rs 3.5 per kg respectively. However, their margin depends on their performance too. Margins of wholesalers could be much higher than this because they also do retailing, by which price increases almost by Rs 10 per kg. Nevertheless, they have to bear losses from rotton Junar during selling or damaged caused by transportation. The district level traders at Sindhuli also export Junar to other major cities in Nepal such as Janakpur, Birjunj, Biratnagar, etc.

Table 3.8: Cost and Margin of Wholesalers

Activities	Unit	District	Kathmandu
Input use	Rs/kg	20.0	25.0
Labor	Rs/kg	2.2	2.5
Total expense	**Rs/kg**	**22.2**	**27.5**
Sale	Rs/kg	23.5	31.0
Profit	**Rs/kg**	**1.3**	**3.5**
Profit percent	**%**	**6.0**	**12.9**

Source: Field Survey

3.2.5 Retailers

Many small fruit shops are available in major market centers. Junar is available at only few shops in Kathmandu and other urban market. Especially during festival seasons, they are sold by different indentify. Nevertheless, fruits shops at the road head and DHQ of the studied districts sell good quantity of Junar. They also sell fresh juice of junar. One of the major buyers of Junar within the districts is service holders or people who visit the districts. They take/send Junar to their home or relatives as a gift from the districts. Table 3.9 presents cost and margin of retailers operating in the district and Kathmandu with details in ***Annex 3.5***. Profit margin enjoyed by retailers operating in the district and Kathmandu is Rs 3.3 and Rs 7.7 per kg, which are 12.4 percent and 20.4 percent of their investment respectively.

Table 3.9: Cost and Margin of Wholesalers

Activities	Unit	District	Kathmandu
Input use	Rs/kg	23.5	31.0
Labor	Rs/kg	2.7	6.3
Total expense	**Rs/kg**	**26.2**	**37.3**
Sale	Rs/kg	29.5	45.0
Profit	**Rs/kg**	**3.3**	**7.7**
Profit percent	**%**	**12.4**	**20.6**

Source: Field Survey

3.2.6 Processors

Small scale value addition and processing is being carried out in the study districts, which is mainly seasonal too. Table 3.10 presents cost and margin of processors involved in processing of Junar. Processors are mainly producing Junar juice, packaging on local bottle and sale at the market. Cost is computed for 1 kg of Junar with details in **Annex 3.6.** Table 3.10 reveals that margin of processors is Rs 19.9 per kg of Junar, which is nearly 28 percent of total investment made on processing or cost.

Table 3.10: Cost and Margin of Processors per kg of Junar

Activities	Unit	District
Input use	Rs/kg	14.0
Labor	Rs/kg	60.6
Total expense	**Rs/kg**	**74.6**
Sale	Rs/kg	90
Profit	**Rs/kg**	**15.4**
Profit percent	**%**	**20.6**

Source: Field Survey

3.3 Analysis of Service Providers/Enablers

Table 3.11 presents different service providers together with their major functions, frequency of services and their limitation/weakness. Table 3.11 reveals that farmers have been accessing services from different service providers. However most of them regularly access services from Agro-vets and nursery despite their complaints on the quality of material supplied by them. Private as well as public sector service providers have not only inadequate technical knowledge and skills but also limited human resources required for effective and efficient delivery of services.

Table 3.11: Assessment of Service Providers

Name	Major functions	Frequency of Service	Limitations/Weakness
DADO	○ Technical support ○ Planting material and equipment supply at subsidized price ○ Supply of trifoliate sapling	Occasional	○ Limited number of staff ○ Inadequate technical support and advice, including farm visit ○ Poor support on market linkage establishment
Agro vets	○ Technical advice ○ Input supply	Regular	○ Un timely availability of production inputs ○ Poor quality ○ Limited technical knowledge
Financial Cooperative	○ Loan	Occasional	○ Limited amount of fund available
Junar Producer Associations	○ Setting of minimum base price of commodities ○ Support on sale of produce ○ Control market arrival of Junar Produce ○ Operation of cold storage	Regular	○ No processing of Junar ○ Limited resources and man power ○ Unable to operate cold storage
Cooperatives (Producers)	○ Support on sale of produce ○ Setting of minimum base price of commodities	Regular	○ No storage facilities
National Citrus Development Program	○ Development of high quality planting materials ○ Research on citrus related to pest and diseases	Rare	○ No access of farmers ○ Limited information to farmers
Nursery (Private)	○ Production of Junar Sapling	Regular	○ Poor quality saplings production having low survival rate ○ High cost of production
District Chamber of Commerce and Industry	○ Strengthening Partnership for market promotion of Junar under OVOP program ○ Support on grading, packaging and labeling	Regular	○ Limited coverage (Only 4 VDCs ○ Trade amount is very less considering volume of production (Around 2500 MT against production of 15000 MT)
Financial institutions	○ Loan/credit	Rare	○ Difficult and time consuming process

3.4 Opportunities and Challenges/Constraints Analysis

Table 3.11 analyzes opportunities and constraints related to the value chain development of Junar. Major challenges or constraints include availability of poor quality saplings, inadequate technical knowledge and skills on cultivation practices and post harvest handling, poor orchard management, poor conditions of road, inactiveness of producers' or farmers group etc. Nevertheless, there exists ample of opportunities as well. Farmers are organized into producer associations and well established network exists. Potentiality for increase on production and productivity by small support and operation of agro-vets at the production center further provides opportunities for the development of

Junar.

Table 3.11: Opportunities and Constraints

Category of Constraints	Constraints/Challenges	Opportunities
Technology/ Production processes	○ Poor quality saplings ○ Inadequate use of plant nutrients and fertilizers ○ Inadequate irrigation facility ○ Insects and Pests control not properly done ○ Timely delivery of services ○ Early/untimely harvesting of fruits ○ Late harvesting of fruits ○ Less aware on post harvest technology	○ Large number of service providers available ○ Potentiality to increase production per unit area ○ High income from cultivation of Junar ○ Suitable production area ○ Small scale value addition and processing
Technical skills/ human resources	○ Limited knowledge and skills of farmers on cultivation practices and orchard management ○ Poor skill enhancement of public agencies ○ Frequent transfer of government officials ○ No specialized technical persons ○ Shortage of agriculture labor ○ Less awareness to organic farming and quality standards	○ Operation of Agro-vets at the village level ○ Development and mobilization of resource persons by different organizations ○ Scope of organic junar fruit and juice
Management/ Production and organization	○ Groups are non functional or inactive ○ No proper cost and benefit analysis ○ Inadequate linkages and coordination among stakeholders, operating in isolations ○ Inadequate follow of cropping calendars ○ Subsistence farmers are not organized ○ Poor orchard management or low investment in orchard management	○ Farmers organized into groups and cooperatives ○ Producer organization functional and active
Marketing	○ Price often controlled by contractors/traders operating at different market chain ○ Loss of products identity when marketed outside districts ○ Consumers are less aware of produce ○ Less preference of produce ○ Early harvesting, bringing low price ○ Market information is not abundantly available on time ○ Inadequate knowledge on market requirements and no service providers for market intelligence	○ Set up of minimum base price ○ Controlled of produce flow to balance between demand and supply ○ Public private partnership for promoting produce, especially through One village One produce movement ○ Declining use of porters
Policy/ Institutional issues	○ Organic certification of produce ○ OVOP programme implemented in limited geographical area ○ Inadequate incentives and support	○ Implementation of "One village One Produce" ○ High priority on commercialization of junar

Category of Constraints	Constraints/Challenges	Opportunities
	for expansion of cultivation area o Limited budget	
Finance	o Inadequate interested of financial institutions to provide loan for production and marketing o High interest rate of cooperatives	o Operation of saving and credit cooperatives at village level o Pre-contract agreement with traders
Infrastructure	o Inadequate storage facility o Lack of information center o Poor road conditions o Power cut offs (load shedding) makes cold storage non functional	o Promotion of non-conventional technologies of irrigation and use of waste water o Large amount of VDC/DDC is spent for improving road conditions o Road access to key production center
Input supply	o Poor quality o Untimely and inadequate o High price	o Operation of Agro-vets at village level o High demand of farmers

CHAPTER 4 CONCLUSIONS AND RECOMMENDATIONS

4.1 SWOT Analysis

Table 4.1 below summarizes strengths, weakness, opportunities and threats of Junar production based on findings of value chain analysis. Strengths and weakness are mainly related with the internal factors while opportunities and threats are external.

Table 4.1: SWOT Analysis of Junar

Strengths	Weakness
o Large number of farmers are traditionally growing Junar o Farmers are organized into cooperatives and associations o Most of the produce are sold locally as gifts o High economic return to farmers o Farmers/producers has higher proportion of margin among different value chain stakeholders o Large number of marketing agents are operating within and outside district o Establishment of cold storage facility o Small level and scale value addition and processing o Farmers don't face much problems on selling of produce, largely organized market o Involvement of farmer's organization, especially producer's organizations and cooperatives on marketing of produce o Minimum market price set by producer's association o Controlled flow of produce on market to balance between demand and supply situation by Producer's Associations	o Poor quality of planting materials supplied by private nursery o Early and late harvesting of produce, not proper follow of calendar of operation o Inadequate amount of fertilizations and pesticides o Improper plant handling by traders during harvesting, owner's less involvement with harvesting o Inadequate value addition and processing o Inadequate water availability and irrigation facilities o Inadequate cold storage as well as poor operation o Poor coordination between production and marketing agencies o Pre-contractural agreement with traders, bringing lower price to farmers o Less risk bearing capacity of farmers o Poor post harvest handling, especially grading, packaging and labelling o Extensive losses caused by fruit damage during transportation o Inadequate knowledge and skills in the techniques of grading, packaging and post

Strengths	Weakness
	harvest handling o High transport costs o Poor packaging methods o Production centers are scattered and are far from market centers o Quality inputs are not available in time and very expensive o The contractual selling system (orchard buying by contractor) not good due to low price offered and uncertainty of payment.
Opportunities	**Threats**
o High geo climatic situations suitability for quality Junar production o Farmers willingness to increase production and productivity o Improvement on road access and transportation facilities o Public and private sector partnership for promoting Junar (OVOP) o Existence of saving and credit cooperatives for providing financial support o Operation of agro-vets at production centers and providing services and inputs o Subsidy and incentives from government for promoting cultivation of Junar o High motivation of farmers on Junar production o Almost more than half of the National production is from SRC area o Department of Agriculture has set up National Citrus Fruit Development Program (NCFDP) to provide services to the farmers. o Department of Agriculture has its Agro-business and Marketing Development Directorate proving marketing information services to the producers and traders. o Increasing scope/demand of organic junar fruit and juices	o Reluctance of external traders to sale Junar during peak harvesting seasons because of less market demand and high transportation cost o High consumer preference on orange o Produce often lost its identity when come to major urban market, sold in name of "Mausami" o High consumer demand during festival seasons, resulting early harvest and low returns o Increasing shortage of agriculture labourer

4.2 Recommendations

Based on the above SWOT analysis and findings of value chain analysis, the study recommended on following actions with a view to increase income and productivity from cultivation of Junar. The focus should be on (a) improving the farming practices to increase production and productivity of farmers, (b) strengthen farmer's organizations on marketing and distribution of Junar and (c) strengthen post harvest handling of Junar.

With a view to increase production and productivity of farmers by improving farming practices, following suggestions are made:

- Support for establishment high quality nursery by involving producer's association and cooperatives
- Develop cropping calendar/calendar of operation for Junar cultivation and disseminate with

farmers

- Orient farmers on balance use of plant nutrients, to control disease and pests
- Strengthen capacity of farmers' on cultivation practices, especially on pit management, orchard care and management and plant care during harvesting operations
- Establish resource center/information center at key production zones with a view to disseminate technical knowledge and market price information
- Develop and mobilize local resource persons for providing support services to farmers, especially on training/pruning operations and bordeaux pastes
- Promote non-conventional irrigation technologies, especially rain water harvesting, catchment ponds and plastic ponds to supply water for irrigation during dry seasons
- Work in partnership with different agencies on delivery of inputs and services
- Gradual reduce of subsidy and incentives to farmers to develop business culture

Following actions are suggested for strengthening marketing and distribution of Junar by strengthening farmer's organizations:

- ➢ Further strengthen and organize farmers into group and cooperatives for collective marketing and develop bargaining capacity
- ➢ Involve cooperatives and groups on marketing of produce
- ➢ Establish a revolving fund/loan at the cooperatives to provide loan to farmers who are on immediate need of cash during festival seasons such that farmers don't sell their produce at lowest price, or avoiding pre harvest contractual selling.
- ➢ Build the capacity of producer's associations and cooperatives by supporting on assets building and addressing their operational constraints
- ➢ Support cooperative and producer's association to develop business plan of their produce
- ➢ Support for operation of market outlet at major cities, especially in urban center (Naryanghat, Kathmandu and Sindhuli) for selling Junar. Outlets should be established in such a way that it become operational throughout the year by selling different produce
- ➢ Support for organization registrations and link cooperatives with concerned government institutions
- ➢ Organize interactions between traders and producers to strengthen linkages and communications with each others

Following actions are suggested for strengthening post harvest handling of Junar:

- Minimize transportation damages by proper packaging on paper cartons and crate
- Conduct grading of the Junar at the production center and bring high grade produce to consumption only

- Establish linkages with the processing industries (buy back agreement) for inferior graded products
- Establish cold storages in key production zones and make them operational
- Participate in trade fairs to promote marketing of organic Junar and value added junar produces
- Collaborate with OVOP movement to make identity of Junar, especially to minimize sale in name of other produce
- Provide financial support/soft loan to processing industries for expansion of Junar

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Annex 1.1: Consultations with Producers

District: Sindhuli

Location: Nakajholi, Baseshwar - 6

Name of participants

SN	Name of the Persons met
1	Mr Sher Bahadur Magar
2	Mr Hem Bahadur Astani
3	Mr Budhi Bahadur Magar
4	Mr Rajan Prasad Koirala
5	Mr Bishnu Koirala
6	Mr Chet Bahadur Purwale
7	Mr Nar Bahadur Asatani
8	Mr Tek Bahadur Magar
9	Mr Som Bahadur Magar
10	Mr Muluk Bahadur Astani
11	Mr Hasta Bahadur Machnagi
12	Mr Man Bahadur Astani
13	Mr Uday Bahadur Machhnagi
14	Mr Lok Bahadur B.K

District: Ramechhap

Location: Bhalukhop, Okhreni - 8

Name of participants

SN	Name of Persons Met
1	Mr Ajam Bahadur Tamang
2	Mr Purna Bahadur Lama
3	Mr Dhan Bahadur Ghising
4	Mr Ramu Tamang
5	Mr Ambar Bahadur Ghising
6	Mr Meg Bahadur Ghising
7	Mr Man Bahadur Lama

Annex 1.2: Consultations with Value Chain Stakeholders

District: Sindhuli

Name of participants

SN	Name	Location	Major functions
1	Mr. Biraj Sharma	Ratanchura	Processor
2	Mr. Yogendra Thapa	Ratanchura	Processor
3	Mr. Hasta Bdr. Magar	Baseshwar	Collector/Trader
4	Mrs. Tirtha Kumari Rana Magar	Sindhulimadi	Retailer
5	Mrs. Sita Tamang	Sindhulimadi	Retailer
6	Mr. Ratna Bdr. Rana Magar	Sindhulimadi	Retailer
7	Mr. Kumar Singh Thapa	Khaniyakharka	Retailer
8	Mr. Harka Bdr. Shrestha	Khaniyakharka	Retailer
9	Sanobhai Fruit Shop	Sindhulimadi	Retailer

District: Ramechhap

Name of participants

SN	Name	Location	Major functions
1	Mr. Lokendra Shrestha	Okhreni	Collector/Processor
2	Mr. Man Bdr. Lama	Okhreni	Collector/Processor/Trader
3	Mr. Harichandra Shrestha	Manthali	Collector/Processor/Trader
4	Mr. Padam Bdr. Lama	Okhreni	Collector/Processor/Trader
5	Mr. Dhal Bikram Karki	Sukajor	Collector/Processor/Trader
6	Mr. Mohan Kr. Shrestha	Okhreni	Collector/Processor/Trader
7	Mr. Purna Bdr. Lama	Okhreni	Trader
8	Mr. Uddhav Ghising	Okhreni	Collector/Processor
9	Mrs. Sasmita Tamang	Manthali	Retailer
10	Mr. Santosh Thapa	Manthali	Retailer
11	Mr. Tilak Budathoki	Manthali	Retailer
12	Mr. Khaman Singh	Manthali	Retailer
13	Mrs. Parbati Magar	Manthali	Retailer
14	Mr. Rishi Ram Lama	Manthali	Retailer
15	Mr. Gopal Khanal	Kathmandu	Wholesaler
16	Mr. Badri Timilsina	Kathmandu	Wholesaler
17	Mr. Bindu Ram Yadav	Kathmandu	Trader
18	Ms. Sonu Ghimire	Dolakha – Tamakoshi	Retailer
19	Ms. Hari P. Gautam	Dolakha – Charikot	Retailer
20	Mr. Tilak Tamang	Sindhulimadi	Wholesaler

Annex 1.3: Consultations with Service Delivery Agencies

District: Sindhuli

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr. Bikram Raj Giri	Giri Agro-vet Centre	Sindhulimadi	Input Supplier
2	Mr. Om Prakash Shrestha	Kamalamai Vet Suppliers	Sindhulimadi	Input Supplier
3	Mr. Bel Bdr. Badal	Sindhuli Vet Pharma	Sindhulimadi	Input Supplier
4	Mr. Dor. Bdr. Rayamajhi	DADO	Sindhulimadi	Technical Support
5	Mr. Ram Dular Sah	DADO	Sindhulimadi	Technical Support
6	Mr. Nathuni Yadav	DADO	Sindhulimadi	Technical Support
7	Mr. Jahan Bdr. Karki	DADO	Sindhulimadi	Technical Support
8	Mr. Yogendra Jha	DADO	Sindhulimadi	Technical Support
9	Mr. Krishna Pd. Gautam	Junar Bikash Sang	Sindhulimadi	Coordination

District: Ramechhap

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr. Tanka Kr. Shrestha	Bhanu & Nisha Vet. Shop	Manthali	Input Supplier
2	Mr. Narayan Poudel	Ramechhap Agro-Center	Manthali	Input Supplier
3	Mr. Mohan Kr. Shrestha	Junar Krishi Sahakari Sanstha	Okhreni	Input Supplier/ Financing/ Processing/ Marketing
4	Mr. Shree Kr. Shrestha	Jamarko Krishi Sahakari Sanstha	Kathjor	Input Supplier
5	Mr. Chabilal Ghimire	DADO	Manthali	Technical Support
6	Mr. Govinda Pokhrel	DADO	Manthali	Technical Support
7	Mr. Mohan Pd. Khatiwada	DADO	Manthali	Technical Support
8	Mr. Rishiraj Subedi	DADO	Manthali	Technical Support
9	Mr. Shiv Narayan Ran	DADO	Manthali	Technical Support

Annex 3.1: Cost Associated with Plantation and Orchard Management of Junar

Unit: Rs/Ropani (0.05 ha)

Particulars	Particulars		1st year		2nd year		3rd year		4th to 25 year	
	Unit	Rate	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
Land preparation including pitting	No	400	5	2,000	0	0	0	0	0	0
Compost	Doko	65	16	1,040	8	520	8	520	8	520
Litter	Bhari	100	16	1,600	0	0	0	0	0	0
DAP	Kg	50	3	150	0	0	0	0	6	300
Urea	Kg	40	1.5	60	0	0	0	0	3	120
Potash	Kg	40	1.5	60	0	0	0	0	3	120
Kerathin	Bottle	400	0	0	1	400	1	400	1	400
Roger	Bottle	130	0	0	1	130	1	130	1	130
Mobil	Lit	800	0	0	0	0	0	0	1	800
Bodopest	LS	200	0	0	1	200	1	200	1	200
Seedling	no	40	16	640	8	320	4	160	0	0
Plantation labor	no	400	1	400	0	0	0	0	0	0
Pruning and bodopest apply	no	200	0	0	1	200	1	200	2	400
Mulching, weeding and composting labor	no	200	1	200	2	400	2	400	2	400
Fencing	ls	1,400	1	1,400	0	0	0	0	0	0
Land rent				30		30		30		30
Sub total				**7,580**		**2,200**		**2,040**		**3,420**
Interest on capital (10%)				758		220		204		342
Total				**8,338**		**2,420**		**2,244**		**3,762**

Annex 3.2: Income from Production of Junar

Year	Cost			Income			Profit
	Input	Operating	Total	Production (kg)	Price	Income (Rs)	
1	4,350	4,038	8,388	0	15	0	-8,388
2	1,410	1,010	2,420	0	15	0	-2,420
3	1,410	834	2,244	0	15	0	-2,244
4	2,590	1,172	3,762	80	15	1,200	-2,642
5	2,590	1,172	3,762	192	15	2,880	-1,074
6	2,590	1,172	3,762	320	15	4,800	718
7	2,590	1,172	3,762	400	15	6,000	1,838
8	2,590	1,172	3,762	432	15	6,480	2,286
9	2,590	1,172	3,762	480	15	7,200	2,958
10	2,590	1,172	3,762	512	15	7,680	3,406
11	2,590	1,172	3,762	560	15	8,400	4,078
12	2,590	1,172	3,762	640	15	9,600	5,198
13	2,590	1,172	3,762	800	15	12,000	7,438
14	2,590	1,172	3,762	800	15	12,000	7,438
15	2,590	1,172	3,762	800	15	12,000	7,438
16	2,590	1,172	3,762	800	15	12,000	7,438
17	2,590	1,172	3,762	800	15	12,000	7,438
18	2,590	1,172	3,762	800	15	12,000	7,438
19	2,590	1,172	3,762	800	15	12,000	7,438
20	2,590	1,172	3,762	800	15	12,000	7,438
21	2,590	1,172	3,762	640	15	9,600	5,198
22	2,590	1,172	3,762	640	15	9,600	5,198
23	2,590	1,172	3,762	640	15	9,600	5,198
24	2,590	1,172	3,762	640	15	9,600	5,198
25	2,590	1,172	3,762	640	15	9,600	5,198
	64,150	31,666	95,816	13216		198,240	89,208

Activities	Unit	Cost	Remark
Input use	Rs/kg	4.9	Rs per kg of input use is computed by dividing total cost by total quantity of production
Labor	Rs/kg	2.4	
Total expense	Rs/kg	7.3	
Sale	Rs/kg	14.0	
Value addition	Rs/kg	6.7	
Profit margin	%	93	

Annex 3.3: Cost and Margin of Collectors Operating at District Headquarters and Kathmandu

A. Districts

Unit: Rs/Kg

	Activities	District			Basis for computations	
		Sindhuli	Ramechhap	Average	Sindhuli	Ramechhap
1	Farm Gate	14.00	14	**14.00**		
2	Harvesting Cost	0.47	0.47	**0.47**	One person can pick 1,000 of Junar in one day; Picking is mostly done by men; Mens; wage rate is about Rs. 300 per day	One person can pick 1,000 of Junar in one day; Picking is mostly done by men; Mens; wage rate is about Rs. 300 per day
3	Transport till road head	0.85	0.85	**0.85**	One person can carry 350 Kg in one day	One person can carry 350 Kg in one day
	Load	0.10	0.10	**0.10**	It cost Rs. 5 to load 50 Kg of Junar	It cost Rs. 5 to load 50 Kg of Junar
4	Transport till DHQ	1.80	1.00	**1.40**	Traders transport Junar using rented vehicle with average cost of Rs. 3,700 from Baseshowr to Sindhuli Madi	Manthali ma sedha bus ko chat ma janneRs. 50/50 =1
5	Unload	0.10	0.10	**0.10**	It cost Rs. 5 to load 50 Kg of Junar	It cost Rs. 5 to load 50 Kg of Junar
6	Storage cost	0.29	0.14	**0.22**	Average cost per night for collection room is Rs. 500	Average cost per night for collection room is Rs. 200
7	Wage/Salary	0.87	0.87	**0.87**	Average daily wage is Rs. 300	Average daily wage is Rs. 300
8	Cost	**18.48**	17.53	**18.01**		
9	Interest	0.005	0.00	**0.00**		
	Cost Price of Collector	**18.49**	**17.53**	**18.01**		
	Loss (0.5 percent)	0.01	0.01	**0.01**		
	Total Cost Price of Collector	18.49	17.54	**18.02**		
	Sales price to wholesaler	20.00	20.00	20.00		
	Profit Margin (Rs)	**1.5**	**2.5**	**1.98**		
	Profit Margin (%)	**8.1**	**14.0**	**11.0**		

B. Kathmandu

Unit: Rs/Kg

SN	Price (NRs.)	Sindhuli	Ramechhap		Sindhuli	Ramechhap
1	Cost of Junar	14.00	14.00	**14.00**		
2	Transport to nearest road head	0.85	0.85	**0.85**	One person can carry 350 Kg in one day	One person can carry 350 Kg in one day
3	Loading	0.10	0.10	**0.10**	Unloading rate is Rs. 5 per 50 kg	Unloading rate is Rs. 5 per 50 kg
4	Transportation	2.50	1.70	**2.10**	It costs about Rs. 20000 to carry 10 ton of Junar to KTM	It costs about Rs. 17000 to carry 10 ton of Junar to KTM
5	Taxes (Road)	0.07	0.04	**0.05**	About Nrs. 700 per Truck	About Nrs. 350 per truck
6	Food expenses	0.24	0.24	**0.24**	Three people including driver visit the districts for collection; Average food expenses per person is 200 per person; They spend about 4 days in the district	Three people including driver visit the districts for collection; Average food expenses per person is 200 per person; They spend about 4 days in the district
7	Lodging Expenses	0.20	0.16	**0.18**	Average cost per room in Sindhuli is about 500 per night;	Average cost per room in Sindhuli is about 400 per night;
8	Unloading	0.20	0.20	**0.20**	Unloading rate is Rs. 10 per 50 kg	Unloading rate is Rs. 10 per 50 kg
9	Total Cost	**18.16**	**17.29**	**17.72**		
10	Loss (5 percent)	0.91	0.86	**0.89**		
11	**Total**	**19.07**	**18.15**	**18.61**		
12	Interest	0.00	0.00	**0.00**		
13	Margin by Wholesaler	2.00	2.00	**2.00**		
14	Total cost to trader	21.07	20.15	**20.61**		
15	Selling Price by Wholesaler	25.00	25.00	**25.00**		
16	**Margin to Traders**	**3.93**	**4.85**	**4.39**		

Annex 3.4: Cost and Margin of Wholesalers Operating at District Headquarters and Kathmandu

Unit: Rs/Kg

SN	Particulars	Places		Basis	
		Sindhuli	Kathmandu	Sindhuli	Kathmandu
1	Purchase from collector	20.00	25.00		
2	Storage	0.18	0.20	Wholeseller handles 1428 kg of Junar in one day; He runs this business for the whole month paying a monthly rent of Rs. 8000	Wholeseller handles 2000 kg of fruits in a day; He runs this business for the whole month paying a monthly rent of Rs. 12000
3	Electricity	0.07	0.08	Monthly electricity bill is Rs 3000	Monthly electricity bill is Rs 5000
4	Staff Salary	0.13	0.13	Average monthly salary for a person is about NRs. 5500	Average monthly salary for a person is about NRs. 8000
6	Packaging	0.40	0.40	It cost NRs. 20 for 50 kg of Junar	
7	Utilities	0.02	0.03	Average telephone cost of a wholesaler is about 1000 per month	Average telephone cost of a wholesaler is about 2000 per month
8	Wage of Wholesaler	0.28	0.25	Average labor per day of semi-skilled labor is about 400	Wage is Rs 500 per day for semi skilled labor
	Total	**21.08**	**26.10**		
	Interest	0.04	0.05	10 percent interest rate for 7 days of total investment	10 percent interest rate for 7 days of total investment
	Total	**21.12**	**26.15**		
	Loss (5 percent)	**1.06**	**1.31**		
	Overall Cost	**22.20**	**27.50**		
	Sales Price	**23.50**	**31.00**		
	Profit Margin	**1.30**	**3.50**		

Annex 3.5: Cost and Margin of Retailers Operating at District Headquarters and Kathmandu

Unit: Rs/Kg

Study districts

SN	Price (NRs.)	District			Basis	
		Sindhuli	Ramechhap	Average	Sindhuli	Ramechhap
1	Purchase from wholesalers	23.5	23.5	23.5	Sindhuli	Ramechhap
2	Retail Space	0.3	0.6	0.4	One retailer sales about 200 kg of fruit in a day; One shutter costs on average Rs. 2,000;	One retailer sales about 150 kg of fruit in a day; Average cost for space is about 2,500 per month
3	Packaging (Plastic)	0.1	0.1	0.1	The cost 5 kg Junar plastic bag is Rs. 10 per packet (100 pieces)	The cost 5 kg Junar plastic bag is Rs. 10 per packet (100 pieces)
4	Wage	0.9	1.0	1.0	Daily wage rate is Rs 180 per day	Daily wage rate is is Rs. 200 per day
	wage					
6	**Sub-total**	**24.8**	**25.2**	**25.0**		
7	Loss (5 percent)	**1.2**	**1.3**	**1.2**		
8	Total	26.1	26.4	**26.2**		
	Sales	**29.0**	**30.0**	**29.5**		
	Margin	**2.9**	**3.6**	**3.3**		

Kathmandu

SN	Price (NRs.)	Kathmandu	
1	Cost of Junar	31.0	A retails sales on average 50 Kg of fruits per day
2	Packaging Plastic Bag	0.2	The price of 5 kg Junar plastic bag is Rs. 20 per 100 pieces
5	Room rent	1.0	Average room rent per room is about 1,500
6	Wage and Salary	1.1	Rs. 5,000 per month is paid for a staff including food
7	Electricity	0.3	Rs. 500 per month is spent on electricity
8	Waste Management	0.3	Rs. 400 per month is paid for disposing the waste
9	Sub-total	**33.9**	
10	Loss (10 percent)	3.4	
11	**Total**	**37.3**	
13	**Overall Cost of Retailer**	**37.3**	
14	Selling price of Retailer	50.0	
15	Margin for Retailer	12.7	

Annex 3.6: Cost and Margin of Processors

	Particulars	Price (NRs.)	Basis
A	**Base Solution**		
1	Cost of Junar	280	20 Kg Junar is required to make a standard 45 liter barrel preservative which is further processed into various products
2	Transport (Farm to Factory)	10	
3	Depreciation of machine/equipments	15	
4	Storage	15	
5	Labour (Peeling)	40	
6	Electricity (Grinding)	5	
7	Labour (Grinding)	20	
8	Perservative (KMS)	30	
A8	**Sub-total for base mixture**	**415**	
1	Sugar	500	
2	Water	10	
3	Electricity	20	
4	KMS	10	
5	Colour	5	
6	Citric Acid	15	
7	Fragrance	20	
8	Bottle	220	
9	Sealing Cover	20	
10	Labelling	20	
11	Labour (filling, labeling)	80	
12	**Add cost for squash**	**920**	
13	**Total cost for 20 bottles of Junar**	**1,335.0**	
14	Interest	0.4	
15	**Total cost**	**1,335.4**	
16	Loss (5 percent)	66.77	
17	**Over all cost for 20 bottles**	**1,402.1**	
18	**Sales (20 bottle)**	**1,800**	
	Commissions	**90**	
	Profit Margin per bottle	**307.9**	
19		**15.4**	

Particulars	Total (Rs /20 kg)	Rs Per unit (1 Kg)
Costs of Junar (20 kg)	280	14.0
Value addition (20 kg)	1,212	60.6
Total cost	1,492	74.6
Sale price per kg of Junar after processing	1,800	90
Margin Rs per kg of Junar	308	15.4
Margin percent	20.6	20.6

SN4.4: Tomato Value Chain Study

CHAPTER 1 INTRODUCTION

1.1 Background

The study aims to assess existing conditions of High Value Commodities (HVC) development along SRC aiming at reviewing development potential of the HVC, identifying potential commodities along their value chains, and testing their improvement through pilot project as a part of master plan development. In this pursuit, JICA study team intends to conduct detailed value chain assessment of selected 11 commodities (Table 1.1) which have commercialization potential in the SRC area. These commodities have been identified by the following robust methodology along with wider consultations with the local, district and central level stakeholders.

Table 1.1: Commodities selected for value chain study

SN	Commodities	Districts			
		Kavre	Dolakha	Ramechhap	Sindhuli
1	Junar			✔	✔
2	Orange (Mandarin)	✔	✔		✔
3	Goat	✔	✔	✔	✔
4	Dairy	✔	✔	✔	✔
5	Tomato	✔		✔	
6	Cauliflower	✔	✔	✔	
7	Potato	✔	✔	✔	✔
8	Tomato	✔	✔	✔	✔
9	Lapsi	✔	✔		
10	Turmeric		✔		✔
11	Pineapple				✔

The main purpose of the value chain study is to thoroughly understand the value chains of selected HVACs from inputs to consumption as well as associated factors such as various support services and policy environments with a view to identify constraints and points of interventions in the chains so as to inform the preparation of Draft Basic Development Strategy.

This report is one of the 11 of series, which presents detailed value chain analysis of tomato while focusing on existing production and distribution system of four districts of SRC, namely Ramechhap, Dolakha, Sindhuli and Kavre.

1.2 Objective

The overall objective of the study is to conduct detailed value chain analysis of tomato, while focusing on:

- Mapping of value chain actors and stakeholders operating at different level
- Analysis of cost and margin analysis of different value chain stakeholders
- Explore potentialities and constraints of the selected commodities
- Conduct the SWOT analysis and recommend potential strategy and interventions

1.3 Study Approach and Methodology

1.3.1 Conceptual Framework

The study will follow value chain approach in conducting the study. A value chain is defined as the full range of activities required to take a product or service from conception to final disposal after use, through the intermediary phases of production, processing and delivery to final consumers. The value chain approach (VCA) focuses on the interaction of actors along each step of the production system as well as the linkages within each set of actors. VCA considers trade relations as being part of a series of networks of producers, exporters, importers, processors and retailers, whereby knowledge and relationships are developed to gain access to markets and suppliers.

Value chain analysis is a process that requires four interconnected steps: data collection and research, value chain mapping, analysis of opportunities and constraints, and vetting of findings with stakeholders and recommendations for future actions. These four steps are not necessarily sequential and can be carried out simultaneously. Figure 1.1 shows simple graphic illustrating the analysis process and components. The value chain team collects data and information through secondary and primary sources by way of research and interviews. The collected data is analyzed using the value chain framework to reveal constraints within the chain that prevent or limit the exploitation of end market opportunities. The resulting analysis of opportunities and constraints should be verified with stakeholders through events such as workshops and focus groups discussions.

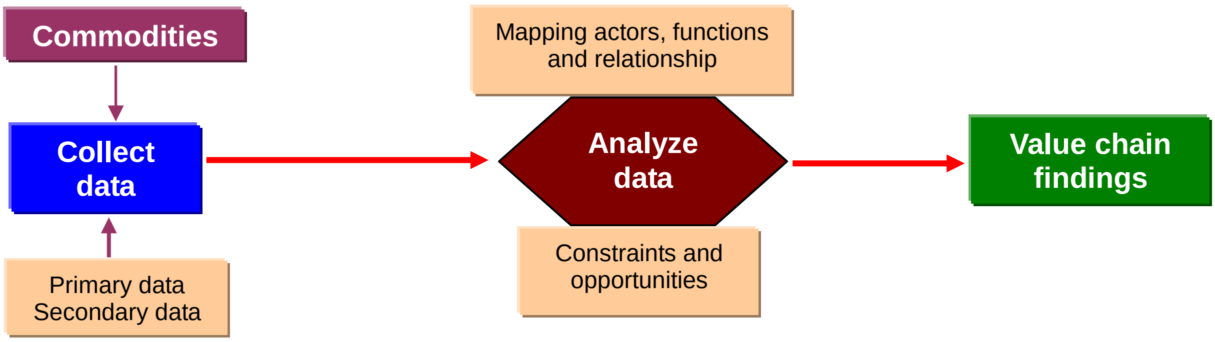


Figure 1.1: Value Chain Analysis Methods

1.3.2 Study Methods

Literature review: Available study reports, annual progress reports, statistical information on Nepalese agriculture were reviewed to collect information related with cultivars, area, production, yield, market price, sale quantity, production location, price, producer groups, etc.

Interaction with producers: Interaction with producers was carried out in key production zone of each district while focusing on:

- Production processes (Cropping calendar)
- Access to services/Mapping of service providers (Technical/technological, finance)
- Input suppliers and mechanism

- Market chain mapping (Place and actors)
- Transportation system and practices
- Grading and packaging practices
- Cost of cultivations
- Price and pricing mechanism
- Problems and constraints

Table 1.2 presents brief overview on consultations with producer groups with detailed on Annex 1.1. Consultations were carried out in three key production areas of four districts where 41 farmers have participated in the group discussions.

Table 1.2: Consultations with Producers

District	Study area/Location	Number of participants
Kavre	Kuntabesi	10
Dolakha	Sundrawati	4
Ramechhap	Khimti	13
Sindhuli	Kamala Nagarpalika-11 Dhang Gaun – KNP – 7	4 10
Total		41

Interaction with value chain stakeholders also focused on (a) core processes in the value chain, i.e. from input provision to retailers and (b) Identifying and mapping the main actors involved in above processes

Interaction with the value chain actors: After interaction with the producer groups, value chain actors operating at different level of value chains are mapped. After wards survey was carried out in selected market places within and outside district. Table 1.2 below number of value chain stakeholders, who were consulted for purpose of study while ***Annex 1.2*** presents name of stakeholders consulted for the purpose of study.

Table 1.3: Number of Value Chain Stakeholders Consulted

Actors	Kavre	Dolakha	Ramechhap	Sindhuli
Collector	5	7	1	3
Traders	4	9	1	3
Wholesaler	3	1	2	-
Retailers	5	1	4	3
Total	**17**	**18**	**8**	**9**

Interactions with value chain stakeholders were carried out to (a) visualize networks in order to get a better understanding of connections between actors; (b) identify processes in value chain (c) examine interdependency between actors and processes in the value chain and (d) enhance awareness of stakeholders to look beyond their own involvement in the value chain. Following issues were discussed during the interactions

- Identifying and mapping the main actors
- Volume of products handled including distribution mechanism (Place and actors)
- Geographical flow of the product or service

- Relationships, linkages and business services between value chain actors
- Price and pricing mechanism
- Transportation system and practices, including mode of transport and cost of transport
- Quality control
- Problems and constraints

After mapping of the value chain, cost and margin analysis of the value chain stakeholders was carried out while focusing on:

- Costs and required investments
- Value added costs
- Estimation of revenues
- Estimation of relative financial position of actors in the value chain

Interactions with service delivery/input suppliers' agencies: Consultations with the service delivery agencies such as District Agriculture Development Office, Agro-vets, private sector, cooperatives etc, non government agencies etc were carried out to understand:

- Nature and type of services
- Service delivery mechanism including cost of services
- Problems and constraints

Table 1.4 presents service delivery agencies consulted for the purpose of study with details in ***Annex 1.3.***

Table 1.4: Number of Service Providers Consulted

Actors	Kavre	Dolakha	Ramechhap	Sindhuli
DADO Officials	2	4	5	5
Agro vet	1	1	2	3
Cooperatives	3	1	1	-
Total	**6**	**6**	**8**	**8**

CHAPTER 2 TOMATO PRODUCTION AND MARKETING

2.1 Introduction

The tomato (*Solanum lycopersicum, syn. Lycopersicon lycopersicum*) is a herbaceous, usually sprawling plant in the Solanaceae or nightshade family, as are its close cousins tobacco, chili peppers, potato, and eggplant. It is a perennial, often grown outdoors in temperate climates as an annual, typically reaching to 1-3m (3 to 10 ft) in height, with a weak, woody stem that often vines over other plants.

Tomatoes are warm season crop and are sensitive to frost. They are usually cultivated in sub-tropical and warm temperate climatic regimes and thrive well in temperatures 10^{o}C to 30^{o}C. Optimum range of temperature is 21^{o}-24^{o}C and temperatures below 16^{o}C and above 27^{o}C are not desirable. Temperature affects germination, crop standing and ultimately affects yield, quality and price. The required temperature regime exists in different agro-climatic regions of Nepal at different times of the year and almost year-round production is possible in different geographical regions of the country.

Table 2.1 presents cropping calendar of major studied crops in SRC. Tomato is grown for two seasons in Nepal, depending upon altitudes and variety. Most of the farmers first prefer to cultivate paddy in low land and maize in the rained area. After paddy, they prefer to cultivate different vegetable crops, such as potato, cauliflower, tomato, tomato etc. However, the seasons of plantation differs by type of crops. Nepal in general and SRC in particular has comparative advantage on growing different type of vegetables because of high variations on altitude and physiographic region.

Table 2.1: Cropping Calendar of Studied Crops

Crops	Land type	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
		B	J	A	S	Bh	As	K	M	P	Mag	F	C
Paddy													
Potato	Low land												
	Upland												
Cauliflower	Low land												
	Upland												
Cabbage	Low land												
	Upland												
Tomato	Low land												
	Upland												

2.2 Production Practices

2.2.1 Calendar of Operation

Tomato production is dominated by small-scale farmers. Table 2.2 presents the cropping calendar of tomato. Tomato is annual herb which is generally grown two times a year (summer and winter season). Season for cultivation of tomato varies on altitude. Tomato is grown in summer time in upland while it is grown in winter in low land.

Tomato production systems vary according to the altitude. In the mid-hills (800 to 1,500 m asl), tomatos are generally cropped on irrigated land after paddy. In mid and higher hills (1,500 to 1,800 m and above), it is grown in upland with maize as a mixed crop.

In low land, preparation of land takes place between July to September while in up land that is between January and March. Planting seedling takes place between August and October in low land whereas that for high land is from February to May. Plant weeding after one month of plantation. It needs frequent irrigation immediately after plantation in interval of 7-12 days. Pesticides and fungicides are used as and when required depending upon nature of problems. Tomato generally takes around 90-120 days for ripening fruit after plantation. Hence crop planted during August will give fruit in November and crop planted in February will give fruit in April.

Table 2.2: Calendar of Operation of Tomato

Crops	Land type	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
		B	**J**	**A**	**S**	**Bh**	**As**	**K**	**M**	**P**	**Mag**	**F**	**C**
Land preparation	Low land												
	Upland												
Seed sowing/planting	Low land												
	Upland												
Weeding	Low land												
	Upland												
Irrigation	Low land												
	Upland												
Spraying insecticides and pesticides	Low land												
	Upland												
Harvesting	Low land												
	Upland												

Note: Nepalese Calendar months (B- Baisakh; J – jestha, A – Ashad, S – Shrawan, Bh – Bhadra, As – Ashwin, K – Kartik, M- Mangshir, P - Poush M – Magh, F - Falgun, C – Chaitra)

2.2.2 Product Input Use and Sources

Seed: Farmers use Nepali and Indian seeds and sometime seeds from overseas such as America. Farmers of SRC districts are producing tomatoes in commercial scale. Kavre and Dolakha district are major sources of tomatoes to the Kathmandu valley while most of the tomato produced in Ramechhap and Sindhuli is consumed locally within the districts. The farmers are quite aware about the varieties of tomatoes. Tomatoes come in a number of varieties with highly standardized cultivation practices. Each variety has its own shape, color, size, timing of cultivation, duration of harvesting, yield, disease resistance, etc. These varieties have production potentials two to six times the average yield at the national level. Abinash and Allrounder are the most popular varieties in the project districts. Abinash has a good yield (up to 18 MT / ha at Research Station), but the fruits are soft and difficult to transport. Allrounder is a hybrid variety and is gaining popularity because the fruits are firm and can be transported easily. These two varieties and another variety Trishul are Indian varieties. Popular

Nepali varieties are Sirjana, Dhanalaxmi and Indra

For the inputs, farmers of all districts rely almost 100% on Agro-vet particularly for seed. Average area of tomato production per household is 0.5-1 ropani in Ramechhap and Sindhuli whereas that in Kavre and Dolakha is 1-2 ropani.

Fertilizers: Compost fertilizer needed is available in the own farm of farmers since they are also rearing livestock. However, farmers of Dolakha use poultry excrete. Farmers purchase chemical fertilizer from cooperative or agro-vets. With the reintroduction of subsidy by the government of Nepal, the fertilizers are available through cooperatives only. Hence, most of the farmers are now purchasing from cooperatives unlike provisions practice of purchasing chemical fertilizers from shops of local markets. Nevertheless, few agro-vets are also selling fertilizers, however farmers are less reliable with fertilizers. They often complained for timely availability of the fertilizers.

Farmers mainly apply chemical fertilizers during two times (a) first during seedling plantation and (b) top dressing flowering times. The quantity of chemical fertilizers used depends on the level of commercialization and availability. In most of the places of Kavre and Sindhuli district such as Kunta Besi and Pachkhal use of chemical fertilizer is very high then recommended dose as tomato cultivation is very commercial in those areas and farmers have relatively easy access to the fertilizers. The use of chemical fertilizer is relatively low than in Ramechhap and Dolakha district. Moreover, farmers of Dolakha prefer poultry excrete compared to compost/farm yard manure.

Table 2.3: Use of Fertilizers

	Recommended dose* (kg/Ropani)	**Current use (Kg/Ropani)****			
		Kavre	**Dolakha**	**Ramechhap**	**Sindhuli**
Compost	1500	1500	1050	1320	750
Urea (46:0:0)#	10	22	0	0	9
DAP Di Ammonium Phosphate (18:46:0) #	6	36	0	0	5
MoP (Murate of Potash) (0:0:60) #	7	0	0	0	2

Source: * Annual Report of Horticulture Center, Kritipur, 2009/2019. Kathmandu, Nepal; ** Field Study, 2012

Figure in Parenthesis denote Nitrogen, Phosphorus and Potash content

Pesticides: Farmers of all districts rely on Agro-vet for pesticides. Whenever farmers have problems in their crop their first place for consultation is agro-vet and buy required inputs such as pesticides and insecticides in recommendation of the agro-vets. Only in very few cases, they go to government service centers to get advice. Farmers are using different pesticides and insecticides two to three times in crop cycle or as and when required. Farmers often complained about duplicate or unreliable pesticides available in the market.

Irrigation: Farmers need to irrigate tomato in an interval of 7-12 days. In dry season frequency is more. Non-conventional irrigation technologies such as pond constructions, rain water harvesting, waste water use etc are hardly used. Applying appropriate water storage and conservation system need to be promoted to enhance capacity of farmers to utilize water resources. Farmers generally cultivate tomato in those areas which have well developed irrigation system.

2.2.3 Care and Management

Major activities performed by farmers for the care and management of field include:

- **Weeding/earthening up:** It is done after one to one and half month to of planting seedling. This minimizes the nutrient competition between weeds and tomato.
- **Top dressing:** Top dressing with urea and DAP is done during weeding and flowering time.
- **Chemical Treatment:** Most commonly used chemical treatment is spraying of pesticides and insecticides. Tomato is very sensitive towards bug; in case of bug problem they use insecticides.

2.2.4 Credit

Large majority of farmers don't need credit for cultivating tomato. Production labor is performed by own family members while production inputs are provided by Agro-vets. All the activities related to farming will be performed by family members and hence they even don't need cash for hiring labor. However, it largely depends upon the extent of cultivation area. Likewise, farmers cultivating tomato in plastic tunnel or house need more investment in such a case farmers use to take loan from co-operatives.

Few farmers who are cultivating in large scale and plastic tunnel/house used to take loan from cooperatives with interest of 12 – 15 percent per annum. Likewise, few farmers take credit in kind (seeds, fertilizers) from Agro-vets. Hence, farmers don't need big amount of credit for tomato cultivation.

Dependency of farmers on formal financial institutions does not exist or is diminishing. Farmer's often complained about cumbersome processes which need to follow for obtaining loan. Hence, they preferred local cooperatives for credit compared to financial institutions.

2.2.5 Technical Services

Farmers mostly rely on Agro-vets and DADO for technical knowledge and services. However, access of farmers to DADO is very limited, mainly because of distance as well as less number of staff. Hence, farmers often consult with their peers and agro-vets for technical advices. Role of DADO has been mainly confined on providing subsidy for saplings and other equipments.

2.3 Area, Production and Yield

2.3.1 Area

SRC area covers about 1.46 percent (2,117 ha) of country's tomato area (15,609 ha). Of the four districts of SRC, Kavre is known for commercial tomato production. Table 2.4 presents extent of cultivation of tomato in SRC districts.

Tomato is cultivated at 0.51 percent of the total cultivated area of the country. Likewise, tomato is cultivated only in 1.46 percent of total cultivated land of the SRC. Of the total cultivated land of the SRC districts, cultivation is high in Kavre district (5.49 percent), followed by Sindhuli (0.17 percent), Dolakha (0.15 percent) and Ramechhap (0.01 percent).

Table 2.4: Extent of Cultivation of Tomato in SRC Districts

SN	District	Total Cultivated land (ha)	Area under Tomato cultivation (2009/10)		% Tomato cultivated area to total cultivated area
			Area (ha)	%	
1	Kavre	36,442	2,000	12.81	5.49
2	Dolakha	29,423	45	0.29	0.15
3	Ramechhap	40,050	4	0.03	0.01
4	Sindhuli	39,485	68	0.44	0.17
	SRC total	145,400	2,117	13.56	1.46
	Nepal	**3,052,900**	15,609	100.00	0.51

Source: MoAC, 2010/11

Table 2.5 compares trend of area under tomato cultivation over last four years. Area under tomato is increasing rapidly in SRC (56.9 percent per annum) as compared to Nepal (13.3 percent per annum). Area under tomato is increasing in the all districts except in Ramechhap. Area under tomato cultivation in Ramechhap is decreasing by 33.8 percent per annum. Increase is significantly high in Kavre district (60.6 percent). This is mainly of expansion of road networks which have created easy market access of Kathmandu.

Table 2.5: Area under Tomato Cultivation over Last Four Years (2006/07 – 2009/10)

Unit: ha

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2006/07	199	31	10	38	278	10,775
2007/08	440	31	8	56	535	12,104
2008/09	1,863	NA	4	62	1,929	15,572
2009/10	2,000	45	4	68	2,117	15,609
Annual Growth Rate (%)	**60.6**	**14.0**	**-33.8**	**17.1**	**56.9**	**13.3**

Source: MoAC, 2010/11

2.3.2 Production

Total production of tomato in the country is 242,018 MT per year in 20009/10 of which SRC contributed 13.74 percent of total tomato production. Sizable amount of tomato is produced in Kavre while production amount is very less in rest of SRC districts.

Table 2.6 Production of Tomato

SN	District	Production (Mt)	Percent
1	Kavre	32,000	13.22
2	Dolakha	404	0.17
3	Ramechhap	44	0.02
4	Sindhuli	803	0.33
	SRC area	**33,251**	**13.74**
	Nepal	242,018	100.00

Source: MoAC, 2011

Table 2.7 presents production of tomato over last 4 years. Production of tomato is increasing in Nepal by 14.1 percent per annum whereas rate of increase in SRC area is 57.4 percent. Production of tomato increases at 59.9 percent per annum in Kavre while it decreases by 21.1 percent per annum in

Ramechhap. Increase in production is mainly because of expansion of cultivated area.

Table 2.7: Production of Tomato over Last Four Years (2006/07 – 2009/10)

Unit: MT

	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2006/07	2,978	294	70	407	3,749	155,088
2007/08	8,483	294	104	676	9,557	194,147
2008/09	27,113	NA	44	745	27,902	219,194
2009/10	32,000	404	44	803	33,251	242,018
Annual Growth Rate (%)	**59.9**	**11.9**	**-21.1**	**19.1**	**57.4**	**14.1**

Source: MoAC, 2011

2.3.3 Yield

Table 2.8 presents yield of tomato over last four years. The table shows that average yield is decreasing in all Kavre and Dolakha while other two districts have positive growth rate. The table shows that overall yield in SRC area is increased only by 0.1 percent in last four years. This can be attributed to many factors such as rising input costs, pests and diseases, effects of climate change, declining farming land due to rise in population, poor crop husbandry practices such as lack of crop rotation and use of poor quality seeds.

Table 2.8: Yield of Tomato over Last Seven Years (2006/07 – 2009/10)

Unit: kg/ha

Year	Kavre	Dolakha	Ramechhap	Sindhuli	SRC	Nepal
2006/07	14,965	9,484	7,000	10,711	10,540	14,393
2007/08	19,280	9,484	13,000	12,071	13,459	16,040
2008/09	14,553	NA	11,000	12,016	9,392	14,076
2009/10	16,000	8,978	11,000	11,809	11,947	15,505
Annual Growth Rate (%)	**-1.0**	**-1.9**	**9.5**	**2.8**	**0.1**	**0.9**

Source: MoAC, 2011

2.4 Production Locations

2.4.1 Production Area

During the consultative meeting, DADO officials were requested to classify VDCs into three classes while considering extent of cultivation and commercialization. This exercise was carried out for all districts of SRC Production is highly scattered and fragmented and confined in few VDCs only.

- ***Fully commercial***, large area under cultivation and produce generally sold outside districts
- ***Semi-commercial*** – relatively high area under cultivation but produce are mostly sold in local market
- ***Subsistence*** – area is very small and produce mainly come to local markets or sufficient for self consumption only

Map 2.1 shows results of consultative meeting to map tomato grown area by VDCs where the detailed value chain assessment has been carried out. The map reveals that tomato is grown commercially in

17 VDCs; semi commercially in 60 VDCs. Likewise, tomato is either cultivated home garden/subsistence level or not cultivated in remaining VDCs of SRC.

2.4.2 Production Pockets

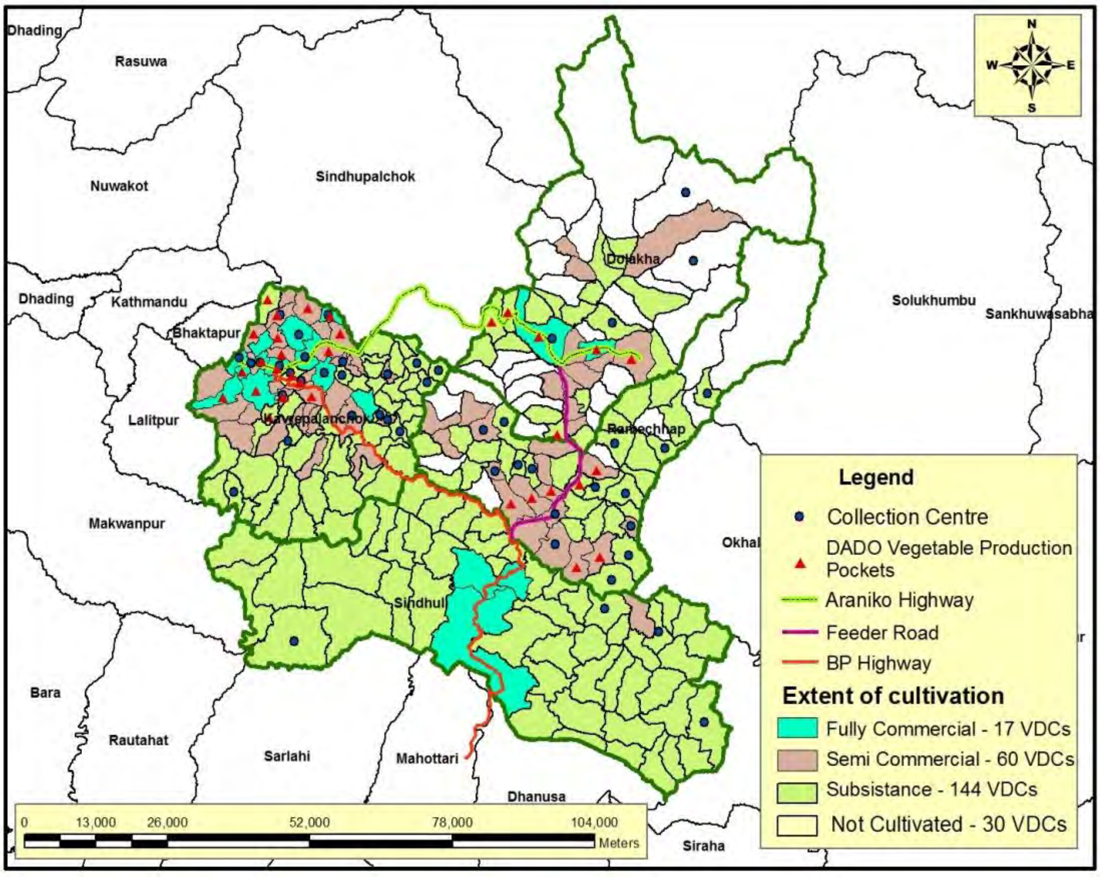
DADO has not designated specific area as production pockets of tomato; however, they have identified vegetable production pockets considering road access and extent of cultivation. Table 2.9 presents production pockets of tomato in the study districts. Number of production area varies by districts from 26 in Kavre to 8 in Ramechhap, 3 in Dolakha and 10 in Sindhuli. Map 2.1 also shows production pockets of DADO/DLSO

Table 2.9: Vegetable Production Pockets of DADO/DLSO

Districts	Production Pockets (VDCs/locations)	Number
Kavre	Dhulikhel N.P., Panchkhal, Baluwa, Hokse, Jyamdi, Nayagaon, Mahadevsthan, Chandeni, Banepa N.P., Panauti N.P., Kavre, Patlekhet, Phulbari, Methinkot, Kanpur, Sarsyukharka, Khanalthok, Mangaltar, Sipalichilaune, Sankhu, Balthali, Tukuchanala, Devitar, Raviopi, Mahendrajyoti, Kushadevi	26
Dolakha	Bhimeshwar N.P., Melung, Jiri	3
Ramechhap	Khimti, Tilpung, Manthali, Bhatauli, Pakarbas, Okhreni, Chisapani, Sukajor	8
Sindhuli	Bhadrakali, Kamalamai N.P., Hatpate, Mahadevsthan, Bhimsthan, Dudhauli, Cithauli, Kapilakot, Jalkanya, Ratanchura	10

Source: Computed from annual progress report of DADO of respective districts, 2011

Map 2.1: Cultivation Area and Production Pockets of Tomato



2.5 Marketing and Distribution System

2.5.1 Harvesting and Sale

Farmers harvest tomato by picking the fruit. In low land areas such as Kunta Besi, Panchkhal of Kavre and Pawati of Dolakha harvesting time starts from September and goes up to February whereas that in high land such as Makaibari and Sailungeshower of Dolakha that starts from April and goes up to July. As tomato cannot be kept for longer time in field after it gets matured it has to pick immediately and sell to markets. After harvesting, farmers seldom do grading. Generally, after harvesting farmers pack tomato in bamboo basket or plastic crate.

Table 2.10: Trends on Harvesting and Market Arrival of Tomato

	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	B	J	A	S	Bh	As	K	M	P	Mag	F	C
Upland												
Harvesting						3	4	8	10	9	7	
Sale						3	4	8	10	9	7	
Low land												
Harvesting	10	8	6	8								6
Sale	10	8	6	8								6

Source: Field Survey
Note: 0 for lowest and 10 for highest; Nepalese Calendar months (B- Baisakh; J – jestha, A – Ashad, S – Shrawan, Bh – Bhadra, As – Ashwin, K – Kartik, M- Mangshir, P - Poush M – Magh, F - Falgun, C – Chaitra)

During the consultative meeting with farmers/producer groups, they were requested to assign score on scale of 0- 10 to show harvesting and market arrival of tomato. From upland tomato is available in the market for about five months from last second half of March to first half of July. However, April and May are the highest available months. Likewise, from lowland, tomato is available in the market for about six months starting from second half of September to first half of February. Maximum availability of tomato from lowland is in December and January.

Generally local collectors reach to the place as close as to the tomato field with their vehicle. Farmers are responsible to bring tomato in bamboo basket or plastic up to road head where weighing takes place. However, now a days use of plastic crate is increasing. The local traders generally buy tomato in credit and pay back to the farmers only after selling tomato in markets. The payback time ranges from one week to one month.

2.5.2 Market Arrival

Table 2.11 presents market arrival of tomato from study districts. Of the total production of tomato in the study districts, famers bring almost all produce to the market. Only 5 percent is self consumed.

Table 2.11: Market Arrival of Tomato

Unit: Percent

District	Kavre	Dolakha	Ramechhap	Sindhuli
Self consumption	1	5	5	10
Brought to market	99	95	95	90

Source: Field Survey

2.5.3 Marketing Practices

The study showed the following distribution system of tomato in SRC area:

- Farmers –Collectors – Retailers - Consumers
- Farmers –Collectors –Commission agent – Retailers - Consumers
- Farmer – Collectors – Wholesalers– Retailers – Consumers
- Farmer –Retailers – Consumers
- Farmers –Consumers
- Farmers – Road head collectors – Wholesalers- Retailers- Consumers
- Farmers – Road head collectors – Collectors - Wholesalers- Retailers- Consumers

Major marketing practices followed by different marketing agents

- ***Producers/ Farmers:*** Farmers mostly sell tomato to local collectors. In some cases they also take to major city centers such as Banepa, Charikot, Manthali, Sindhulimadi etc. and sell to retailers. However it depends upon size of the produce. Likewise, farmers are also bringing tomato to rural haat market for sale, especially in case of Rammechhap, Sindhuli and Dolakha.
- ***Road head collectors:*** They are operating in the road head center in the areas where the production pocket is scattered and production is less. Some buy tomato themselves and sale to collectors while few perform as commission agents of contractors/collectors. They purchase tomato from farmers supply to collectors or wholesalers operating in different market places based on demand. They get money from collectors/wholesalers within two weeks of sale of produce. They generally operate small grocery shops in the road head and provide food as well as other essential items needed to farmers.
- ***Contractors/Collectors:*** Collectors purchase tomato from farmers immediately after harvesting. Collectors fix price with farmers depending upon the Kalimati market. Farmers mostly get their money after a week or fortnight of sale of produce. Collectors bring products to district headquarters, major city centers and capital city Kathmandu. They sell produce to wholesalers and retailers or to commission agents at Kathmandu. They are operating at production center, district head quarters and Kathmandu.
- ***Commission agent/Traders:*** Commission agents receive tomato from collectors. They sell to retailers and wholesalers. They are operating at wholesale market of major urban cities such as Kathmandu, Narayanghat, Hetauda, Pokhara etc
- ***Wholesalers:*** Wholesalers purchase tomato from commission agents or from collectors. They are mostly operating at district head quarters, urban cities and Kathmandu. There are very few wholesalers or none in district headquarters; however, they are many in Kathmandu markets.
- ***Retailers:*** Retailers purchase tomato from wholesalers in urban market or from producers directly in nearby weekly *haat markets*. They are operating at district head quarters, urban cities and Kathmandu.

2.5.4 Transportation Mechanism and Costs

Producers themselves or hire porters (if produce in big volume) mainly for transporting tomato from production pocket to nearby road heads. Small producers carry tomatoes in bamboo baskets (*doko*) or plastic crates to local and district haat markets for sale. But, in case of bigger consignments, they used to pack tomatoes in plastic crates and transport by mini-trucks and pick-ups to outside big market places, especially at Kathmandu.

Depending upon volume of produce handled, different mode of transportation exists. Almost all production pockets/area is now connected with the earthen vehicle pliable roads. Farmers/Traders generally bring produce up to nearest road head in bamboo basket or in shack. Transportation cost varies from Rs 0.1 to 0. 75 per Kg depending upon distance to road head. This situation remains similar in all the districts.

After bringing to the road head, tomato is either loaded in a mini truck, which carry 3 to 5 MT or in public bus. People generally use local bus if the quantity is very small. Local buses generally charge Rs 1 to 5 per kg depending upon the distance. If farmers/collectors bring to district head quarter, they generally pay Rs 1 per kg while they pay Rs 5 if they bring to Kathmandu.

Use of small truck (popularly known as Tata mobile or Mini truck) is quite common nowadays to transport tomato. Collectors hire small truck/lorry with a capacity of 3 to 5 Mt. They collect the produce at road head and then bring to the market. The transporter charges about Rs 2500 – Rs 5500 to bring produce to District head quarters depending upon the capacity of truck. Likewise, transportation cost varies by distance/places and the capacity of truck. For example, truck with capacity of 5 MT charges Rs 2,500 – Rs 3,500 for bringing produce to Kathmandu market from Kavre districts.

Table 2.12 reveals that renting that mode of transportation in district producing low volume such as Sindhuli, Dolakha and Ramechhap is porter and public transport wheras in Kavre where production is significantly high product is transported by mini truck or tata mobile. Use of public transport and labor is very limited in Kavre while they are highest in Ramechhap. Farmers carry their produce in bamboo basket or plastic crate to bring to nearest markets; however such practice is now declining. Instead, farmers use public transport means to bring their produce to market.

Table 2.12: Mode of Transport to Different Markets

Unit: Percent

Mode of transport to market	Kavre	Dolakha	Ramechhap	Sindhuli
Porter (Labor)	10	15	35	85
Public transport (Passenger bus/jeep)	30	85	65	15
Truck/Mini Truck/Tata mobile	60	0	0	0
Total	**100**	**100**	**100**	**100**

Source: Field Survey

2.6 Pricing Mechanism and Prices

2.6.1 Price Determination Methods

Prices of the products are affected by the different factors like supply and demand of market, quality of the produce, speculative price based on situation and supply, previous day price, time, season, weather, ceremony, quantity disposed at the market, agreement with the farmers, availability of substitutes and bargaining based on quality. Besides these factors, previous day's price, seasonality and cyclic variation are important for price formation in specific markets.

Market has major roles on determining prices at farmer level. Collectors and farmers inquire the price at Kathmandu and other city center and fix the price. In some cases where farmers directly bring to district headquarters, sell tomato in prevailing market price. At wholesalers' level, the supply and demand of the market determines the price followed by carteling of businessman; quality of the produce; speculative price based on situation and supply; purchased price; and bargaining based on quality. At retailer's level, the purchased price play key role in the retail price formation at all the retail markets followed by supply and demand of market; quality of the produce; previous day price; bargaining based on quality; and addition of profit. Table 2.13 presents different factors which play for determination of price.

Table 2.13: Criteria for Price Determinations

Farmers	Wholesalers/Collectors	Retailers
• Previous day/week price • Dealing with collectors • Urgency to dispose produce • Urgency of cash • Advance taken from the collectors • Production amount	• Supply and demand at market • Purchase price and associated costs • Last day/week market price • Quality of produce • Speculative price based on situation and supply • Risk associated with produce	• Purchase price and associated costs • Supply and demand at market • Last day price • Quality of produce • Bargaining based on quality • Risk associated with produce

Source: Field Survey

Farmer's consider last day price and urgency of sale as main factors which influences on determination of prices. Wholesalers/Collectors determine price based on supply and demand situation together with last day/week market price and other associated risks. Retailers determined price based on purchase price and associated costs including risk associated with the products.

2.6.2 Market Price of Tomato at Different Markets

Prices are lowest in markets near production areas and highest in faraway markets. Table 2.14 presents average price of tomato at different market places in study districts. Market price of tomato varies by places and locations. Farm gate price of tomato varies from Rs 12-30 per kg. Retailing price also varies by districts.

Table 2.14: Market Price of Tomato

Unit: Rs/kg

Places	Kavre	Dolakha	Ramechhap	Sindhuli
Farmers/Farm gate	12	30	22	25
Wholesalers/ Commission agents	22			
Retailers	25	35	32	32

Source: Field Survey

The table reveals that farmers of Sindhuli and Dolakha are getting better price for their produce than of Kavre and Ramechhap. Price of tomato in Kavre is least among SRC districts this could be because of high production of tomato in Kavre and the product has to compete with that of Lalbandi.

2.7 Post Harvest Handling

2.7.1 Grading

Tomatos are generally traded without grading at farm gate. No post-harvesting treatments are applied and traditional packaging is mainly used. No quality standards exist for tomato in Nepal. However, in some cases retailers do grading for selling.

2.7.2 Packaging, Labeling and Branding

Bamboo baskets and plastic crates are used for packing and carrying to road head and transporting in public vehicle. However, use of plastic crates is becoming very common now a days.

2.7.3 Storage

Farmers used to sell tomatoes immediately after harvesting. There is no practice of storing. Storing is done for 1-2 days in wholesale market if the produce could not be sold in time. However, tomato being highly perishable crop storing for value addition is not practical.

2.7.4 Value Addition and Processing

Consumption is mainly in unprocessed form in homes and restaurants. There is no any value addition and processing activity in tomato. All percent tomato is sold in fresh to be consumed as fresh vegetable.

CHAPTER 3 VALUE CHAIN ACTORS MAPPING AND ANALYSIS

3.1 Value Chain Analysis

3.1.1 Value Chain Map

Mapping of value chain actors was carried out to visualize networks in order to understand linkages between actors and processes in a value chain and assess interdependency between actors and processes in the value chain. Figure 3.1 presents core processes involved in value chain of tomato. It moves form production to consumers, passing through different stages and processes. The linkages are shown vertically from bottom to top. The left hand blocks represent the major functions of the chain. The functions, in this case, include production, collection, trading, processing and marketing.

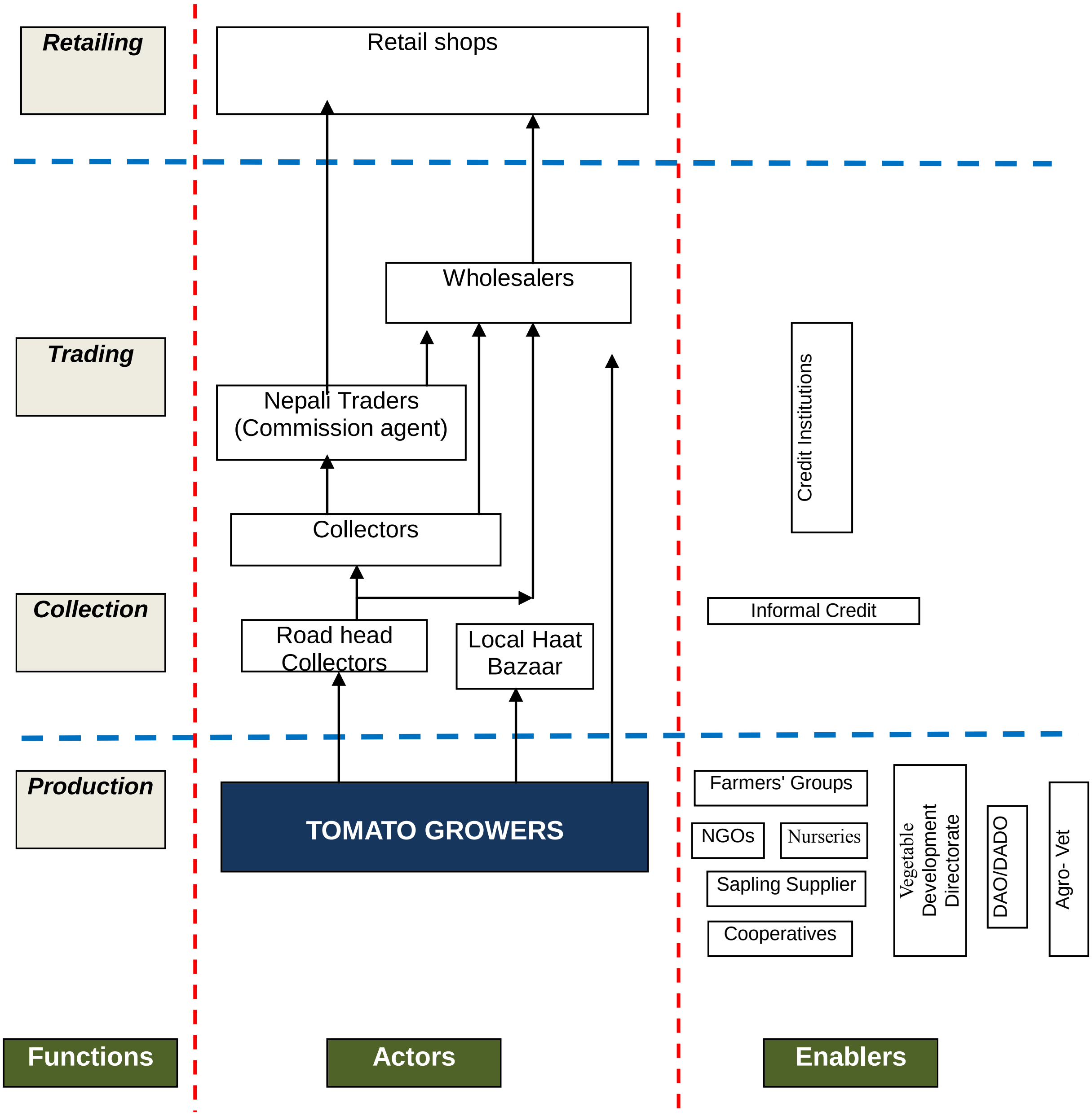


Figure 3.1: Tomato Value Chain Map

3.1.2 Value Chain Actors and Functions

Major actors involved in value chain of tomato and their function are:

Producers: Producers are mainly involved in cultivation and sale of tomato. Major functions performed by producers include

- Preparing field and planting seedling of tomato along with its care and management
- Field care and management, including application of fertilizers, pesticides, weeding, irrigation etc.
- Bring tomato up to the nearest road head
- Negotiation with collectors on price and sale of produce
- Provide tomato in credit for about 15 days to 1 months from harvest of produce

Road head collectors/contractors: They are generally involved in collection and sale of produce. They are mostly present at road heads where the production is scattered or less. They mostly sell produce to wholesalers or collectors. They generally establish small grocery shops in the village to supply food and other essential items required to farmers in credit. Some are the commission agents of collectors or wholesaler as well. Major functions performed by them includes

- Negotiation with farmers on price of produce, based on quality
- Provide foods (rice, pulses and oil) together with other grocery required by farmers in credit
- Sale produce to wholesalers and collectors, especially loading in public transportation
- Fix price with collectors and wholesalers and supply tomato

Contractors/Collectors: Collectors are generally involved in sell of produce. They are mostly present at production pockets. They mostly sell produce in Kathmandu. They operate their business mainly during vegetable including tomato production seasons. Major functions performed by them includes

- Negotiation with farmers and road head collector on price of produce, while considering quality and quantity of produce
- Provide credit or advance to the farmers and road head collectors prior to harvest, mainly for input purchase and meeting their immediate cash needs
- Transportation to market center
- Sale of producers to wholesalers/traders/commission agents

Traders/Commission agents: Traders and commission agents are operating at the wholesale market center, especially in Kathmandu and other urban market etc. They sell produce brought by collectors on commission basis. They generally take commission of 5-8 percent to sale produce. They are least bothered with the purchase price of collectors but fix prices considering market demand and supply situation. Likewise, they operate annually and sell tomato from other part of county such as Terai or India in off season period for SRC areas. They generally operate business for about 6-8 hours a day. Major functions performed by them include:

- Determine price of tomato considering market demand and product flow situation
- Sale produce wholesalers, retailers and consumers on bulk quantity
- Provide interest free loan to collectors to purchase tomato during peak production seasons

Wholesalers: Wholesalers are operating at district head quarters and key market centers, especially in urban areas and also in Kathmandu. They purchase tomato either directly from collectors, especially in the market center like Baneshwor, Kalimati, Lagankhel, Banepa etc or from traders and commission agents in market centers. They sell produce to retailers or consumers. Wholesalers fix prices based on their purchase price along with market demand. Major functions performed by wholesalers include:

- Determine price of tomato considering market demand, product supply situation, quality and their profit margin

- Sale produce retailers and consumers on small quantity (at least 5 kg)
- Adjust prices considering volume of sale and quality of produce
- Provide goods to retailers on credit for a period of 2-3 days for selling of produce

Retailers: Retailers are operating at road head, weekly markets, and district head quarters as well as in key market centers in the urban areas. Retailers operating on production districts purchase tomato from farmers or collectors. Likewise, they purchase from traders/commission agents or wholesalers in case of market centers. Retailers sale produce to consumers. Retailers fix prices based on their purchase price along with market demand. Major functions performed by wholesalers include:

- Determine price of tomato considering demand, quality and their profit margin
- Sale produce consumers as per their need
- Bargaining on price with consumers based on quality of produce

Table 3.1 summarizes major functions performed by different value chain stakeholders and their involvement. Farmers are highly involved only in production and harvesting activities. Their involvement in marketing is very low. Only very few farmers are involve in marketing.

Table 3.1: Major Functions Performed by Value Chain Stakeholders

Functions	Farmer	Collector	Agro -vet	Cooperatives / Association	DADO	Commission Agent/Wholesalers	Retailers
Production/ Cultivation	High	No	No	Low	No	No	No
Input supply	No	No	High	High	Low	No	No
Credit/ loan/Finance	No	Low	Medium	Medium	No	No	No
Farm /management	High	No	No	Low	No	No	No
Technical support	Low	No	High	Low	Medium	No	No
Harvesting	High	Medium	No	No	No	No	No
Grading	No	No	No	No	No	Low	High
Sale/Marketing	Low	High	Low	Medium	No	High	High

Local collectors are highly involved in marketing and few also provide credits to farmers in a condition that the farmers have to sell tomato only to the loan lender trader. Role of agro vets is basically input supply and technical supports, however few of them also involved in financing credit and marketing of tomato. They supply insecticides and pesticides to farmers. In addition, they also supply chemical fertilizers. It is surprising to see that role of DADO in entire value chain is not prominent. Their involvement is only in technical supports that also at medium level. Product based cooperatives are involved in input supply and lending loan. These cooperatives sell chemical fertilizers and also provide credit to farmers. Financial cooperatives are only involved providing credit to farmers. Commission agents, wholesalers and retailers perform the role of marketing.

3.1.3 Volume Handled

Focus group discussions with farmers and value chain participants were carried out to understand volume handled by different value chain stakeholders. Figure 3.2 shows volume handled by different value chain stakeholders.

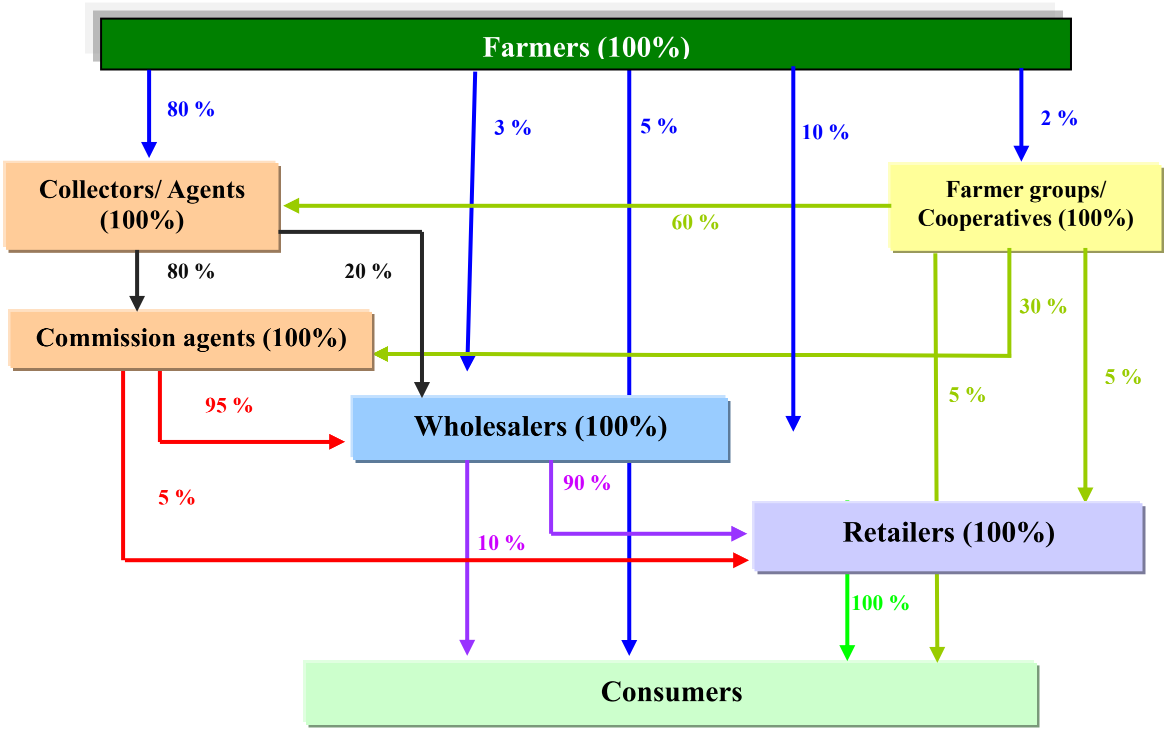


Figure 3.2: Volume Handled by Different Value Chain Stakeholders

A large part of the total production goes to outside markets, specifically from Kavre district. One of the key reasons for going a large part of tomato in the market is the access of these districts to Kathmandu valley, particularly Kalimati fruits and vegetable wholesale market and a high demand of tomato.

Based on above figure, table 3.2 summarizes the key market chain stakeholders and volume handled by them. Of the total produce of tomato in SRC area, in Sindhuli and Ramechhap 100 percent product is being handle by retailers there is no presence of wholesalers and cooperative for handling tomato. Nevertheless, in Kavre 60 percent is handle by collectors and only 13 percent is handled by retailers. This is mainly because in other three district except Kavre all or most of the tomato is consumed locally within the districts

Table 3.2: Produce Handled by Different Market Chain Stakeholders Directly

Unit: Percent

Market agents	Kavre	Dolakha	Ramechhap	Sindhuli
Collectors	60	5	0	0
Producer Association/Cooperatives	2	0	0	0
Wholesalers	25	0	0	0
Retailers directly (including farmers self retailing)	13	95	100	100
Total	**100**	**100**	**100**	**100**

Source: Field Survey

3.1.4 Places

Tomato produced in the districts is sold locally as well as Kathmandu (see map 3.1). Table 3.3 presents proportion of tomato sold at different market places. Table reveals that most of the produce of Kavre is sold in Kathmandu whereas produce of other three districts is sold in local market, district headquarters and neighboring districts.

Map 3.2: Markets of Tomato

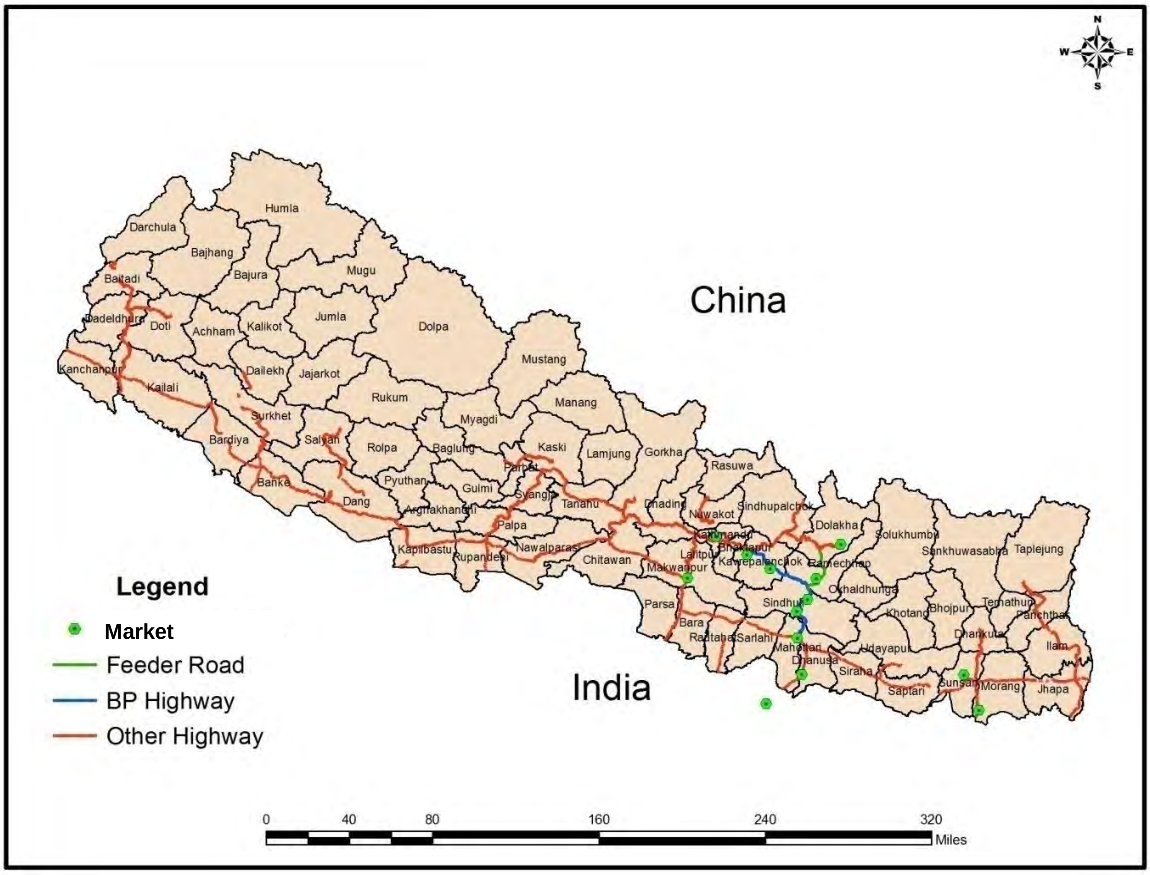


Table 3.3: Produce Sold in Different Market Places

Unit: Percent

Market places	Kavre	Dolakha	Ramechhap	Sindhuli
Local markets (weekly haat bazaars and within district)	10	60	85	90
District head quarters	20	30	15	10
Teria market (Birgung, Janakpur, Biratnagar etc)		0	0	0
Neighboring districts	10	10	0	0
Kathmandu (Kalimati)	60	0	0	0
Total	**100**	**100**	**100**	**100**

Source: Field Survey

Table 3.4 shows the market access of different value chain stakeholders. The table reveled that farmers do not have access to Kathmandu market whereas local collectors have access to all market places. District traders/wholesalers mostly do not go to farm gate but they have a presence in other market places. Commission agents only present in Kathmandu and big market centers like Banepa, Narayanghat etc. Likewise, wholesalers are present in DHQ and Kathmandu. Similarly, retailers are present in all market places except farm gate.

Table 3.4: Market Access of Different Value Chain Stakeholders

Places	Farmers	Local collector	District traders/wholesalers	Commission agent/ Wholesalers	Wholesalers (KTM/DHQ)	Retailers (KTM/DHQ)
Farm Gate	Yes	Yes	-	-	-	-
Road head market (High way)	Yes	Yes	Yes	-	-	Yes
DHQ	Yes	Yes	Yes	Yes	Yes	Yes
Kathmandu	-	Yes	Yes	Yes	Yes	Yes
Urban Cities	-	Yes	-	Yes	Yes	Yes

Source: Field Survey

3.2 Value Chain Performance

The analysis of priced margins has been carried out by using a standard format that shows major costs, losses, margins and prices along the chain and the share of each players as the product moves from production to local collectors, traders, wholesale market and finally up to the consumers. The information is based on the information obtained from the districts and Kathmandu market.

3.2.1 Producers

Table 3.5 presents cost and margin of producers. The study found that cost of cultivation differs by districts. This is mainly because of high different on wage rates, quantity of use of production inputs such as seeds, fertilizers, farm gate price and yield. Farmers are gaining high profit in all the districts from cultivation of tomato which varies from 186 percent in Sindhuli to 353 percent in Ramechhap. The profit of farmers is much higher than this, because they don't hire labour for cultivation. Instead, they use their own family members. Hence, there direct production cost is minimal. Use of input per unit cost of production in Doalkha is high because farmers used poultry manure as well apart from compost. Likewise production cost is calculated in Dolakha for tomato production in tunnel.

Table 3.5: Cost and Margin of Producers

Activities	Unit	Amount (Rs)			
		Kavre	Dolakha	Ramechhap	Sindhuli
Input use	Rs/kg	0.9	5.9	2.6	4.5
Labor	Rs/kg	2.2	3.5	2.9	4.2
Total expense (Cost)	Rs/kg	3.2	9.4	5.5	8.7
Sale price	Rs/kg	12.0	30.0	25	25.0
Profit	Rs/kg	8.8	20.6	19.5	16.3
Profit margin percent	%	277.6	219.0	353.7	186.2

Source: Field Survey

Annex 3.1 presents cost of production by districts.

3.2.2 Collectors

Role of collectors along the value chain is important. They act as a bridge between producer and markets. They purchase tomato with farmers in weight basis. The margin enjoyed by them is around

Rs 2.3 per kg. Nevertheless, they have to bear the risk of price fluctuation in the market and damage during transportation. Depending upon relationship with farmers, they purchase on cash or credit. Farmers' don't sell their produce in credit if the collectors are outsider of villages. However, majority of local collectors purchase on credit and pay within fortnight to one month. The major costs incurred by collectors include loading, transporting, unloading, rent of plastic crate. ***Annex 3.2*** presents details on cost associated with collectors and their income. If collectors bring produce to Kathmandu market, collectors enjoy margin of Rs 2.3 per kg. Profit margin percent is 14.4 percent if traded locally and 14.9 percent if traded in Kathmandu. In some cases, for example in Ramechhap and Sindhuli farmers performs role of collectors too. They take their products directly to retailers. This happens mostly when farmers are closely located to the market centers.

Table 3.6: Cost and Margin of Collectors

Activities	Unit	District	Kathmandu
Purchase price	Rs/kg	12.0	12.00
Value addition cost	Rs/kg	2.0	3.7
Total cost	Rs/kg	14.0	15.7
Sale price	Rs/kg	16.0	18.00
Profit	Rs/kg	2.0	2.3
Profit margin percent	**%**	14.4	14.9

Source: Field Survey

3.2.3 Commission Agents /Wholesalers

These actors are available in Kalimati, Baneshower and Banepa markets at Kathmandu. They sell tomato in bulk quantities (wholesale) by charging commission. Commission is generally 5-8 % of sold quantity. In whole value chain, commission agents possess the lowest risk while their margin is very high. They are least affected by price fluctuation.

According to the traders who bring tomato to Kalimati or Baneshower market, the market opens at 3 AM in the morning. Commission agents fix the high price in the morning and start reducing prices as day proceeds, depending upon quantity of sale. They clear place for next consignment at the end or mid of the day. If commission agents charges 7% commission on sale amount of collectors/contractors, they will make a profit margin of Rs 2.3 per kg, which is more than three times higher than their investment. Profit margin is very high considering risk.

Table 3.7: Cost and Margin of Commission Agents/Wholesalers

Activities	Unit	Kathmandu
Rent	Rs/kg	0.17
Wage and other expense	Rs/kg	0.2
Interest (Advances)	Rs/kg	0.15
Value addition (Total cost/investment)	**Rs/kg**	0.52
Commission (Income)	Rs/kg	2.3
Profit	Rs/kg	1.78
Profit margin percent	%	342.3

Source: Field Survey

3.2.4 Wholesalers

These actors perform three roles; traders, wholesalers and retailers. They are situated in the districts as well as in urban market center. The study found that wholesalers of tomato are operating in Banepa. Likewise, they are also operational at Kalimati. Wholesalers operate business for whole year but products dealt by them vary by seasons.

Table 3.8 presents cost and margin of wholesalers operating at district particularly in Banepa and Kathmandu, with details in **Annex 3.3**. Profit margin enjoyed by wholesalers operating at district and Kathmandu is Rs 2.1 and Rs 3.3 per kg respectively. However, their margin depends on their performance too. Margins of wholesalers are much higher than this because they also do retailing, where price increases almost by Rs 5 per kg. Nevertheless, they have to bear losses because of rotting up of tomato in selling or damaged in transportation. Their profit margin per kg is around 10 percent in district and more than 17 percent in Kathmandu of their investment.

Table 3.8: Cost and Margin of Wholesalers

Activities	Unit	District	Kathmandu
Purchase price	Rs/kg	16.0	18.0
Value addition cost	Rs/kg	3.9	1.6
Total cost	**Rs/kg**	**19.9**	**19.6**
Sale price	Rs/kg	22.0	23.0
Profit	**Rs/kg**	**2.1**	**3.4**
Profit margin percent	**%**	**10.6**	**17.1**

Source: Field Survey

3.2.5 Retailers

Many small vegetable shops are available in major market centers. Tomato is available on all shops in Kathmandu and other urban market. Table 3.9 presents cost and margin of retailers operating at district and Kathmandu with details in ***Annex 3.4***. Profit margin enjoyed by retailers operating at district and Kathmandu is Rs 4.6 and Rs 6.0 per kg which 17.82 percent and 22.8 percent of their investment respectively.

Table 3.9: Cost and Margin of Retailers

Activities	Unit	District	Kathmandu
Purchase price	Rs/kg	20.8	23.0
Value addition cost	Rs/kg	5.6	3.0
Total cost	**Rs/kg**	**26.4**	**26.0**
Sale price	Rs/kg	31.00	32.00
Profit	**Rs/kg**	**4.6**	**6.0**
Profit margin percent	**%**	**17.8**	**22.8**

Source: Field Survey

3.3 Analysis of Service Providers/Enablers

Table 3.10 presents different service providers together with their major functions, frequency and their limitation/weakness. Table reveals that farmers have been accessing services from different service providers. However most of them regularly access services from Agro-vets despite of their complained with the quality of material supplied by them. Private as well as public sector service providers have not only inadequate technical knowledge and skills but also human resources required for effective and efficient delivery of services.

Table 3.10: Assessment of Service Providers

Name	Major Functions	Frequency of Services	Limitations/Weakness
DADO	• Tomato seed distribution with 50% subsidiary • Tomato production demonstration in plastic house • Technical support and services • Training on Tomato cultivation • Plastic crate distribution • Equipments supply viz. water cane, sprayer, sprinkler irrigation pipe • Provide emergency services to control diseases	As per the Target fixed in annual program	• Not sufficient distribution materials to fulfill the demand of the farmers • Limited budget • Limited staff to provide services in big farm families and big area
Agro-vets	• Inputs supply • Advices	Regular	• No guarantee of seeds quality • Untimely availability • No advance knowledge
Financial Co-operatives	• Loan	Regular	• Limited amount of fund available for selected individual
Co-operative (Producers)	• Inputs supply especially seeds to the producers • Support in marketing	Seasonal	• No quality standard maintained • Costly seedlings • Lack of knowledge about new high yielding varieties to the Nursery man • Inadequate knowledge about the cultivars suitable for specific time and location for cultivation • Inadequate knowledge about crop and nursery management
Financial institution	• Loan/credit	Rare	• Complicated process not conducive for subsistence farmers

3.4 Opportunities and Challenges/Constraints Analysis

Table 3.11 analyzes on opportunities and constraints related to the value chain development of tomato. Major challenges or constraints includes availability of poor quality seed, inadequate technical knowledge and skills on cultivation practices, poor conditions of road, inactiveness of producers' or farmers group etc. Nevertheless, there exists ample of opportunities as well. Farmers are organized into producer associations and well established network exists. Potentiality for increase on production and productivity by small support and operation of agro-vets at the production center further provides opportunities for the development of tomato.

Table 3.11: Opportunities and Constraints

SN	Categories of constraints	Constraints/Challenges	Opportunities
1	Technology/ production process	• Seeds and seedlings not quality guaranteed • Incidence of diseases • Inadequate irrigation facility • Lack of advance technical skills and knowledge about crop production to the farmers • Timely delivery of farmers in postharvest technology	• GO, NOG, INGO, and other private service providers available • Consumers increasing and markets are emerging • Farmers interested with organic farming • High return from cultivation of crops • Potentials area expanding
2	Technical skill/ human resources	• Inadequate advance knowledge about nursery management, crop production practices of the nursery man and farmers respectively • Limited knowledge about the "Plastic House" cultivation practices • Limited knowledge about organic farming • Less interest of young generations in Agriculture occupation	• Plan Nepal, Seeds Nepal, SSMP, CEPRED, IDE Nepal along with govt. staff involved in development of skillful resources person and their mobilizations • Plastic House cultivation of crops increasing and encouraging • Inputs suppliers are available
3	Management/ production and organization	• Cost record not done by the farmers • Unlike/less interest in group works by farmers • Cropping calendar not properly followed • Weak coordination and linkages among different stakeholders • Crop management poor	• Farmers are active and organized in groups • Farmers are conscious about quality • Producers groups are active
4	Marketing	• Price mostly fixed by traders/ marketing committee • Inadequate knowledge about market demand/place • Lack of knowledge about harvesting time of maturity of crop for local and distant market • Little knowledge about packages and packaging materials for marketing • High transportation cost • Sorting and grading not necessarily done by farmers • In season, very low price	• Consumers demand high • Markets emerging • Demand can be met where there is no time for production as off season vegetable • Off season vegetable fetch high price

SN	Categories of constraints	Constraints/Challenges	Opportunities
5	Policy/ institutional issues	• Not sufficient budget to support the tomato growing farmers • Organic farmers package of practices not implemented • NO crop insurance	• Govt. priority in high value crop production • Tomato production in "Plastic House" is encouraging • Big market of organic produce
6	Finance	• Financial institutes are not interested to invest in production and marketing • High interest rate • Time for giving interest not conducive for farmers	• Saving and credit co-operatives are at the rural village • Private money lender available
7	Infrastructure	• No storage facility • Lack of marketing information center • Seasonal/ poor road condition • No facility for processing • Inadequate irrigation facility	• Irrigation facility improvement by DADO and NGO/INGO • Road improvement by DDC and VDC • Radio Nepal and FM give price information
8	Input supply	• No quality guarantee • High price of seed • No technical information about the seed supplied	• Advices of inputs supplier is available • High demand of farmers

CHAPTER 4 CONCLUSIONS AND RECOMMENDATIONS

4.1 SWOT Analysis

Table below summarizes strengths, weakness, opportunities and threats of tomato production based on findings of value chain analysis. Strengths and weakness are mainly related with the internal factors while opportunities and threats are external.

Strength	Weakness
• Tomato cultivation is an ongoing enterprises • It successfully grows in normal season as well as "off seasons" cultivation in Plastic House • Early or late cultivars seeds available • Consumers preference of Tomato • Organic farming of Tomato developing • Well established govt. organization, NGO, INGO and private service providers deliver services to the farmers • Tomato easily sale in local and distant market • High economic return • Organized marketing network • Traders check the balance of demand and supply • Farmers groups/cooperatives active in production and marketing	• No guarantee of seeds quality/ planting materials • Costly hybrid seed • Available resources are not fully and efficient utilized • High transportation cost • Inadequate knowledge about post harvest and handling procedures of perishable commodity • Unavailability of farm supplies to promote organic farming • Inadequate knowledge about IPM approach to manage manage/control pest and diseases • Lack of knowledge about complete package and practices of organic farming to the farmers/ technicians

Opportunity	Threats
• Tomato grows best in certain season/in certain places • Processing add value and their demand is year round • Markets and consumers are increasing • Provide alternatives to marketing in fresh form or processed form • Supermarkets are emerging • Creates job opportunities in Production, Processing and Marketing • Suitable soil and climatic condition favors the tomato cultivation • Tomato suitably fits in cropping pattern of farmers • Seeds and farm equipments supply in subsidiary price is encouraging • Supply of Plastic tunnel/Plastic House materials on subsidize • Loan/ credit facility available	• Unusual weather during production or harvesting • Major crop disease • Variation in price and quantity • Changing consumer demand • Bulky and perishable nature • Rejected/ unsellable from fresh market used for processing can't meet the definite standards of quality • Production is labor incentive • Zigzag road affects on quality during transportation • Sudden heavy rain/storm and hail stones damage the crop • Detention of to tomato loaded transportation vehicles on strike/ Banda deteriorate the quality

4.2 Recommendations

Based on the above SWOT analysis and findings of value chain analysis, the study recommended on following actions with a view to increase income and productivity from tomato cultivation. The focused should be on (a) improving the farming practices to increase production and productivity of farmers (b) Strengthen farmer's organizations and (c) improvement on marketing and distribution of tomato.

With a view to increase production and productivity of farmers by improving farming practices, following suggestions are made:

- Support for ensuring timely available of good quality seed
- Promote farm mechanization suitable for mountainous regions as a substitute for costly labour
- Promote off-season tomato cultivation through expansion of tunnel or shed technology
- Introduce crop insurance schemes
- Farmer access to production inputs including finance should be increased
- Provision of sufficient and quality extension services by strengthening farmer's organization and networks
- Mobilization of farmers and utilization of other linkages for bulk purchases and access to government subsidized fertilizer
- Develop crop husbandry practices/calendar of operation for tomato cultivation and disseminate with farmers
- Orient farmers on balance use of plant nutrients, to control disease and pests

- Strengthen capacity of farmers' on cultivation practices, especially on plant care management in case of disease and pest
- Establish resource center/information center at key production zones with a view to disseminate technical knowledge and market price information
- Develop and mobilize local resource persons for providing support services to farmers, especially on training and safe and efficient use of pesticide, insecticide and fertilizers
- Promote non-conventional irrigation technologies, especially rain water harvesting, catchment ponds and plastic ponds to supply water for irrigation during dry seasons
- Work in partnership with different agencies on delivery of inputs and services
- Conduct regular monitoring of diseases and pests
- Conduction of Integrated Crop Management (ICM) and Integrated pest management training to farmers
- Train agro-vets and other input suppliers on different cultivars suitable for the locality and discourage use of un-recommended variety

Following actions are suggested for developing and strengthening of farmers' institutions

- ➢ Raise awareness about the benefits of working in a group and cooperative
- ➢ Organize farmers into group and cooperatives for collective marketing and support to form a co-operative
- ➢ Involve cooperatives and groups on marketing of produce
- ➢ Support cooperative and producer's association to develop business plan of their produce
- ➢ Build the capacity of producer's associations and cooperatives by supporting on assets building and addressing their operational constraints
- ➢ Support for organizations and registrations cooperatives with concerned government institutions
- ➢ Mobilize farmers co-operatives to function as Agri-input suppliers along with technical advice

Following actions are suggested for strengthening marketing and distribution of tomato

- Collection and dissemination of information on market prices, demand-supply conditions, market destinations by using mobile network system etc
- Discourage bamboo basket for transport and promote plastic crate for reducing loss during transportation
- Establish a revolving fund/loan at the cooperatives to provide loan to farmers who are on immediate need of cash for seed and fertilizer such that farmers don't depend on collectors
- Organize interactions between traders and producers to strengthen linkages and

communications with each others

- Explore possibility of small value addition and processing of tomato such as ketchup
- Improve tomato marketing by promoting market information systems, and educating and raising farmers' awareness on group approach of marketing
- Support for packaging of tomato such that freshness could be maintained
- Train transporter and collectors on type of vehicle used for transportation along with developing appropriate carrying structures such that transportation losses could be minimized and freshness of tomato could be maintained
- Modify vehicle use improvement on existing transportation system

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Annex 1.1: Consultations with Producers

District: Ramechhap

Location: Khimti

Name of participants

SN	Name of Persons Met
1	Mrs Mira Poudel
2	Mr Bhoj Prasad Pokhrel
3	Mrs Dipsikha Dahal
4	Mrs Gita Dahal
5	Mrs Kalyani Thapa
6	Mrs Sushila Thapa
7	Mrs Durga Kadariya
8	Mrs Uma Devi Pokharel
9	Mrs Gova Dahal
10	Mrs Durga Dahal
11	Mrs Pushpa Dahal
12	Mr Bhoj Prasad Khadka
13	Mr Chitra Prasad Pokharel

District: Dolakha

Location: Sundrawati

Name of participants

SN	Name of Persons Met
1	Mr Rudra Bahadur Oli
2	Mr Jaganath Pakuwal
3	Mr Ganesh Bahadur
4	Mr Ram Bahadur Thami

District: Kavre

Location: Kuntabesi

Name of participants

SN	Name of Person Met
1	Mr Achyut Prasad Sapkota
2	Mr Shyam Prasad Sapkota
3	Mr Ram Prasad Sapkota
4	Mr Pashupati Prasad Sapkota
5	Mrs Parbati Sapkota
6	Mrs Bagititi Sapkota
7	Mrs Bhawani Sapkota
8	Mrs Menuka Sapkota
9	Mr Maheswar Dahal
10	Mr Hari Prasad Sapkota

District: Sindhuli

Location: Kamalamai Municipality - 11

Name of participants

SN	Name of persons met
1	Mr Ganesh Prasad Niraula
2	Mrs Sarda Giri
3	Mr Santosh Giri
4	Mrs Renuka Bhandari

Location: Dhang Gaun, Kamalamai Municipality - 7

Name of participants

SN	Name of persons met
1	Mr. Chet Bhd. Baral
2	Mr. Dilli B. Palpali
3	Mr. Murari Shrestha
4	Mr. Hari B. Karki
5	Mr. Tanka Lal Shrestha
6	Mr. Tirtha Kumari Baral
7	Mr. Ambika Palpali
8	Mr. Gyanu Karki
9	Mr. Arun Thapa
10	Mr. Yadav Raj Karki

Annex 1.2: Consultations with Value Chain Stakeholders

District: Dolakha

Name of participants

SN	Name	Location	Major functions
1	Mr Sher Bahadur Gurung	Makaibari	Trader/Collector
2	Mr Ramesh Shrestha	Charikot	Trader/Collector
3	Mr Puroshtam Ghimire	Charikot	Trader/Collector
4	Mr Rajan Shrestha	Dolalghat	Trader
5	Mr Indra Pathak	Charikot	Wholesellar
6	Mr. Shantosh Raut	Charikot	Retailer
7	Mr Shyam Shah	Charikot	Trader/Collector
8	Mr Narbahadur Tamang	Charikot	Trader/Collector
9	Mr Chitra Bahadur Tamang	Charikot	Trader/Collector
10	Mr Sher Bahadur Tamang	Charikot	Trader/Collector
11	Mr. Bal Krishna Oli	Pawati	Trader

District: Ramechhap

Name of participants

SN	Name	Location	Major functions
1	Mrs Sita Karki	Manthali	Retailer
2	Mr Santosh Thapa	Manthali	Wholeseller
3	Mr Mukti Prasad Prasain	Pakhrebal	Retailer
4	Mr Sher Bahadur Shrestha	Manthali	Retailer
5	Mr. Bhakta Manandhar	Manthali – 5	Collector/Trader/Wholesaler/Retailer

District: Kavre

Name of participants

SN	Name	Location	Major functions
1	Mr. Dhan B. Bhujel	Banepa	Trader/Collector/Wholesaler/Retailer
2	Mr. Lal Kaji Lama	Banepa	Trader/Collector/Wholesaler/
3	Mr. Durga Narayan Shrestha	New Baneshwor	Trader/Collector/Wholesaler/Retailer
4	Mr. Tej Kumar Shrestha	Banepa	Collector
5	Mr. Kishan Shrestha	Banepa	Retailer
6	Mr. Om Krishnsa Shrestha	Banepa	Retailer
7	Ms. Reena Shrestha	Banepa	Retailer
8	Mr. Ishwor Thapa	Patlekhet	Collector/Trader

District: Sindhuli

Name of participants

SN	Name	Location	Major functions
1	Mr. Hari Bhd. Karki	Kamalamai Municpality	Collector/Trader
2	Mr. Arun Thapa	Kamalamai Municpality	Collector/Trader
3	Mr. Hari Bhd. Karki	Kamalami NP	Collector/Trader
4	Mr. Shredhi Parajuli	Bhiman	Retailer / Trader
5	Ms. Sitam Maya Devi	Bhiman	Retailer
6	Ms. Kavita Khoer	Bhiman	Retailer

Annex 1.3: Consultations with Service Delivery Agencies

District: Ramechhap

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr. Tanka Kr. Shrestha	Bhanu & Nisha Vet. Shop	Manthali	Input Supplier
2	Mr. Narayan Poudel	Ramechhap Agro-Center	Manthali	Input Supplier
3	Mr. Shree Kr. Shrestha	Jamarko Krishi Sahakari Sanstha	Kathjor	Input Supplier
4	Mr. Chabilal Ghimire	DADO	Manthali	Technical Support
5	Mr. Govinda Pokhrel	DADO	Manthali	Technical Support
6	Mr. Mohan Pd. Khatiwada	DADO	Manthali	Technical Support
7	Mr. Rishiraj Subedi	DADO	Manthali	Technical Support
8	Mr. Shiv Narayan Ran	DADO	Manthali	Technical Support

District: Dolakha

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr Shree Lal Baral	DADO	Charikot	Technical Support
2	Mrs Sangeeta Sunuwar	DADO	Charikot	Technical Support
3	Mr Tara Dahal	DADO	Charikot	Technical Support
4	Mr Parmeswor Mandal	DADO	Charikot	Technical Support
5	Mr Dal Bahadur Tamang	Cooperatives	Charikot	Input Supplier/Financing
6	Mr Vasu Thapa	Agro-Vet Shop	Charikot	Input Supplier

District: Kavre

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr. Ishowri Pandey	DADO	Dhulikhel	Technical Support
2	Mr. Surya B. Thapa	DADO	Dhulikhel	Technical Support
3	Mr. Ek Bhd. Tamang	Sankhu Saving and Credit Cooperative Society Limited	Sankhu	Input Supplier/Financing
4	Mr. Basu Dhital	Yuwa Krishi Sahakar Santha Limited	Patlekhet	Input Supplier/Financing
5	Mr. Dinesh Tiwari	Yuwa Krishi Sahakar Santha Limited	Patlekhet	Input Supplier/Financing
6	Mr. Kumar Neupane	Hanuman Agro-vet Pvt. Ltd	Patlekhet	Input Supplier/ Technical Support

District: Sindhuli

Name of participants

SN	Name of Person	Institutions	Location	Major functions
1	Mr. Bikram Raj Giri	Giri Agro-vet Centre	Sindhulimadi	Input Supplier
2	Mr. Om Prakash Shrestha	Kamalamai Vet Suppliers	Sindhulimadi	Input Supplier
3	Mr. Bel Bdr. Badal	Sindhuli Vet Pharma	Sindhulimadi	Input Supplier
4	Mr. Dor. Bdr. Rayamajhi	DADO	Sindhulimadi	Technical Support
5	Mr. Ram Dular Sah	DADO	Sindhulimadi	Technical Support
6	Mr. Nathuni Yadav	DADO	Sindhulimadi	Technical Support
7	Mr. Jahan Bdr. Karki	DADO	Sindhulimadi	Technical Support
8	Mr. Yogendra Jha	DADO	Sindhulimadi	Technical Support

Annex 3.1: Cost of Cultivation of Tomato

A. Kavre

Unit: 1 ropani (0.05 ha);

S.N.	Particulars	Unit	Quantity	Rate (Rs)	Amount (Rs)
1	Inputs				
	Seeds	gm	10	40	400
	Compost	Kg	30	30	900
	DAP	Kg	5	36	180
	Urea	Kg	3	22	66
	Pesticides	Ls	1	800	800
	Sub-total				**2,346**
2	Labor				
	Seedling preparation	No	1	300	300
	Tractor	Hr	1	400	400
	Dang preparation	No	1	400	400
	Compost carrying and spreading	No	2	300	600
	Seedling planting	No	1	300	300
	Mulching (Ukera)	No	2	500	1,000
	Irrigation and pesticide spraying	No	1	500	500
	Picking and transportation	No	7	300	2,100
	Sub-total				**5,600**
3	**Total expenses**				**7,946**
4	**Sales**	Kg	2500	12	**30,000**
5	**Profit**				**22,054**

		Total	**Rs/kg**
Input use		2,346	0.94
Labor		5,600	2.24
Total expense (Cost)		7,946	3.18
Sale price		12	12.00
Profit		22,054	8.82
Profit percent		277.55	277.55

B. Ramechhap

In Shed: 4 Ana (0.01 ha)

S.N.	Particulars	Unit	Quantity	Rate (Rs)	Amount (Rs)	Remarks
1	Inputs					
	Seeds	gm	8	65	520	
	Compost	Doko	11	50	550	
	Sandy soil	Bhari	1	50	50	
	Bamboo	No	24	50	1,200	
	Plastic	Ls	1	1,300	1,300	
	Rope	Ls	1	120	120	
	Oil cake	Kg	2	25	50	
	Vitamin	Ls	1	100	100	
	Sub-total				**3,890**	
2	Labor					
	Land preparation for seedling growing	Hr	1	37.5	37.5	Female
	Seed sowing, covering with paral and irrigation	Hr	1	37.5	37.5	Female
	Bamboo work and digging	No	5	500	2,500	Male
	Plastic sewing	Ls	1	200	200	
	Covering shed with plastic	Hr	1	62.5	62.5	Male
	Composting, sapling planting and irrigation	No	1	300	300	Female
	Weeding	Hr	3	37.5	112.5	Female
	Bamboo stick burrowing and ropening	Hr	3	37.5	112.5	Female
	Pruning	Hr	3	37.5	112.5	Female
	Picking	No	3	300	900	Female
	Sub-total				**4,375**	
3	**Total Expenses**				**8,265**	
4	**Sales**	Kg	1,500	25	**37,500**	
5	**Profit**				**29,235**	

		Total	Rs/kg
Input use		3,890	2.6
Labor		4,375	2.9
Total expense (Cost)		8,265	5.5
Sale price		25	25
Profit		29,235	19.7
Profit percent		353.7	353.7

C. Dolakha

In Tunnel (64 plants) 9m*4m

S.N.	Particulars	Unit	Quantity	Rate (Rs)	Amount (Rs)	Remarks
1	Inputs					
	Seeds	gm	10	28.5	285	
	Compost	Doko	7	120	840	
	Bamboo	No	30	75	2,250	
	Plastic	Kg	13	260	3,380	
	Rope	Ls	1	300	300	
	Sub-total				**7,055**	
2	Labor					
	Land preparation for seedling growing	Hr	3	37.5	112.5	
	Seed sowing in lines and irrigation	Hr	3	37.5	112.5	
	Bamboo work and digging	No	5	300	1,500	
	Covering shed with plastic	Hr	3	62.5	187.5	
	Composting, sapling planting and irrigation	No	1	300	300	
	Weeding	No	1	100	100	
	Bamboo stick burrowing and ripening	Hr	3	37.5	112.5	
	Pruning	No	1	300	300	
	Picking	No	5	300	1,500	
	Sub-total				**4,225**	
3	**Total Expenses**				**11,280**	
4	**Sales**	Kg	1,200	30	**36,000**	
5	**Profit**				**24,720**	

	Rs/Kg	219.1
Input use	5.88	
Labor	3.52	
Total expense (Cost)	9.4	
Sale price	30	
Profit	20.6	
Profit percent	219	

D. Sindhuli

S.N.	Particulars	Unit	Quantity	Rate (Rs)	Amount (Rs)
1	Inputs				
	Seeds	Gm	10	26	260
	Compost	Kg	25	50	1,250
	DAP	Kg	5	40	200
	Urea	Kg	9	75	675
	Potash	Kg	2	50	100
	Pesticides	Ls	1	2,000	2,000
	Sub-total				**4,485**
2	Labor				
	Oxen ploughing	No	1	800	800
	Land preparation				
	Male Labor	No	3	300	900
	Female Labor	No	2	150	300
	Seedling planting				
	Male Labor	No	1	300	300
	Female Labor	No	2	150	300
	Composting	No	2	150	300
	Irrigation and pesticide spraying	No	1	300	300
	Picking and transportation	No	7	150	1,050
	Sub-total				**4,250**
3	**Total expenses**				**8,735**
4	**Sales**	Kg	1,000	25	**25,000**
5	**Profit**				**16,265**

Input use	4.48		
Labor	4.25		
Total expense (Cost)	8.73		
Sale price	25		
Profit	16.27		
Profit percent	186.2		

Annex 3.2: Cost and Margin of Collectors Operating at District Headquarters and Kathmandu

A. Districts

SN	Price (NRs.)	Districts	Basis
		Kavre	Kavre
1	Farm Gate	12.0	
2	Transport till road head	0.4	The cost of carrying 55 kg of potato is Rs. 20
3	Load	0.1	Rs. 5 is loading charge for 55 kg
4	Transport till DHQ	0.5	Rs. 1600 for 3000 kg
5	Unload	0.1	Rs. 4 for unloading 55 Kg
6	Crate (Rental)	0.2	Rs. 8 per 50 kg of potato crate
7	Wage	**0.2**	2 people working for one day @ Rs. 300 per day per person; Daily handling of 2.5 ton
8	Food expenses	0.1	Rs. 140 per two persons
9	Sub-total	13.5	
10	Interest	0.0	
11	Total	13.5	
12	Loss (3.5 percent)	0.5	
13	Overall Cost Price	**14.0**	
14	Sales price to Wholesaler	**16.0**	
15	Profit Margin to collector	2.0	

Unit: Rs/Kg

B. Kathmandu

SN	Price (NRs.)	Districts	Basis
		Kavre	Kavre
1	Farm Gate	12.00	
2	Transport till road head	0.36	The cost of carrying 55 kg of potato is Rs. 20
3	Load	0.09	Rs. 5 is loading charge for 55 kg
4	Transport till Kathmandu	1.50	It cost Rs. 2 per Kg to transport from Kavre to KTM
5	Unload	0.07	Rs. 4 for unloading 55 Kg
6	Tax	0.02	About Nrs. 150 per truck
7	Shack	0.16	Rs. 8 per 50 kg of potato shack
8	Wage	0.16	2 people working for two days @ Rs. 300 per day per person
9	Food expenses	0.04	Rs. 140 per two persons
10	Lodging	0.00	Rs. 800 for two persons
11	Sub-total	14.40	
12	Interest	0.004	
13	Cost	14.40	
15	Margin by Wholesaler	1.26	
16	Total cost	15.66	
17	Sales price to wholesaler/Retailers	**18**	
18	Profit margin	2.34	

Annex 3.3: Cost and Margin of Wholesalers Operating at District Headquarters and Kathmandu

Unit: Rs/Kg

SN	Price (NRs.)	Districts		Basis	
		Kavre	KTM	Kavre	Kathmandu
1	Purchase from Collector	16.00	18.0		Rate is same as Kavre except Rs.0.5 additional expenses on transport
2	Unload	0.07	0.1	Rs. 4 for unloading 55 Kg	Rs. 5 for unloading 55 Kg
3	Crate	0.16	0.2	Rs. 8 per 50 kg of Tomato shack	Rs. 8 per 50 kg of Tomato shack
4	Wage	2.86	0.3	Month salary of Rs. 5000; Daily handling of 1750 kg	Monthly salary per person is Rs. 7000; Daily handling of 750 kg
5	Food expenses	0.08	0.19	Rs. 140 per two persons	Rs. 140 per two persons
6	Storage	0.04	0.1	Rs. 2000 per month for storage rental	Rs. 2500 per month
7	Utility (electricity)	0.001	0.1	Rs. 60 per month	Rs. 90 per month
8	Sub-total	19.21	19.0		
9	Interest	0.01	0.01		
10	Total	19.21	18.98		
11	Loss (3.5 percent)	0.672	0.664		
12	Overall Cost Price	19.89	19.65		
13	Sales price to Retailer	22	23		
14	Profit Margin to collector	2.11	3.35		

Annex 3.4: Cost and Margin of Retailers Operating at District Headquarters and Kathmandu

Study districts

Unit: Rs/Kg

SN	Price (NRs.)	Districts				Basis			
		Kavre	Dolakha	Sindhuli	Ramechhap	Kavre	Dolakha	Sindhuli	Ramechhap
1	Purchase from wholesaler, collector or farmer	16.0	25	20	22				
2	Retail Space	1.4	0.12	1.3	1.0	Monthly rental is Rs. 2500; Daily sales is about 60 kg	Daily 50 Kg sales; monthly rent of Rs. 2500	Daily 50 Kg sales; monthly rent of Rs. 2000	Daily 70 Kg sales; monthly rent of Rs. 2000
3	Packaging (Plastic)	0.2	0.15	0.15	0.15				
4	Wage	1.9	2.67	2.3	1.4	Month salary is about 3500	Month salary is about 4000	Month salary is about 3500	Month salary is about 3000
5	**Sub-total**	19.5	27.93	23.82	24.53				
6	Loss (10 percent)	1.9	2.79	2.38	2.45				
7	Total	21.4	30.73	26.20	26.98				
8	**Sales**	25.0	35.000	32	32				
9	Margin	**3.6**	**4.27**	**5.80**	**5.02**				

Kathmandu

SN	Price (NRs.)	Kathmandu	Basis
1	Cost of Tomato	23	
2	Packaging Plastic Bag	0.15	
5	Room rent	0.07	Average room rent is about 1500
6	Wage and Salary	0.16	Rs. 3500 salary per month;
7	Electricity	0.30	Rs. 500 spend per month
9	Sub-total	**23.68**	
10	Loss (10 percent)	2.37	
11	**Overall Cost of Retailer**	**26.04**	
14	Selling price of Retailer	32	
15	Margin for Retailer	5.96	

Section 5
Pilot Projects

Section 5: Pilot Projects

Table of Contents

CHAPTER 1 INTRODUCTION

1.1 Objectives of the Pilot Projects

In the phase 2 of the Study, between July 2012 and October 2013, pilot projects were implemented in the study area. The objectives of the pilot projects were as follows.

Objectives of Pilot Projects

1. **Verification of the validity of Draft Basic Development Strategy**
2. **Reflect the lessons obtained through implementation of pilot projects to the revision of Draft Basic Development Strategy**
3. **Establish the referential model in the promotion of HVCs**
4. **Capacity development of the MOAD staff through their involvements in planning, implementation, and management of pilot projects**

The pilot projects were planned and implemented with taking into consideration multiple aspects of agricultural commercialization, e.g. facilities, technologies, marketing, and organization strengthening. They consisted of various components that helped verification of the Draft Basic Development Strategy. The outcomes of the pilot projects were used for the improvement of approach as well as for its further expansion in the future. Due to the short implementation period, the pilots that produce tangible lessons and outcomes within the period were chosen. Some aspects considered for designing the pilot projects are explained below.

(1) Comprehensive Approach Proposed in Program Formulation Study (JICA 2009)

The Program Formulation Study conducted in 2009 for the SRC area proposed the comprehensive development program towards 2018. It included various project plans based on the five focal points; 1) improvement of infrastructures/facilities; 2) improvement of agricultural production techniques; 3) strengthening of farmer groups/cooperatives; 4) improvement of post-harvest handling/processing/ marketing; and 5) consideration of environmental aspect. The Draft Basic Development Strategy has taken into account these points. In the formulation of pilot project, these aspects also were considered in the ways that they relate each other within a comprehensive picture.

(2) Financial Sustainability

In the formulation of pilot projects, special attention was paid to the financial sustainability. The verified approach cannot be sustained without due consideration on financial aspect. Thus, pilot projects under this study were designed not only to be effective but also to be financially efficient. Various fund sources, e.g. government (MOAD, DDC, etc.), donors, producers, private sector, financial institutions, etc., were analyzed and how to create the sound cost sharing methods for the future expansion of the approach were considered for the financial sustainability.

(3) Bottlenecks in the Value Chain

The pilot projects were designed in a way that contribute to breaking the bottlenecks in the value chain of the target commodities. The private businesses and in some cases NGOs as players in the value chains are important since they are often in better position to perform from various aspects, e.g. information, technology, finance, etc. The government sector players are expected to take roles for bridging between different players for the improvement of the value chains. Therefore, the pilot projects also sought for the ways the government sector counterparts perform such bridging roles.

1.2 Criteria for Selection of Pilot Projects

In light of the objectives of pilot projects discussed above, the selection criteria for the pilot projects that consist of three categories in stratum were proposed in March 2012. The definitions of three categories of criteria were as follows.

1st Criteria:

Criteria in this category related to the “approach” of the pilots, i.e. what to be verified, with what kind of activity contents and designs. All these criteria had to meet to be selected as pilot projects as the necessary conditions.

2nd Criteria:

Criteria in this category related to the “location” of the pilots. After the 1st criteria was met, 2nd criteria were applied. All these criteria were regarded as the ones that must be met, in order to decide the locations of pilots.

3rd Criteria:

It was proposed to apply 3rd criteria only in the cases when competing target areas/groups emerged after the application of 1st and 2nd criteria. As it was seen in Table 1.1, 3rd criteria address on the consideration of social aspects. Although it was unquestionable that the social aspects need to be paid attention, for the prime purpose of implementing the pilot project (the verification of the approach proposed in DBDS), social aspects should not be regarded as most important. Rather, it was proposed that social aspects should be taken into consideration in the expansion stage after the verification of approaches. Table 1.1 below lists the criteria proposed by the Study Team.

Table 1.1: Criteria Proposed for the Selection of Pilot Projects

#	Selection Criteria	Approach	Location
1st Criteria (regarding the approach of pilot: all criteria listed below needs to be met)			
1	No negative social and environmental impacts assumed	✔	
2	Sustainability of the activity and effects after the completion	✔	
3	Capacity of DADOs and DLSOs in study districts (i.e. for implementation, monitoring, budget allocation for these activities)	✔	
4	Importance in the verification of the approach presented in DBDS	✔	
5	Relation to the potential commodities identified in DBDS	✔	

6	Cost required will be within the allocated budget	✔	
7	Feasible to implement	✔	
8	Outcomes are verifiable within limited time period	✔	
9	Composition of the pilots as a whole covers different activities in value chain	✔	
10	Potential for spreading effect	✔	
2nd Criteria (regarding the location of pilot: all criteria listed below needs to be met)			
1	Accessibility (in light of demonstration effects)		✔
2	Ease of periodical monitoring		✔
3	Availability of necessary natural resources such as land and water		✔
4	Willingness of the stakeholders to participate (include the cost and labor sharing, depending on the design of pilot)		✔
5	Future potential in light of production and marketing as against current situation		✔
6	Balance among different zones (to promote vegetable, fruits, and livestock)		✔
7	Balance among study districts		✔
3rd Criteria (consider after 1st and 2nd criteria)			
1	Social status, e.g. poverty level, ethnic minority, etc. (taking into consideration in case when further selection is required after application of 1st and 2nd criteria)		✔
2	Equity, in order to avoid arousing the sense of partiality among stakeholders (verification of the approach should be prioritized for pilots and expansion of the approach with consideration of equity will come at later stage)		✔

1.3 Proposed Composition of Pilot Projects

Based on the discussions in the previous sections and objectives of the pilot project stated above, three categories of pilot project, i.e. Core, Horticulture and Livestock, were proposed as listed in the table below.

Table 1.2: Proposed Pilot Projects

#	**CORE Pilots (prerequisite for all pilot sites)**	**Horticulture**		**Livestock**	
		Vege.	Fruit	Dairy	Goat
C-1	Improvement of Agricultural Commercialization Support Service from DADO/DLSO	✔	✔	✔	✔
C-2	Introduction of Integrated Collection Center System with Public-Private Partnership (PPP) approach	✔	✔	✔	✔

#	**HORTICULTURE Pilots (to be combined with CORE pilots)**	**Horticulture**	
		Vege.	Fruit
H-1	Introduction of Unified Standard Group Production for Marketing	✔	✔
H-2	Introduction of the Multiple Water Utilization and Micro Irrigation System	✔	
H-3	Utilization of Rain-shed Plastic House	✔	
H-4	Quality Improvement of Seedlings and Saplings	✔	✔
H-5	Single Cropping and Tree Management for Citrus (esp. Suntara)		✔
H-6	Appropriate Pruning and Thinning for Citrus		✔

H-7	Introduction of Unified Grading and Proper Packaging System	✔	✔
H-8	Junar Processing for Improvement of Storability and Transportability		✔

#	**LIVESTOCK Pilots (to be combined with CORE pilots)**	**Livestock**	
		Dairy	Goat
L-1	Effective Use of Low-Quality Roughage	✔	
L-2	Development of Roughage and Concentrate Mixed Feeding	✔	
L-3	Fodder Yield Improvement by the Establishment of Technique by Utilizing Slope Area	✔	✔
L-4	Evaluation of Dairy Performance of Distributed Stud Bulls by Govt.	✔	
L-5	Monitoring of Candidate Breeding Buffalo Bull and Breeding Bull by Using Frozen Semen (AI) for the Efficient Implementation of Genetic Improvement	✔	
L-6	Liver Fluke/Internal Parasite Control	✔	
L-7	Improvement of Housing of Milking Animal for Hygiene Control and Prevention of Mastitis	✔	
L-8	Improvement of Rearing Environment for Goats		✔
L-9	Improving local practice of goat selection		✔
L-10	Establishment of Roughage Based Stall Feeding Technique		✔

CORE Pilots : C-1 and C-2

C-1	**Improvement of Agricultural Commercialization Support Service from DADO/DLSO**
Target crop	All crops and livestock
Location	ASC coverage area of DADO/DLSO where pilots are implemented
Target Group	Producers groups (cooperatives etc.) undertaking the pilot projects
Implementation	・ Guide and support target groups for implementation of pilots wherever JT/JTA can. ・ Accumulate the experience in promotion of agricultural commercialization through pilot implementation.
Monitoring	・ Writing of daily log ・ Performance and outcomes of pilot activities involved ・ Interview with producer groups for their performance
Demonstration effect	・ Improved capacity of JT/JTAs in promoting agricultural commercialization ・ Outcomes of all pilots will bring out demonstration effects

C-2	**Introduction of Integrated Collection Center System with Public-Private Partnership (PPP) approach**
Target crop	Vegetables, fruits, milk, livestock for meat
Location	・ Central location of various producer and their groups within the accessible distance ・ Appropriate lands available, size, location on the roadside
Target Group	・ Member of active producers group ・ Farmers practice various types of agriculture in both horticulture and livestock ・ Willing to sell their produce through management of collection center ・ Traders and input supplier in Value chains

Implementation	・ Facility development ・ Coordination of participants with PPP modality based on Participatory Market Chain Approach proven in some other areas of Nepal ・ Coordinate market management committee to link marketing and production ・ Link this activity with other pilot projects
Monitoring	Quantity of handled produce, efficiency of collection, sales amount, etc.
Demonstration effect	・ Increase in handling volume and sale of collection center ・ Improvement in marketability

HORTICULTURE Pilots: H-1, H-2, H-3, H-4, H-5, H-6, H-7, H-8

H-1	**Introduction of Unified Standard Group Production for Marketing**
Target crop	Vegetables, Fruits
Location	Combination with C-2
Target Group	Producer groups producing same crop
Implementation	・ Coordinate producers to produce same crop in same standard ・ Arrange input in same standard ・ Organize workshop to understand equal standard of cultivation management ・ Plan and start production in same procedure to attain same quality crop as group
Monitoring	・ Process and outcome of each producer's practice ・ Quality and condition of produce as output ・ Marketability and profitability
Demonstration effect	・ Improvement in market response for stable and reliable quality and quantity ・ Improvement in marketability leads to better price ・ Efficient handing with uniform product ・ Lower inventory management cost and reduction of waste ・ Increase of profits

H-2	**Introduction of the Multiple Water Utilization System (MWUS) and Micro Irrigation System to Improve Productivity of Dry-season Vegetable in Less Irrigated Area**
Target crop	Tomato, Cauliflower and other green leafy vegetables
Location	・ Accessible distance from major road for proper delivery of fresh vegetable. ・ Accessible distance to carry the water into the system from water source ・ Appropriate water source available at upstream
Target Group	Members of producer groups with abilities to shoulder partial cost of the system and to maintain, afford to buy other inputs
Implementation	・ Coordinate community for water use ・ Design the basic structure of water utilization system ・ Establish a local supplier to overview the distribution and maintenance
Monitoring	・ Distribution condition of water through system, ・ Quantity and quality of produce, labor condition, sales
Demonstration effect	・ Improvement of life and work conditions after introduction ・ Quantity of vegetable produced during dry season ・ Increased profit from vegetable production

H-3	Utilization of Rain-shed Plastic House for Improvement of Quality and Quantity for Vegetable Production
Target crop	Tomato, cucumber, green leafy vegetables
Location	Accessible distance from target site of C-2
Target Group	Producer has funds to shoulder part of initial and maintenance cost, with the capability to build the frame by himself
Implementation	Combination with H-2 (drip irrigation)
Monitoring	Harvest, quantity, condition, labor, sales
Demonstration effect	・ Quantity of production, sales amount and profit ・ Analyze the cost (setup for facility and maintenance, production input, labor, etc.) and benefits (sales, improvement of labor quality, etc.)

H-4	Quality Improvement of Seedlings and Saplings for Commercial Production
Target crop	Tomato, Junar, orange
Location	Accessible area from target crop growers
Target Group	・ Seedling and sapling producers ・ Existence of at least one established business as a seedling producer in the region
Implementation	・ Provide technical assistance to transfer appropriate ideas and techniques ・ Guarantee of the sales value for experimented seedlings ・ Partial assistance of equipment if needed
Monitoring	Condition of seedling, number produced,
Demonstration effect	・ Survival rate of seedlings and saplings, ・ Fruit quality, plant and tree condition ・ Profitability of seedling production

H-5	Single Cropping and Tree Management for Citrus Orchards
Target crop	Orange
Location	Commercial orchard in accessible distance from major road for monitoring
Target Group	・ Managing orchard with vegetable intercropping under tree ・ Implementing a traditional practice of tree management
Implementation	・ Shift the under tree cropping pattern of orchard from vegetable to perennial feed crop ・ Appropriate variety needs to be identified from experimental planting during pilot project
Monitoring	・ Quality and quantity of fruit, tree condition ・ Labor condition, efficiency of work hour for same amount of tree care ・ Total sales including vegetable sales producers have expected
Demonstration effect	Compare cost, lost opportunity for vegetable production as against benefits, improvement of fruit quality and quantity, value of feed for livestock, work efficiency, etc.

H-6	Appropriate Pruning/Thinning Techniques to Improve Citrus Fruits Quality and Quantity
Target crop	Junar, orange
Location	Commercial orchard within accessible distance, possible for monitoring and demonstration
Target Group	・ Orchard growers practicing traditional tree management ・ Sufficient family labor to thoroughly practice the technique
Implementation	・ Designate a plot to compare the techniques between introduced and traditional ・ Guarantee of loss for experiment

Monitoring	・ Fruit quality and quantity, tree conditions ・ Efficiency of work input. Compare the hours and output from work ・ Total sales, compare the sales value
Demonstration effect	Comparison of cost (work input) and benefit (total sale, quality x quantity)

H-7	Introduction of Unified Grading and Proper Packaging System to Improve Consumer Trust
Target crop	Cauliflower, other vegetables and fruits
Location	・ Area under commercial production and shipping produce in bulk without packing ・ Multiple number of producers producing same crop ・ Within the distance of the collection center
Target Group	・ Producers organizing an active group or cooperative for producing same crop ・ Producers arranging transportation (truck) for shipment
Implementation	・ Organize the uniform production with same input and management ・ Selection and packing practice at collection center ・ Examine current shipping condition ・ Identify procedure to improve packaging for efficiency of transportation ・ Examine the cost and condition of transportation with new packaging
Monitoring	Product quality, labor input, marketability, sales value, efficiency of load, condition of produce in the package
Demonstration effect	Improvement in marketability, loss ratio at consumption area, efficiency in transportation, reduction in transportation cost, improvement in labor efficiency, improvement in arrival quality at destination

H-8	Junar Processing for Improve Storability and Transportability
Target crop	Junar, orange
Location	Within production area
Target Group	Farmer with excess production
Implementation	・ Coordination with processing factory ・ Technical assistance from processing factory for preparation and production (extraction) ・ Sample production of final product and marketing test
Monitoring	Quality of primary product, quality of final product, production efficiency (yield rate)
Demonstration effect	・ Reduction in product loss ・ Contributions to income

LIVESTOCK Pilots: L-1, L-2, L-3, L-4, L-5, L-6, L-7, L-8, L-9, L-10

L-1	Effective Use of Low-Quality Roughage (Introduce of Urea Treatment)
Target produce	Milk (Cows and Buffalos)
Location	Accessible distance from Livestock service center, sub-service center and DLSO.
Target Group	Dairy farmers: The members of the target group may be relatives so that they are willing to share the result and disseminate this technique among themselves.
Implementation	・ Treat roughage by urea to improve nutritional value, and storage stability and feed treated rice straw to lactating animals. ・ Compare if this technique could give positive effect on milk production of cows and buffalos.
Monitoring	・Quality and quantity of milk production. ・Extra cost and labor involved.

Demonstration effect	・Improvement of quality (fat contents) in milk. ・Improvement of quantity of milk ・Increase of profit from the result

L-2	**Development of Roughage and Concentrate Mixed Feeding**
Target produce	Milk (Cows and Buffalos)
Location	Accessible distance from Livestock service center, sub-service center and DLSO.
Target Group	A group of dairy farmers, desirably relatives so that they are willing to share the result and disseminate this technique among themselves.
Activities/ Contents	・ Apply newly developed high nutrition feed to dairy animals and compare the effect on quantity and quality of milk production. ・ Rice straws chopped into small pieces (about 2 centimeters) will be mixed into the usual concentrated mixed feed, which contains corn flour, rice polish, mustard seed oil cake, or wheat, in order to increase nutrition and amount in the feed. In addition, the concentration of TDN and CP in the mixed feed will be fixed as more than 65% and 15% respectively. It is expected that this inexpensive mixed feed will improve quality and quantity of milk production.
Monitoring	・Quality and quantity of milk production. ・Extra cost and labor involved in this effort.
Demonstration effect	・Improvement of quality (fat contents) in milk. ・Improvement of quantity of milk ・Increase of profit from the result

L-3	**Fodder Yield Improvement by the Establishment of Technique by Utilizing Slope Area**
Target produce	Milk, Meat
Location	・Accessible distance from Livestock service center, sub-service center and DLSO. ・Area where Community forest user group and leasehold forest user group is present.
Target Group	A group of dairy farmers, desirably relatives, Community forest user group and leasehold forest user group so that they are willing to share the result and disseminate this technique among themselves.
Implementation	・ Fodder production utilizing unused land including road side slope and agro-forestry (3 tier system of fodder production) ・ Integration of the forage and fodder tree production with Road side Bio-engineering ・ Verification of method of planting work by using "Nursery block" ・ Establishment of a seed re-distribution system
Monitoring	・Quality and quantity of milk production. ・Growth of the forage and fodder trees ・Extra cost and labor involved.
Demonstration effect	・ Quantity of production, sales amount and profit ・ Analysis of the cost (setup the facility and maintenance, input, labor, etc) and benefit (improvement milk production and income, etc.) ・ Environmental benefit (positive effect on soil erosion) ・ Alleviation of hard work of women and children

L-4	**Evaluation of Dairy Performance of Distributed Stud bulls by Govt. (Establishment of Dairy Performance Recording System)**
Target	Milk (Buffalos and Cows)
Location	Area where distributed stud bull is present.
Target Group	Farmer groups who obtained stud bull from Govt.

Implementation	・ Certify dairy farmers who own the excellent breeding buffalo cows or cows. ・ These certified farmers will keep lactating record of daughter buffalos and cows. ・ Compare lactating record of these daughters with regular cows and buffalos and analyze if these certified animals have higher capacity. ・ Evaluate dairy performance of breeding bull.
Monitoring	Lactating record of regular buffalo and cows
Demonstration effect	・ Higher quantity and quality milk production by daughters of these certified cows and buffaloes ・ Understanding of dairy performance of stud bull who obtained from Govt.

L-5	**Monitoring of Candidate Breeding Buffalo Bull and Breeding Bull by Using Frozen Semen (AI) for the Efficient Implementation of Genetic Improvement**
Target crop	Milk (Buffalo, Cattle)
Location	Accessible distance from Livestock service center, sub-service center and DLSO.
Target Group	Farmers who own excellent breeding buffaloes cow and cows as well as high feeding technique
Implementation	・Identify excellent buffalo cow and cow. ・To conduct artificial insemination these identified buffalo cow and cow ・To keep the records on milk yield and reproduction of certified daughter and young bull.
Monitoring	Lactating record of daughter buffaloes and cows
Demonstration effect	・ Higher quantity and quality milk production by daughters of these certified cows and buffaloes. ・ To be certified dairy performance of stud bull.

L-6	**Liver Fluke (fasciola hepatica infection) / Internal Parasite Control**
Target produce	Milk (Buffalo and Cattle)
Location	Farmers raise several buffalo and cattle at Paddy field area
Target Group	Farmers who owns several buffalo and cattle
Implementation	・ Study a case of treatment of Liver fluke and actual situation of farmer's practices of animal feeding. ・ Treat rice straws with urea and boiling rice straw before feeding animals. ・ Observe effect on development of Liver fluke (fasciola hepatica infection)
Monitoring	Health condition of buffalo and cattle (or morbidity of disease)
Demonstration effect	Decrease of Liver fluke disease

L-7	**Improvement of Housing of Milking Animal for Hygiene Control and Prevention of Mastitis**
Target produce	Milk (Cows and Buffalos)
Location	Accessible distance from Livestock service center, sub-service center and DLSO.
Target Group	Farmers who owns several buffalo and cattle
Implementation/ Activities	・ Study a case of treatment of mastitis ・ To conduct mastitis test ・ Understanding situation of mastitis affected animals. ・ Reform the stall floor to concrete and create dry, comfortable environment for daily animals. ・ Compare if there is positive effect on mastitis or other diseases ・ By product urine collected can be used for vegetable production.

Monitoring	・ Number of mastitis affected animals ・ Quantity and quality of milk production
Demonstration effect	・ Improvement of quality (fat contents) in milk. ・ Improvement of quantity of milk ・ Decrease of mastitis (or morbidity of disease) ・ Analysis of the cost (investment and maintenance cost, labor, etc.) and benefit (improvement of animal health, milk production and income, etc.)

L-8	**Improvement of Rearing Environment for Goats**
Target crop	Meat (Goats)
Location	Accessible distance from Livestock service center, sub-service center and DLSO.
Target Group	Goat farmers
Implementation	・ Improve shed condition by using locally available materials. ・ See if breeding rate and weight gain improve.
Monitoring	Weight of goats, kidding intervals
Demonstration effect	Daily weight gain

L-9	**Improving local practice of goat selection**
Target produce	Meat (Goats)
Location	Accessible distance from Livestock service center, sub-service center and DLSO.
Target Group	Goat farmers
Implementation	・ Develop the appearance evaluation technique and selection skills in order to distinguish the cross-bred goats between Khari-breed and Jamunapari-breed ・ Cross-breeding technology
Monitoring	・Skill development of farmers and government technicians ・Survival rate of kids ・Number of kid at a birth ・Adaptability to the environment
Demonstration effect	・ Increase of cross-bred goats which have higher environmental adoptability, breeding ability, meat productivity, and lactating ability. ・ Increase of profitability

L-10	**Establishment of the Roughage Based Stall Feeding Technique**
Target	Meat (Goats)
Location	Accessible distance from Livestock service center, sub-service center and DLSO.
Target Group	Leasehold forest user group, Community forest user group
Implementation/ Activities	Develop a new feeding management program in order to supplement seasonal shortfall of feed by combining available fodder trees and pasture (woody plants, herbaceous plants, agricultural byproducts, crop residue, etc) whose nutritious analysis has already been done in the past.
Monitoring	・ Possibility of combination of fodder trees and pasture ・ Weight gain of goats ・ Raising number of goat head
Demonstration effect	・ Analysis of the cost (investment and maintenance cost, labor, etc) and benefit (improvement of animal health and income, etc.) ・ Increasing number of raising head from improved utilization of grass feed

The basic idea of three categories of pilot project was that "although there are various combinations exist, majority of farmers in study area more or less practice both horticulture and livestock production in an integrated manner." Likewise, although the pilot activities proposed were encompassing different aspects of commercial agriculture from production to marketing of different HVCs, they inter-relate each other. Therefore, the Study team considered that it was better to apply pilot project activities listed above in an integrated manner, allowing some variations in combinations, rather than applying separate activities to different producers of different commodities in scattered locations. In this way, the synergy effects were expected among the pilot activities by having interrelations. In addition, the transaction costs for pilot implementation including monitoring and evaluation would be lowered, and that would also enable stakeholders to learn lessons in efficient way so as to become able to adjust the approach more effectively.

Figure 1.1 shows the proposed basic combination of pilot projects. Two CORE Pilot projects were implemented in all selected site, combined with either or both Horticulture and Livestock Pilots in accordance with site conditions.

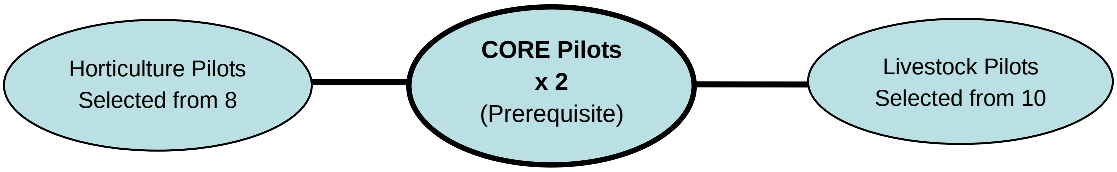

Figure 1.1: Proposed Basic Combination of Pilot Projects in One Location

The underlying notions for C-1 and C-2 were that;

C-1: DADO and DLSO personnel were expected to be involved in the implementation and monitoring of all these pilot activities as the supporter for agricultural commercialization, in the ways guiding and helping producer groups wherever they could but at the same time, learn from experiences gained throughout his/her involvements in these pilots as a set of learning opportunity for promotion of agricultural commercialization.

C-2: Marketing of any HVCs can be more effective when efficiency is achieved from production to shipping. Public-Private Partnership (PPP) approach within which concerned stakeholders form a group and discuss on how the efficiency of particular value chains can be improved was put in the center of the pilot. The group approach in both horizontal (among producers) and vertical (among value chain players) directions was taken in this approach. As a physical window of channeling the produces to the market and market information to producers, the collection center played important roles as well.

Coupling with C-1 and C-2 as the prerequisite, various combinations of other pilot activities for each selected site were formulated. This approach was applied to different agroecological zones since production timing of targeted commodities were varied in accordance with zones.

For the convenience in operation and for the ease of comprehensions by concerned parties, these combinations of different activities were later grouped as "packages" as shown in Table 1.3.

Table 1.3: Horticulture and Livestock Pilot Project Packages

Name of package	Main objective	Pilot Activities
Vegetable package	Improvement of quality and quantity of vegetable products to meet commercial demand	H-1: Introduction of unified standard group production for marketing H-2: Introduction of the Multiple Water Utilization and Micro Irrigation System H-3: Utilization of rain-shed plastic house H-4: Quality improvement of seedlings and saplings H-7: Introduction of unified grading and proper packaging system
Fruit package	Improvement of quality and quantity of Junar to meet commercial demand	H-1: Introduction of unified standard group production for marketing H-4: Quality improvement of seedlings and saplings H-5: Single cropping and tree management for citrus H-6: Appropriate pruning and thinning for citrus H-8: Junar processing for improvement of storability and transportability
Goat package	Improvement of daily weight gain and increase of goat number to meet commercial demand	L-3: Fodder yield improvement by the establishment of technique by utilizing slope area L-6: Liver fluke control L-8: Improvement of rearing environment for goats L-9: Improving local practice of goat selection L-10: Establishment of roughage based stall feeding technique
Dairy package	Improvement of milk production capacity of buffalo and cattle to meet commercial demand	L-2: Development of roughage and concentrate mixed feeding L-3: Fodder yield improvement by the establishment of technique by utilizing slope area L-4: Evaluation of dairy performance of distributed stud bulls by Govt. L-5: Monitoring of candidate breeding buffalo bull and breeding bull by using frozen semen (AI) for the efficient implementation of genetic improvement L-6: Liver fluke control L-7: Improvement of housing of milking animal for hygiene control and prevention of Mastitis

Table 1.4 shows where each proposed pilot activity in each package positions in the value chains. The vertical columns consist of different pilot activities in different steps in value chains, while in horizontal rows there are several numbers of same pilot activities shown with underlines. The CORE pilots (C-1 and C-2) were related with all other pilot activities.

Table 1.4: Proposed Pilot Projects in Value Chains

<table>
<tr><th colspan="2" rowspan="2">Categories</th><th colspan="2">Horticulture Crops</th><th colspan="2">Livestock</th><th rowspan="2">DADO/ DLSO support Groups</th></tr>
<tr><th>Vegetables Package</th><th>Fruits Package</th><th>Dairy (Milk) Package</th><th>Goat Package</th></tr>
<tr><td rowspan="3">↓ Value Chain ↓</td><td>Production</td><td>H-1
H-2
H-3
H-4</td><td>H-1
H-4
H-5
H-6</td><td>L-1
L-2
L-3
L-4
L-5
L-6
L-7</td><td>L-3
L-8
L-9
L-10</td><td rowspan="3">←
C-1
←</td></tr>
<tr><td>Post-Harvest Handling</td><td>H-7</td><td>H-7
H-8</td><td></td><td></td></tr>
<tr><td>Marketing/ Distribution</td><td>C-2</td><td>C-2</td><td>C-2</td><td>C-2</td></tr>
</table>

1.4 Selection of the Pilot Sites

(1) Criteria Adopted for Site Selection

At the end of March 2012, the Study Team in coordination with counterparts sent the format for pilot sites recommendation to DADOs/DLSOs of the target area. In this process, the criteria relating the location of pilot projects were adopted (2nd Criteria 1 to 6 listed in Table 3.1). Based on the notion that the pilot activities would consist of Core Pilots (C-1 and C-2) as prerequisite and combined with Horticulture and Livestock pilots, DADOs and DLSOs in respective districts were asked to coordinate among themselves to match the recommended sites (up to three sites per district) prior to fill in the recommendation formats[1]. The filled formats from four districts DADOs/DLSOs were submitted to the Study Team through counterparts by mid-May 2012.

(2) Recommended Pilot Sites by DADOs/DLSOs

Table 1.5 lists the pilot locations recommended by respective DADOs and DLSOs. As it can be seen, the number of recommended sites exceeded the requested numbers (3) in some districts while Ramechhap recommended only two sites.[2]

Table 1.5: Recommended Pilot Locations by DADOs/DLSOs of Target Districts

District		Recommended Sites (VDC)
Kavre	DADO	1) Katunjebeshi, 2) Patlekhet, 3) Khanalthok, *4) Bhimkhori (added in July)* *
	DLSO	1) Katunjebeshi, 2) Khanalthok, 3) Patlekhet, *4) Bhimkhori (added in July)* *
Dolakha	DADO	1) Bocha, 2) Sunkhani, 3) Bhimeshwor, 4) Pawati
	DLSO	1) Bocha, 2) Suspa, 3) Namdu,4) Bhimeshwor, 5) Sunkhani, 6) Namdu
Ramechhap	DADO	1) Hattitar, 2) Okhreni (for citrus)
	DLSO	1) Hattitar
Sindhuli	DADO	1) Kamalamai (Milanchowk), 2) Ratanchura (for citrus), 3) Ratamata
	DLSO	1) Kamalamai (Ward 4, 6, 12), 2) Ratanchura, 3) Ratamata

* Initially Bhimkhori was not included but later (in July 2012) it was recommended as the alternative for once selected Katunjebeshi.

1 Refer to Annex 3-1 of SRCAMP Interim Report.
2 According to counterparts (both DOA and DLS sides), the reasons being incapability of DADO/DLSO level to understand the requests made by Study Team through counterparts.

(3) Site Selection Process

The Study Team with counterparts started visiting the proposed pilot sites on June 4 and completed by June 18, 2012.

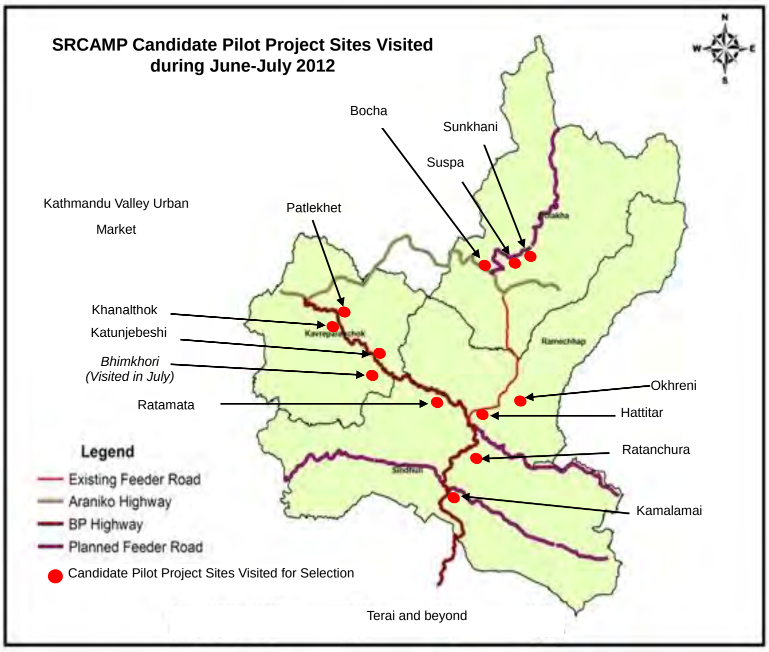

Figure 1.2: Candidate Pilot Project Sites Visited for Selection

In each district, the Study Team and counterparts jointly followed the selection process described below.

1) Provided the evaluation sheets[3]that consisted of detailed evaluation items for the reference material to the Study Team member and counterparts.

2) Held a meeting with DADO/DLSO to explain the selection process and received the explanations on each recommended sites. Candidate sites were narrowed down.

3) Visited each candidate site and held the focus group session (1 to 2 hours) with the potential beneficiaries. In this session, the (i) geographical outlines of the area, (ii) general situation of the agriculture and livestock-related practices with potentials and constraints, and (iii) aspirations of the participants for commercialization of their agriculture practices with the potential level of their commitments both in time and cost, were investigated through dialogue.

4) Held another meeting with DADO/DLSO to tentatively prioritize candidate sites. Each participant (Study Team member, counterparts, DADO/DLSO staffs) voted based on their evaluations and tentative priorities for candidate sites by each district decided.

5) After the steps 1) to 4) described above, on June 20 2012, a meeting to decide the pilot sites

[3] Refer to Annex 3-2 of SRCAMP Interim Report.

were held in Kathmandu. Based on the tentative prioritizations conducted in all four target districts, the participants (Study team members and counterparts) further discussed the combinations of pilot sites in view of i) balance among four districts, ii) combinations of pilot activities as against its objectives, iii) operationability and iv) costs. As the results, total 5 pilot project sites were selected.

(4) Selected Pilot Sites

The selected 5 pilot sites are listed in Table 1.6.

Table 1.6: Selected Pilot Project Sites with Combination of Pilot Activities

District	Pilot Sites (VDC)	Core Pilots	Horticulture Pilots	Livestock Pilots
Kavre	1) Bhimkhori	✔	Vegetable Package	Dairy+Goat Packages
Dolakha	2) Bocha	✔	Vegetable Package	Dairy+Goat Packages
Ramechhap	3) Hattitar	✔	Vegetable Package	Goat Package
Sindhuli	4) Ratanchura	✔	Fruit Package	Dairy+Goat Packages
	5) Ratamata	✔	Vegetable Package	-

As shown in this table, Sindhuli district has 2 pilot sites. This was based on the opinion that Citrus (in this case Junar)-oriented pilot should be included at least one site.

As for Kavre district, Katunjebeshi was once selected, but it was found that another donor-funded project was planning to set up the collection center there.[4] The selection had to be started over again, and eventually Bhimkhori VDC was selected as an alternative site.

For each one of 5 selected pilot project sites, the Study aims at verifying the approach of pilot activities taking into account establishing the different models for agriculture commercialization under different conditions (Table 1.7).

Table 1.7: Verification of each Pilot Project Site Selected

Pilot Sites (District)	Agriculture Commercialization Models to be Sought for
1. Bhimkhori (Kavre) 2. Bocha (Dolakha)	Commercialization model for temperate mountainous production pockets to supply off-season crops with improved accessibility
3. Hattitar (Ramechhap) 5. Ratamata (Sindhuli)	Commercialization model for sub-tropic river bank production pockets with improved road accessibility
4. Ratanchura (Sindhuli)	Quality improving and production stabilization model for Junar

The geographical locations of the selected pilot sites are depicted in Figure 1.3, and for the detailed site profiles of each pilot project site, please refer to Annex 1.

[4] In 2012, USAID funded NEAT Project was going on, in which almost all main production pockets on the Sindhuli road in Kavre district was covered. The projects promoted near-organic agriculture through provision of technical assistance and subsidies to seeds, equipment and collection centers. Kathunjabeshi was one of its target pockets, but, according to DADO office in Kavre, they did not know the locations of the project.

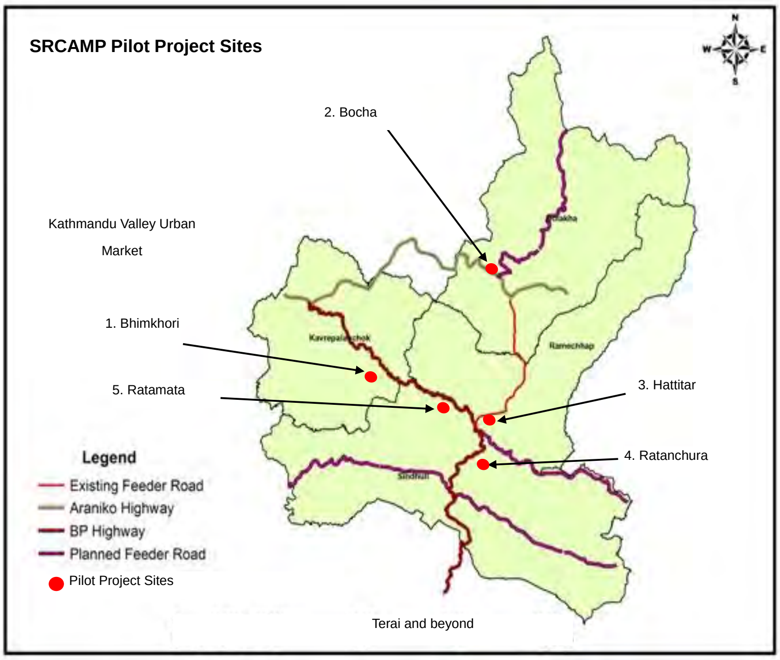

Figure 1.3: Pilot Project Sites Selected

1.5 Implementation Structure of Pilot Projects

The implementation structure adopted for the pilot projects is shown below.

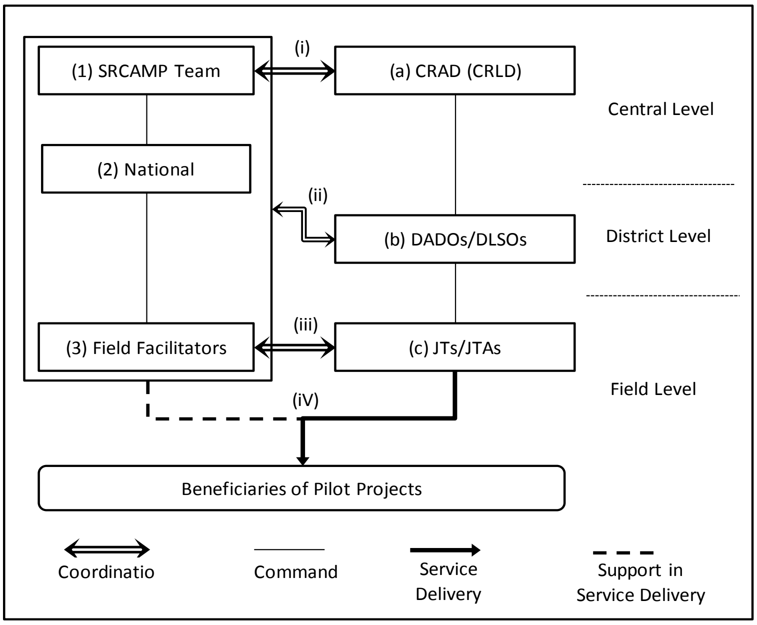

Figure 1.4: Implementation Structure of Pilot Projects

1. (1) SRCAMP Team engaged a team of (2) National Consultants, in order to ensure smooth implementation of pilot projects in the aspects of coordination and technical backstopping in limited area of expertise.
2. (1) SRCAMP Team also engaged (3) Field Facilitators (FFs) in four districts. The Field Facilitators stayed in or frequently traveled to the pilot sites in the designated district and

facilitated the implementation of the pilot activities by assisting JTs/JTAs.

3. Coordination line (i) between (1) SRCAMP Team and (a) CRAD (CRLD) was the mainstay of SRCAMP implementation. Through this coordination line, all activities related to SRCAMP pilots were coordinated.
4. Coordination line (ii) between (b) DADOs/DLSOs and a group consisting of (1) SRCAMP Team, (2) National Consultants and (3) Field Coordinators were utilized only when required. This coordination line was subordinate to the coordination line (i) and when it was utilized, the CRAD (CRLD) was to be informed about the contents.
5. Coordination line (iii) between (3) Field Facilitators and (c) JTs/JTAs in the field level was utilized in daily basis in order to implement pilot activities as per planned.
6. Service Delivery and Support line (iv): JTs/JTAs who were assigned to implement pilot activities were expected to perform as the main person who deliver the services. The FFs performed supporting roles "with" and "under the instruction of" SRCAMP Team and National Consultants who were delegated the partial authority on behalf of SRCAMP Team.

The reason for assigning the FFs was based on the considerations in actual capacity of JTs/JTAs to invest their time and efforts for SRCAMP pilots. Each JT/JTA was charged with the responsibility to cover 4 VDCs in average and it was considered that redirecting their manpower into SRCAMP pilots would result in weakening their services to other areas. In light of this, taking into consideration the necessity to properly implement certain volume of extension works within limited time, study team decided to allocate FFs to supplement functions expected to be performed by JTs/JTAs in the field level, as second best option.[5] The TOR for the FFs is attached as Annex 2.

In addition to the implementation structure shown in Figure 1.4, the district level coordination body named District Progress Review Committee (DPRC) was set up. This committee was chaired by DADO/DLSO chiefs in respective districts and charged with the role of coordinating the proper progress of pilot activities through information sharing, in their monthly meeting. While it was agreed among concerned parties that the arrangement and management of DPRC were based on the initiatives of district level DADO/DLSO. However, it did not function very well and DPRC was held only once in Dolakha district in September 2012. Figure 1.5 shows the structure and function of DPRC.

5

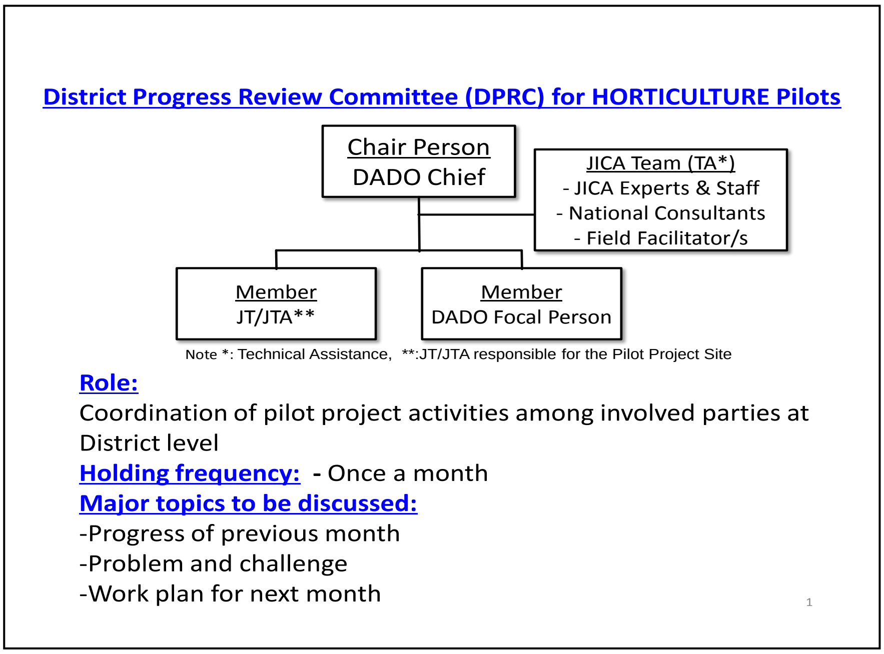

Figure 1.5: District Progress Review Committee (DPRC) for Horticulture Pilots

1.6 Selection of the Beneficiaries

Selection of the beneficiaries was very important for effective and efficient implementation of the pilot project. SRCAMP followed participatory, transparent and consultative processes for selection of beneficiaries. The following steps were taken to select the beneficiaries:

i. All farmers at a selected site were invited in the meeting. The invitation was sent by district DADO office.

ii. The Study Team made a presentation on the pilot project to be implemented at the site. The eligibility criteria for a pilot farm were also explained in the presentation. The criteria for horticulture and fruits are shown in Annexes 3 and 4.

iii. Risks and responsibilities for participating in the pilot project were explained after the presentation. The nature of the project was more like an experiment than a subsidy, and possible risks such as losing part of income must be shouldered by the farmers themselves were clearly stated.

iv. Interested farmers were interviewed individually to confirm the tasks and responsibilities according to the scoring sheet. The scoring sheet for horticulture package[6] is shown in Annex 5 as an example.

v. After the individual interviews, several farmers decided to withdraw. All farmers agreed to participate in the pilot activities were finally selected. MOUs were signed among the farmers, the Study Team and DADO.

[6] The scoring sheet for the horticulture, dairy and goats, please refer to Annexes 3-9, 3-14 and 3-15 of SRCAMP Interim Report.

Table 1.8: Number of Selected Farmers for Horticulture and Fruit Pilot from each Site

District	Pilot Site(VDC)	Number of selected farmers
Vegetable Package		
Kavre	Bhimkhori	15
Dolakha	Bocha	15
Ramechhap	Hattitar	13
Sindhuli	Ratamata	17
Total		60
Fruit Package		
Sindhuli	Ratamata	12
Total		12

Basic method and process of selecting livestock pilot beneficiaries were same as of the Horticulture pilots as explained above. It was conducted with the cooperation of DLSO, instead of DADO. In addition, those farmers who met the criteria and were interested in implementing the pilot activities were visited by the DLSO and SRCAMP Team, and their livestock and rearing environment were assessed according to the scoring sheets. In the end, a total of 40 farmers for goat package activities and 30 farmers for daily package activities were selected. Tripartite MOUs were signed among farmers, DLSO and SRCAMP. For the criteria for the selection of livestock beneficiaries, refer to Annexes 6 and 7.

Table 1.9: Number of Selected Farmers for Livestock Pilots from each Site

District	Pilot Site(VDC)	Number of selected farmers
Goat (Meat) Package		
Kavre	Bhimkhori	10
Dolakha	Bocha	10
Ramechhap	Hattitar	10
Sindhuli	Ratamata	10
Total		40
Dairy Package		
Kavre	Bhimkhori	10
Dolakha	Bocha	10
Sindhuli	Ratamata	10
Total		30

CHAPTER 2 CORE PILOT PROJECTS

2.1 Commencement of the Pilot Activities

Pilot project activities were commenced in July 30, 2012, with the SRCAM Pilot Project Kick-off Meeting held in Kathmandu. It was participated by DOA/DOL counterparts, 4 district DADO and DLSO officers, JT/JTAs, and SRCAMP Team members. The objectives, pilot project contents, schedules, implementation structure/responsibilities of each party, etc. were confirmed.

The MOUs were signed between SRCAMP and DADO/DLSO and between SRCAM and the beneficiaries. Necessary materials were procured, and activities at 5 pilot project sites started in August 2012. Implementation schedule of all pilot projects were presented in Annexes 8 and 9.

2.2 C-1: Improvement of Agricultural Commercialization Support Service from DADO/DLSO

DADO and DLSO personnel were expected to be involved in the implementation and monitoring of all pilot activities as the supporter for agricultural commercialization, in the ways guiding and helping producer groups wherever they could but at the same time, learn from experiences gained throughout his/her involvements in these pilots as a set of learning opportunity for promotion of agricultural commercialization. Monitoring sheets for record keeping were provided to each JT/JTA. They had to understand the objectives of the pilot projects to maintain proper record of the activities. Direct participation in the pilot activities would enhance JT/JTAs technical knowledge as well as their extension ability. Therefore, SRCAMP recommended that they visit pilot farmers as frequently as possible to observe the field and consultation with farmers. The basic design of the pilots was presented by SRCAMP, and the detailed contents such as types of input materials were decided by each DADO/DLSO according to the locally adopted techniques. Then, appropriate methods to utilize these materials were instructed by SRCAMP at each site. Depending on the pilot activity, JT/JTAs were expected to visit beneficiaries once or twice in a month and keep the record. Giving technical advice to farmers as necessary was also an important task given to JT/JTAs in the pilot project.

Result

The number of visits made by DADO officials was recorded at the end of every month. Earlier during the inception of SRCAMP, a formal consensus was made between DADO and SRCAMP that each Senior Agriculture Development Officer (SADO) and Subject Matter Specialist (SMS) would visit the pilot sites once every month while JT/JTAs would visit each site twice every month with the main objective of providing timely feedback about the pilots activities to the farmers.

Table 2.1 presents the average number of visit made by different officers in the entire cauliflower production season (August 2012 – March 2013). The highest number of average visits by JT/JTAs was found in Bocha followed by Bhimkhori. Lowest was seen in case of Hattitar (12 visits) followed by Ratamata (13 visits). When the total number of visits by all the concerned staff of DADO was estimated, highest visit was seen in Bocha (25 visits) followed by Hattitar (18 visits), Bhimkhori (16 visits) and Ratamata (14 visits).

Table 2.1: Total No. of Visits by Different Officers from DADO

Month	Bhimkhori			Bocha			Hattitar			Ratamata		
	JT	SO	SMS	JT	SO	SMS	JT	SO	SMS	JT	SO	SMS
August 2012	-	-	-	2	1	2	1	0	1	1	0	0
September 2012	1	1	1	4	1	2	2	0	0	2	0	0
October 2012	2	2	2	1	1	0	2	0	1	3	0	1
November 2012	3	3	3	3	0	0	4	1	1	3	0	0
December 2012	1	1	1	1	1	1	1	0	0	2	0	0
January 2013	2	2	2	1	0	0	1	0	1	1	0	0
February 2013	2	2	2	3	0	0	1	0	1	1	0	0
March 2013	3	3	3	1	0	0	-	-	-	-	-	-
Total Visits	**14**	**14**	**14**	**16**	**4**	**5**	**12**	**1**	**5**	**13**	**0**	**1**
Avg. visits/month	**1.8**	**1.8**	**1.8**	**2.0**	**0.5**	**0.6**	**1.5**	**0.1**	**0.6**	**1.6**	**0.0**	**0.1**
Total DADO	**16**			**25**			**18**			**14**		

Although the level of understanding varied among individuals, level of involvement seemed directly relate to their level of motivation. The dedication and interest in the pilot activities seem to give a greater influence to JT/JTAs activeness, together with interest and direction of the DADO/DLSO chiefs and officers. The better DADO/DLSO and JT/JTAs understood the situation, higher quality of information/data collection and dissemination took place.

Another factor was related to the accessibility to the site. While Bocha in Dolakha, Ratamata in Sindhuli, and Hattitar in Ramechhap are located along the main road and have relatively easy access, the project farmers in Bhimkhori in Kavre and Ratanchura in Sindhuli are scattered and some are located in few hours walking distance from the closest public transportation route. Those JT/JTAs who have a motorcycle had great advantage, and they tended to be more actively involved in monitoring visits.

After all, implementation of the pilot activities and information/data collection was greatly attributed to the FFs who lived in the target village and work closely with the farmers.

Findings

- **Lack of budget caused the limited involvement of JT/JTAs**

In general, JT/JTAs are not provided with funds and equipment to fulfill their duties, due to the lack of budget. The strong appeal was officially made from both DOA and DLS sides that “unless the additional incentives (at least equal to official TADA[7] level) were provided to those JTs/JTAs, they would not be involved.” In response to this appeal and taking the reality into consideration, JICA agreed to provide those officials involved in the pilot with the TADA. This financial support should have enhanced JT/JTAs site visit for extension and monitoring. Increasing the opportunity for JT/JTAs to visit the field and communicate with farmers was believed to improve the farmers’ trust on them. Consequently, it was expected to improve the government capacity for extension work.

[7] TADA indicates dairy service allowance, accommodation fee, and transportation fee for the government officers.

However, sufficient level of their involvements to properly implement pilot activities was not ensured since they still had to carry out other activities they were originally charged with. Incentives such as sitting fee to attend the meeting, TADA to carry out field visits, etc. have been institutionalized within the government, and without such provisions the officials tend not properly perform duties. This was recognized as one of the fundamental issues needs to be addressed when designing any programs being implemented through the government structure.

- **Better communication induced DADO/DLSO's support**

Improved communication between DADO/DLSO and farmers led to additional supports from both DADO and DLSO. Follow-up assistance to the pilot sites have been provided and committed by DADO and DLSO as shown in the Table 2.2. Many of these activities were autonomously requested by newly organized collection center management groups. More attention from JT/JTAs and DADO/DLSO officers motivated farmers to have better communication with them, which also made the farmers more active in many positive ways.

Table 2.2: Follow-up Activities to the Pilot Program by DADO/DLSO

Site	Follow-up activities by DADO/DLSO	
	Completed	Planned
Bocha	***DADO*** • 1 Farmers' Managed Irrigation System (FMIS) to the pilot members (worth more than Rs. 100,000). ***DLSO*** • Rs. 100,000 fund support for operation of milk sales point at Charikot; • Milk container; 40L;1,15L;15 • 3;chaff cutter,1;electric chaff cutter (Big size)	***DADO*** • Funds for tomato production through the collection center marketing planning committee (PMC) (Rs.35,000) • 30 plastic crates to the PMC • Development of Bocha farmers to potato seed growers group
Hattitar	***DADO*** • Irrigation pump – Rs. 70,000. • Training (vegetable / kitchen gardening) • Seed for paddy and wheat under seed production program • Vegetable seeds ***DLSO*** • Winter forage crop distribution • Artificial Insemination (AI) Program • Distribution of livestock medicine	***DADO*** • Continuity of current support • Power tiller
Ratamata	***DADO*** • Power tiller Rs.120,000 (50% subsidy) • Pesticide sprayers (50% subsidy)	***DADO*** • Fund support for vegetable production (Rs. 30,000)

	Follow-up activities by DADO/DLSO	
Ratanchura	***DADO*** • Pheromone trap • Continuation of regular technical service • Training program for One Village One Product (OVOP) • Junar sapling (50% subsidy)	***DADO*** • Development of private technicians for Junar farm management • 1-2 Famer Managed Irrigation System (FMIS)
Bhimkhori	***DADO*** • Regular program and technical support	***DADO*** • FMIS • Vegetable seeds • Plastic House

Source: Consultation with DADO/DLSO and pilot farmers, 2013

- **Sustainability after the pilot project**

Major part of the extension services for farmers was performed by the SRCAMP national consultants and FFs in the pilot project. Basic understanding of the project ideas may have been transferred to the participated farmers; however, extension to other areas may be limited under the level of DADO and JT/JTAs' involvement in the project. In order to ensure the sustainability of the assistance, utilization of the private sector actors should be also considered. Establishing more beneficial conditions for the central traders needs to be enhanced so that those central traders encourage farmers to continue the production, not only for pilot farmers but even for farmers in other areas.

2.3 C-2: Introduction of Integrated Collection Center System with Public-Private Partnership (PPP) Approach

Main activities conducted under the C-2 pilot project were; 1) preparatory works, including selecting the collection center location, forming the collection center committee, etc.; 2) actual construction of the center facilities; 3) holding the farmers-traders meetings for better linkage and communication; and 4) collecting commodities and conducting businesses.

(1) Formation of the Collection Center (Construction) Committee

The committee was formed at each site in September 2012 in order to register the collection center building and land. The number of the Collection Center Committee varied between 4 and 21, depending on the site. These members were not necessarily the pilot farmers but possessed leadership abilities. Reading and writing skills were also considered for those positions which involved record keeping and minute preparation.

MOU was signed between SRCAMP and the committee, with the witness of DADO/DLSO. The MOU clarified roles and responsibilities of each party as well as their rights. One of the major provisions of the MOU was to make the committee conduct timely and regular meeting and keep compulsory minutes while taking any expenditure and income related decisions. Detailed procurement plan and exact dates of purchase of construction materials were also finalized after the MOU.

(2) Construction of a Collection Center Facility

Site Selection

The collection centers were constructed in four out of five pilot sites of SRCAMP. Selection of the collection center location was made in highly participatory way. All the stakeholders, including farmers, traders, DADO/DLSO officials, VDC officials, SRCAMP Team, were consulted for the selection. The following criteria was taken into consideration for site selection; 1) adjoining the Sindhuli road; 2) good demonstration effect; 3) convenience for traders to visit frequently; 4) popular meeting point for vegetable collection even prior to SRCAMP; and 5) land availability (public land). Site selection process was not very easy and took several months before precise sites were identified.

Construction

Design specification of the collection centers varied by the site. They were designed by the communities, considering the budget and technical engineering requirements. The public land was disposed from the local government to the committee. The registration of the land was properly processed by the committee although it was not easy and took some time. The construction started in September 2012. All the collection centers were completed and inaugurated by February 2013 as shown in Table 2.3.

Table 2.3: Details of Construction Dates of Collection Centers

Collection Center	Construction Start Date	Inauguration Date
Bhimkhori	December, 2012	February 21, 2013
Bocha	October, 2012	January 26, 2013
Hattitar	September, 2012	January 25, 2013
Ratamata	November, 2012	January 23, 2013

Collection Center in Bhimkhori, Kavre

Collection Center in Hattitar, Ramechhap

Construction Cost

The construction cost varied by site. It was highest in case of Bhimkhori (Rs. 966,000), followed by Bocha (Rs. 805,000). Tables 2.4 and 2.5 provide further details of construction cost. All local communities made in-kind contribution, including provision of unskilled labor and local materials. Also, in two locations, Bocha and Bhimkhori, local government and other organizations contributed.

The highest local contribution was made in Bhimkhori (about 50 percent), followed by Bocha (42 percent). In case of Hattitar and Ratamata, actual cost was almost the same.

Table 2.4: Actual Construction Cost of Collection Centers

Name of the Site	Cash Contribution						In Kind Contribution			
	SRCAMP		Local		Total		Local In kind		Total	
	Rs. '000	%	Rs. '000	%	Rs. '000	%	Rs. '000	%	Rs. '000	Overall
Bhimkhori	487,000	50.4	118,100	12.2	605,100	**62.6**	360,900	**37.4**	966,000	**100**
Bocha	467,000	58.0	63,000	7.8	529,000	**65.8**	275,000	**34.2**	80,5000	**100**
Hattitar	467,000	81.9	0	0.0	467,000	**81.9**	103,000	**18.1**	570,000	**100**
Ratamata	467,000	84.4	0	0.0	467,000	**84.4**	86,000	**15.6**	553,000	**100**

Table 2.5: Breakdown of Cash Assistance by Source

Sites	SRCAMP		GOV*		VDC		CFUG		Local		Coop.		Total	
	Rs. '000	%	Rs. '000	%	Rs. '000	%	Rs. '000	%	Rs. '000	%	Rs. '000	%	Rs. '000	%
Bhimkhori	487	81	0	0	50.6	8	5.5	1	54	9	8	1	605.1	100
Bocha	467	88	1	0.2	29	56	15	3	18	3	0	0	529	100
Hattitar	467	100	0	0	0	0	0	0	0	0	0	0	467	100
Ratamata	467	100	0	0	0	0	0	0	0	0	0	0	467	100

* Bocha Farm

Detailed presentation on financial aspect in construction of the collection center was given by the treasurer of the committee in each of the sites. At all sites, there were no major concerns raised by the pilot farmers or the local community, and the overall expenditure presented was approved by the community.

(3) Formulation of the Market Planning Committee (MPC)

The Market Planning Committee (MPC) comprising of pilot farmers was formulated at each collection center. It ultimately acted as the main body looking after the management and operations of the collection center. The construction committee handed over all the responsibility of future management to the MPC. In most of the sites, the construction committee was converted into MPC with minor adjustments in membership. The board members of MPC consist of 1 chairman, 1 secretary and 1 treasurer were selected.

The following is the specific roles and responsibilities of MPC:

- **Overall management of the collection center including taking care of the day-to-day activities**
- **Marketing of the agriculture produce collected in the collection center**
- **Establishing communication and coordination with nearby and distant market and their players for timely supply of collected product at the collection center**
- **Planning the overall harvest time and ensure unified production system implemented by its members**

- **Undertaking adequate survey and information collection of markets on a day-to-day basis for determining the most adequate price of any commodity**
- **Facilitating timely availability of agriculture inputs like seeds, fertilizers, pesticides to its member farmers**
- **Assisting farmers by linking them with services providers such as DLSO and DADO**
- **Acting as the planning body and as a leading think-tank for implementation of innovative concepts such as uniform production system and others**

(4) Farmers and Traders Meetings

Even before the collection center facilities were constructed, the pilot farmers and local traders started marketing activities under the pilot. The Farmers-Traders meetings were one of these activities. Two main objectives of the meeting were:

1) <u>To enhance up-front communication</u>

Communicating in advance with target buyers is very important in order to let buyers know what they can expect. Farmers should consult with traders in advance to meet specific demand of the market. This communication improves the security of farmers as they will be able to plan their production based on specific demand.

2) <u>To develop multiple contacts</u>

Even with the up-front communication, shortage and surplus of produce occur many times in a season. Farmers are never able to guarantee either quality or quantity for their produce to traders because there are so many factors over farmers' control in production such as climate conditions. It is same for traders; they can guarantee neither price they offer nor quantity they take. The market condition is also uncontrollable for individual traders. Even a usual fluctuation in demand and supply induces heavy shortages and surpluses. However, the conditions are usually different at different locations, and someone has more capacity than others. It is impossible to eliminate all the risks, but there will be more chances to reduce the risks by utilizing multiple contacts within the network for more appropriate relocation of the commodities. All players in the market should maintain as many regular contacts as possible to prepare for the unexpected conditions.

The first one was held on October 8, 2012 in the Banepa market in Kavre district. One representative farmer from Bhimkhori and one Banepa trader had attended the meeting. Purpose of the meeting was to initiate the proper contact between production area and consumption area to improve efficiency of transaction. Both parties agreed to maintain contact throughout the season.

Second meeting was held on November 20, 2012 in Banepa between Banepa and Kalimati traders and Ratamata farmers. At this meeting, traders mentioned that the current condition of small aggregated production is a major issue and the farmer responded to explain the project activity of uniform production to meet their request. It seemed that the farmers had improved their understanding of the meaning and also the commercial benefit of the program through this kind of meeting.

Third meeting was held on November 22, 2012 at the Kalimati market. 5 Kalimati traders and 1 local farmer/trader from Bocha were attended. Although it is not common to exchange advance information before the season starts in Nepal, all the traders realized and mentioned the importance for better efficiency. This kind of meeting should be held until it becomes common practice.

A half-day informal interaction workshop was organized by SRCAMP on February 27, 2013 in Kalimati Market in order to forge better communication and coordination between central traders (Kathmandu, Balkhu, Banewhowr and Benpa) and collection center management committee members from four pilot sites. A total of 55 persons attended the interaction workshop. Traders presented the high-season (better market and price) and low season for major vegetables. Farmers presented their capability of the supply (production) of selected commodities. Executive members of each MPC and traders had a chance to have one-to-one communication and conversation. Traders clearly understood the different crops and their supply chains whereas farmers also personally contacted and talked with their potential buyers (demand side). The need to properly aggregate the products through one communication channel was also confirmed between the two groups. The exchange of contacts and communication done during the course of this interactive meeting was expected to generate future business opportunities between MPC and the traders.

(5) Study trip to observe experienced Collection Centers in other regions in Nepal

The study trip was conducted in February 2013 for MPC members and JT/JTAs in these four pilot project sites to observe and learn about collection center management from three successful centers in Kaski and Dhading districts, namely Bhalam, Lumle, and Churaundi collection centers. By learning from predecessors' experiences and sharing the ideas and information, the participants were able to obtain ideas on how they can effectively and sustainably manage their own collection centers. It also gave them a chance to network with other farmer groups in different area in Nepal.

Farmers are relatively less mobile especially in remote areas including SRCAMP pilot sites. Also, target area farmers are more conservative compare to suburban farmers, who are direct competitors for Kathmandu market. In order to compete with those suburban farmers, target farmers must become more motives and flexible to adopt different ideas. This trip provided an opportunity to expose themselves to more advanced conditions in similar situations.

The following is some of the feedbacks from participants:

- **Sale of the produce through the collection center increased farmers revenue**
- **Actually seeing by myself made me understand about the role of the collection center and how to operate it**
- **They have materialized commercial agriculture by reducing the cost of production, utilizing experience and investing in labor, and made relatively good profit**
- **Transparency is very important in the management of the collection center**
- **It became clear that regional economic development cannot be attained without cooperation among farmers, and in that sense the building cooperatives is very important**

- **Members can save time by utilizing the collection center and that time can be used for farming and household errands**
- **Farmers receive reasonable price for their produce through collection center**
- **Learning the management system of these collection centers made me want to establish a similar system at our collection center**
- **Like these collection centers, even we can run a small shop, providing members with necessary inputs like seeds, fertilizer, insecticides, etc. at the collection center**

The program is attached as Annex 10.

(6) Collection Center Operation

MPC meetings

The MPC meetings were held on a regular basis (once a month) at all sites. Important decisions taken during the MPC meetings were; finalization of product collection dates; input (seeds and fertilizers) distribution method (for pilot farmers); determination of pricing system of commodities; determination of service charges; increasing the number of members, etc. Each MPC allocated certain days of a week for harvesting and collection. Farmers harvested only limited volume of production on any particular day and aggregated them at the collection center for sales. Not all production went through the collection center. Some were directly handed to the traders from their firms or sold to nearby farmers. However, each farmer properly maintained the harvest- and sales- records at the collection center. Negligible cases of direct sales to other parties without taking consent from the MPC also seen, but the MPC tried to correct such practices.

Service Charge system

Each MPC had its own rules for setting service charge for bringing the produce to the collection center. These rules were formulated based on the discussion between MPC members. Table 2.6 provides the basis used for service charge collection at each collection center.

Table 2.6: Service Charge System for Pilot Sites

Collection Center	Service charge system* (Rate)
Bhimkhori	Rs. 1/kg regardless of commodity
Bocha	Rs.0.20/kg Cauli, Rs.0.10 potato, Rs. 0.50 Tomato and Rs. 0.50/ltr milk
Hattitar	Cauliflower per farmers Rs. 500, Cucurbits Rs.100/farmer, Tomato Rs. 0.50/kg
Ratamata	2% of the total transaction amount

Note: Only the data of cauliflower has been included as the transaction of the other commodities have not been finalized.
* Commission/profit/service charge is determined through mutual understanding between producers and MPC

Fund Generation and Mobilization

Generation: Apart from the money collected for construction, the collection center generated fund for their operation mainly from three sources. First source was in the form of grant assistance of Rs. 30,000 provided by SRCAMP as seed money. Second source was service charge collected from the farmers for the sales of the agriculture commodities. And third source was savings made by collection center members. Table 2.7 provides total amount of fund generated as of September 2013 from different sources. Bocha collection center generated the most as the members saved monthly. Bhimkhori collection center also initiated savings but this money was counted in the account of the cooperative separately.

Table 2.7: Amount of Funds Generated by Collection Centers (as of September 22, 2013)

Name of the site	Grant Assistance from SRCAMP	Income from service charges	Income from Saving activities	Total (Rs.)
Bhimkhori	30,000	11,309	0	41,309
Bocha	30,000	2,114	9,100	41,214
Ratamata	30,000	7,460	0	37,460
Hattitar	30,000	7,800	0	37,800

Note: Interest of these savings was deposited in the account itself. Except for Bocha and Hattitar, others have not utilized these savings.

Mobilization: Out of four collection centers, only Bocha collection center mobilized the collected fund in the form of credit to farmers. All the money collected as service charge and savings (Rs. 11,000) was circulated as credit to the collection center members for the purpose of vegetable farming. Only Hattitar collection center used seed money for purchasing stationeries and basic furniture.

(7) Business transaction

Sales Price determination

One of the major functions carried out by the MPC included sales price determination. In order to determine the price of commodities, MPC communicated with potential traders from different markets and identified those places where brought higher returns to the farmers. This information was then communicated with the pilot farmers, and upon approval, cauliflowers were sent to respective markets.

MPC faced different issues and challenges which influence the price. For example, due to lack of large size markets nearby, Bocha collection center had to depend almost entirely on Kalimati and Balkhu Market in Kathmandu where products arrives from many parts of the country, especially terai and nearby districts. Bocha cauliflower had non-competitive quality due to diseases. This factor played a crucial role in determining the price of cauliflowers. On the contrary, in case of Hattitar, the price fluctuation was very small as the price was largely based on production in few nearby cauliflower pockets.

Table 2.8: Total Business Transaction of Cauliflower by Collection Centers

Collection Center	Total Volume of Cauliflower sold (kg)	Average Price of the commodity (Rs.)	Total Value of transaction (Rs.)
Ratamata	17,500	22.5	393,750
Hattitar	19,100	19.0	362,900
Bocha	11,700	16.4	191,588
Bhimkhori	5,490	21.3	1,166,628

Sales quantity

Each collection center had transactions with specific markets shown in the Table 2.9. In case of Bhimkhori, the highest sales was made with Banepa market (58.7 percent) followed by direct sales to consumers (32.8 percent) with less than 10 percent sold to the nearby Kaldhunga market. In case of Bocha, nearly 60 percent of the total volume of transactions was made with Kathmandu (equal proportion in Kalimati and Balkhu), while nearly one quarter of the total transactions was also made with Manthali, with remaining was sold to local retailers and consumers.

Table 2.9: Volume and Price of Sales to Major Markets

Collection Center	Market	Total volume of transaction (Kg)	Price range (Rs./kg)	Average Sales price (Rs./kg)
Bhimkhori	Banepa	3,225	10 - 35	22. 5
	Bhimkhori, kaldhunga and mangaltar	467	10 - 30	20
	Direct sales to the customers	1,798	10 - 35	22.5
Bocha	Kalimati, Kathmandu	3,500	6 - 25	15.5
	Balkhu, Kathmandu	3,500	6 - 25	15.5
	Manthali and Khurkot	3,000	10 - 20	15
	Direct Sales	1,700	9 - 30	19.5
Hattitar	Manthali	15,650	18 - 20	19
	Khurkot	3,150	18 - 20	19
	Sanghutar (district boundary along Okhaldhunga)	300	18 - 20	19
Ratamata	Sindhulimadhi	8,550	20 - 25	22.5
	Chainpur	300	20 - 25	22.5
	Khalte	250	20 - 25	22.5
	Khurkot	2,500	20 - 25	22.5
	Ratamata	5,900	20 - 25	22.5

Findings

Pilot farmers had never worked under the collection center system before, and making them to follow a common practice was the leading challenge for the project. Encouragingly, however, the majority of them followed the system and provided key lessons and feedbacks for future improvement. The following were the major problems and challenges seen during the operation of collection centers:

- **Lack of awareness about the benefits of aggregation and collective marketing under collection center system**
- **Difficulty in finding a right mechanism for division of roles and responsibilities among MPC members for day to day operations of the collection center**
- **Lack of confidence to trade agriculture commodities to external markets**
- **Difficulty in drawing larger number of farmers under CC umbrella for enhancing volume of collection**
- **Difficulty of transportation of cauliflower to larger markets mainly due to limited volume of production**

In order to address these issues and challenges, the following measures need to be considered.

➢ MPC cannot function properly unless its members fully understand the essence of product aggregation and marketing: MPC still requires supervision and assistance from SRCAMP Team. Awareness about importance of external markets and traders need to be enhanced. In addition, MPC needs to build good relationships with many traders for greater negotiations for the sales of their commodities.

- With limited number of membership at a collection center, there will be very small volume of product collection, which is a major challenge for smooth collection center operation. The effort to increase the number of farmers who participate in unified production system and increase the volume of production is necessary. MCP should prepare a cropping calendar by consulting with the traders and wholesalers and provide plantation timing in order to efficiently aggregate their products.
- Proper planning, transparency and regular coordination and meeting of MPC and member farmers is a key to the collection center's success. Limited number of meetings could result in rising mistrust between MPC and members. Sharing the details of MPC activities to the wider range of stakeholders not only enhances the trust of the MPC members but also helps to increase the number of farmers. Conduct regular meetings of MPC, at least once a month, by inviting all the farmers in the vicinity. Formulate annual plan of MPC comprising of production planning, income-expenditure planning, training needs, etc. is a must.
- Unless fund is regularly generated by MPC, it will be impossible to run the day-to-day activities of collection and marketing. The following activities may be the way to address this issue; diversify the products and increase outreach to new market; increase production volume; make service charge compulsory and based on type and volume of production; and invest the collected money to within and outside members in preferably agriculture sector.

CHAPTER 3 HORTICULTURE AND FRUIT PILOTS

3.1 H-1: Introduction of Unified Standard Group Production for Marketing

The pilot activities of the vegetable package were started from August 2012. The idea of uniform production is to produce the same variety of the produce, using the same cropping calendar by group of farmers so that the certain volume of commodities with same quality is produced for efficient and effective marketing. District Agriculture Development Office (DADO) in cooperation with SRCAMP formulated detailed activities (Activity chart) for the pilot crops (Annex 11 for Cauliflower as an example), and these charts were distributed to individual farmers. The farmers were requested to follow the technical details in the chart in consultation with JT/JTAs and DADO.

Some of the major activities included the following.

- **Same cropping calendar for all farmers from nursery bed preparation to harvesting and marketing**
- **Use of same variety of seed (Snow Mystic)**
- **Equal spacing between plants and planting rows**
- **Application of Same amount of fertilizer, pesticides and micro-nutrients**
- **Same size and quality**

(1) Uniformity

Unified Cauliflower Production in Bocha, Dolakha

Farmers in all the sites were asked to put the precise dates on the calendar for undertaking the activities under uniform production system. Adhering to this simple rule, almost all of the farmers followed the activity calendar under supervision by FFs. Given the variation in agriculture conditions such as irrigation, soil type, diseases, etc., it was difficult to bring all the farmers to the same timeframe. Despite the difficulty, farmers tried adjusting their traditional practice to the newly recommended guidelines. In some activities, farmers were not able to follow the instructions on the calendar. Table 3.1 shows the percent of farmers who followed and not followed the new practice.

Table 3.1: Status of Compliance against Key Activities During UPS

(Unit: %)

	Bhimkhori			Bocha			Hattitar			Ratamata		
	TC	E	D	TC	E	D	TC	E	D	TC	E	D
Nursery	54	0	46	94	6	0	91	9	0	82	0	18
Pot hole preparation	8	0	92	100	0.0	0	9	0.0	91	0	0	100
Transplantation	0	0	100	100	0.0	0	9	18	73	0	0	100
1st fertilizer application	0	0	100	100	0.0	0	9	0	91	0	0	100
First Weeding/Top Dressing	15	0	85	71	29	0	64	27	9	0	0	100
Second Weeding Top Dressing	100	0	0	100	0.0	0	55	0	46	100	0	0
Harvest, packaging and Sales	0	31	69	77	0.0	24	91	11	0	100	0	0

Note: TC: Total compliance, E: Early, D: Delay

None of the farmers complied with all the seven major activities. However compliance in more than 80 percent of the activities was highest in case of Bocha whereas about 30 percent in Bocha and about 20 percent Hattitar complied with 60-80 percent of the activities. The percentage of farmers complying between 40-60 percent of the total activities was highest in case of Bhimkhori, followed by Ratamata and Hattitar. The percent of farmers complying less than 40 percent of the activities was highest in case of Hattitar, followed by Ratamata and Bhimkhori.

(2) Production and Yield

The total production of cauliflower from all four sites was about 63.5 tones whereas the average production per person across all the sites was about 1.3 tons. The average production per farmer was highest in Ratamata followed by Hattitar, which were 1.7 tons and 1.6 tons respectively. The third highest was seen in Bocha (1.2 tons/person) followed by Bhimkhori (0.6 tons/person). Table 3.2 presents the details.

Table 3.2: Production and Yield from the Uniform Production

Name of the site	Total Area (Ropani)	Total Production (tons)	Avg. Production (tons)/ Ropani
Bhimkhori	11	6.4	0.6
Bocha	17	20.1	1.2
Hattitar	11	19.1	1.7
Ratamata	11	17.9	1.6
Total	**50**	**63.5**	**1.3**

The yield increased most in Hattitar and Ratamata, whereas it was lowest of Bhimkhori with the value of 0.6 tons/ropani (11.6 tons/ha). In Bocha, the yield was 1.2 tons/ropani (23.7 tons/ha).

Relatively lower production and yield in Bocha and Bhimkhori was mainly due to climatic factors like temperature and frost. This did not only lead to prolongation of duration of maturity of plants but also many fungal diseases which led to the poor production. In case of Bhimkhori, similar climatic situation was aggravated by poor management of plots by the farmers. Farmers were not very optimistic of the cauliflower from the nursery stage as the growth of plants was not encouraging.

(3) Production Cost

The total cost of production was estimated in each site, using focus group discussions with all pilot farmers. It included production inputs (seeds, fertilizers, pesticides, etc.), labor and other investments during cauliflower piloting. Production cost was about Rs. 16,000/ropani in Ratamata and Hattitar while it was Rs. 9,065/ropani in Bhimkhori. In Bocha, the production cost was Rs. 13,965/ropani. Low amount in Bhimkhori was mainly due to low labor cost of Rs. 100 per day for both men and women. As this is a unified production system of cultivation, other costs were almost equal. See Annex 12 for Details.

(4) Return on Investment (RoI) and labor productivity

Return of investment is a function of net profit and cost of production i.e., RoI = (Net Profit/Cost of production)*100. This formula has been used to estimate the return on investment in the cauliflower piloting. Table 3.3 shows the value of return on investment for each of the pilot sites. The highest RoI was seen in case of Ratamata (115.1), followed by Hattitar (91.1), while the lowest RoI was seen in case of Bhimkhori (19.1) with slightly higher value seen in case of Bocha (26.0). The reason for low RoI in case of Bhimkhori and Bocha was mainly due to low volume of cauliflower production.

Table 3.3: Return on Investment and Labor Productivity of Unified Cauliflower Production

(Unit: Rs. per Ropani)

Particulars	Bhimkhori	Bocha	Hattitar	Ratamata
Total cost of Production (Rs) (a)	9,065	13,965	16,015	16,365
Total Income (Rs) (b)	10,800	22,000	30,600	35,200
Net Profit (Rs) (c); c=b-a	1,735	8,035	14,585	18,835
Return on Investment (RoI) (c/a*100)	19.1	57.5	91.1	115.1
Total Income	6,685	17,585	13,063	30,335
Total Labor Days	31.5	36	31.5	40.5
Labor Productivity	212.2	488.5	813.8	749.0

The labor productivity of cauliflower production was estimated based on the net profit per Ropani. The net profit per ropani divided by the total labor days was used as the formula for estimating the labor productivity. The labor productivity was highest in case of Ratamata and Hattitar and lowest in case of Bhimkhori. Due to lower value of profit made in Bhimkhori, labor productivity also was very low. Table 3.3 also includes the value of labor productivity by sites.

3.2 H-2: Introduction of the Multiple Water Utilization and Micro Irrigation System (MWUS) Project Site

Cool summer climate in Bocha has fair advantage in monsoon vegetable. In order to work on monsoon production, seedlings must be prepared during dry season. Shortage of irrigation water was a main restriction for the farmers to work on this advantageous production. It was expected that a MWUS would supply 3.75 ha worth of irrigated water. The estimation of increased revenue for the farmers could expect to exceed the whole construction and maintenance cost. However, it should be noted that this benefit is not applicable to any locations. This system is only good for the place with good water source. The specific location in Bocha had all the good factors to realize the benefit from this system by chance.

MWUS in Yarsha village in Bocha

Yarsha village of Bocha VDC was selected for MWUS pilot site, after a brief feasibility study by the MWUS engineer was conducted. This village is about 12 Km from the district headquarter Charikot, being located between altitude of 1,500-1,700 m, and is spread in ward no. 5 of the VDC. Although Bocha VDC in general has fairly good water availability, the Yarsha village is relatively dry. Between March and May, water availability is constrained whereas there is plenty of rainfall during monsoon months. In terms of demography, there are about 21 households in the Yarsha village. Majority of the households belong to ethnic caste group with high dominance of Tamang caste.

(1) Construction Phase and Process

Construction process of MWUS is summarized in Table 3.4. First phase mainly consisted of preparatory activities such as undertaking detailed consultations with different stakeholders including DADO and community members. Recommendations from DADO were very crucial in identifying the precise site for pilot implementation. Likewise, the major activities such as undertaking detailed feasibility study, formation of water users committee and undertaking agreement between water users' committee and donor were also conducted in this stage.

The second phase was the design and construction phase which lasted from September to December of 2012. First activity under this phase was the digging of pipelines involving the local community. Likewise, local community collected the local materials such as stone and sand required for the construction. SRCAMP facilitated the procurement of materials such as cement, iron rod, etc. The system was completed and inaugurated with participation of DADO in December 2012. The system was functional from onwards and orientation of use of the scheme was conducted between January and February 2013.

Table 3.4: MWUS Construction Phase and Processes Conducted

Phase	Major processes
Preparatory phase July – August, 2012	• Consultative meeting with stakeholders • Scheme screening • Feasibility study • Scheme ranking and selection • Formation of water user committee • Detail engineering survey and cost estimation • Work plan preparation • Formation of construction committee • Agreement between water user committee and SRCAMP
Construction phase September – December, 2012	• Collection of local material • Procurement of material and tools • Handed over the material to the construction committee • Started to dig the pipeline section • Land preparation and developed the tank and tap stand • final testing of the tank, tap and pipeline
Utilization Phase January 2013 -	• Inauguration of the MWUS scheme and conducted the social audit • Formulation of the scheme operation and maintenance committee • Scheme operation and micro irrigation installation training • Monitoring and fallow up the completed scheme • Conducted the different meeting about the scheme performance and feedback.

(2) Technical design

Civil engineer and technician hired by SRCAMP prepared the overall technical design of the MWUS. A total of five main structures were designed namely a) ferro cement tank b) double off take c) public stand post d) drinking water flow scheme and e) irrigation water flow scheme. Annex 13 (a and b) presents the detailed technical design of each of these structures of MWUS.

(3) Construction Cost Sharing

Total cost for MWUS construction was Rs. 576,295. SRCAMP covered Rs. 333,295 (about 60%) of the total cost and the rest was bone by the beneficiaries. Table 3.5 shows the breakdown of the cost and expenditures.

Table 3.5: Detailed Cost and Expenditure of MWUS

Items/Source of Funds	Amount (Rs.)
Income	**576,295**
SRCAMP	333,295
Local cash contribution	17,000
Local unskilled labor contribution	213,900
Local in-kind contribution	12,100
Expenses	**576,295**
Materials and Transportation	362,395
Local labor	213,900

Source: Public Audit of MWUS users committee

There were mainly two types of beneficiaries of MWUS, direct and indirect beneficiaries. Direct beneficiaries were those households for whom the MWUS construction was targeted. They used drinking water and irrigation system in a very regular manner, and took the leading role in the management and operations of the system. The SRCAMP selected 17 households (population: 111) which had very high scarcity of water. On the other hand, indirect beneficiaries are those households who are proximally located to the direct users that they can use the surplus water for irrigation after the use by the direct beneficiaries. They do not have direct access to drinking water taps. They were not involved in management committee and did not make any financial contribution either for construction or maintenance. There are about 25 (population: 141) indirect beneficiary households.

(4) MWUS management committee

MWUS management committee was originally established as the construction committee, but it was conversed to the management committee when the construction was completed. The committee consisted of 9 members, and the major role of the committee is to make decisions about MWUS operation and maintenance.

The committee decided to collect monthly fees from the beneficial households in order to prepare for the maintenance and repair. The amount for the monthly fee was Rs. 10 per household. Under necessary situation, extra fund will be collected from member households, depending upon the scale of the problem.

For the maintenance and repair, the following rules were set up.

- **2-3 members from a cluster are given task to repair and maintain the system if the problems is small (minor leakage in end point taps)**
- **If there are problems in the main system, 2-3 members from each cluster contribute labor for repair & maintenance**

(5) Result

The outcomes of the MWUS installation are summarized in the Table 3.6.

Table 3.6: Facility and Number of Beneficially

Particulars	Before the Pilot	After the Pilot	Change
Total number of benefitting households	0	17 – Paid* 25 – Unpaid**	+32 person
Total number of beneficiaries	0	111 – Paid* 141 – Unpaid**	+252 person
Number of drinking water tap	0	10 (5 posts)	+ 10
Time spent to collect D/W	1 hr/day	< 1 minute	- 59 minutes
Water consumption amount per L/HH/day	80	350	+270
Number of irrigation point	0	6	+ 6
Total irrigated area (Ropani)	29	89	+190
Total area of vegetable production (Ropani)	4.5	33.9	+27.3
Total area of potato cultivation (Ropani)	24.5	51.0	+26.5
Income from total producers (Rs.)	312,800	989,675	+ 216 %
Total Cost of production of farmers	124,494	281,382	+126 %
Approximate Net Income in the village MWUS	188,307	708,293	+276 %

Access to the Irrigation

Improved access to the irrigation system contributed to increase the vegetable cultivation area. MWUS has been highly instrumental in supplying water during the dry season, especially from March to May. It has enhanced the total areas of irrigation. Only about 29 ropani (1.4 ha) were being used for vegetable cultivation before the installation of MWUS, and it was increased to 84 ropani (4.2 ha). Out of the total irrigated land by MWUS, 51.9 ropani has been irrigated using non-conventional irrigation system while remaining 3.1 ropani is being irrigated directly by the use of plastic water distribution pipes.

Crop Production

Traditional crops in Yarsha village were cereals such as paddy, maize, millet, buckwheat, wheat, mustard. Potatoes were also produced. Table 3.7 shows the change in area of different crops before and after the installation of MWUS. As seen in the Table 3.7, the cereal production in general decreased and potato production area is increased by about 108 percent after the installation of MWUS.

Some of the emerging crops include cauliflower, tomato, cabbage, onion, turmeric, garlic and green leafy vegetables. It is seen that there is a substantial growth in the area of cash crops and vegetable crops after MWUS installation with average growth about 163 percent. Due to very low production prior to MWUS installation, some of the numbers look even unreal (esp. cauliflower and tomato)

Table 3.7: Change in the Area of Traditional Crops after MWUS

Name of Commodities	Area (ropani)			Total Production (kg)		
	Before	After	Δ (%)	Before	After	Δ (%)
Paddy	18.0	18.0	0	N/A	N/A	N/A
Maize	37.0	54.5	47	N/A	N/A	N/A
Maize and Millet	117.0	70.0	-40	N/A	N/A	N/A
Potato	24.5	51.0	108	N/A	N/A	N/A
Buckwheat	27.0	20.5	-24	N/A	N/A	N/A
Wheat	36.0	17.5	-51	N/A	N/A	N/A
Mustard	20.5	17.0	-17	N/A	N/A	N/A
Cauliflower	0.1	11.7	9,251	75	7,565	9,987
Tomato	0.1	2.5	3,900	90	7,030	7,711
Potato	24.5	51.0	108	1250	31,250	2,400
Cabbage	1.5	2.2	46	650	1,300	100
Onion/garlic turmeric ginger etc.	1.4	4.5	213	350	1,700	386**
Other green leafy vegetable	1.4	4.5	213	550	1,800	227**
Chili	0.1	0.5	700	NG	550	N/A
Pea	0.1	8.0	12,700	N/A	NH	N/A

Note: NG: Not grown, NH: Not yet harvested; N/A: Not available
**: More than 90 % produce was consumed by the producers

In addition to the area, there was a very high growth in the production after the use of MWUS irrigation. Table 3.7 also presents the change in the production before and after the MWUS installation. Highest increase was seen in case of cauliflower, tomato and potato: cauliflower and tomato were not cultivated before. In case of potato, due to better irrigation access at present, the production went up very high. According to the farmers, production from the same land went up and they expanded the commercial production which was initially thought to be inadequate due to lack of irrigation. Chili and peas which were only grown for home consumption before are grown commercially. For these crops, there was no basis to estimate the change due to lack of the baseline.

Income change

Increased production resulted in the increased income for the MWUS beneficiaries. The total income from all the 17 farmers from major crops increased by nearly 216 percent. Table 3.8 presents the change total income among all the beneficiaries after the installation of the scheme. Highest increase in income was seen in case of cauliflower followed by tomato. Substantial change was because farmers had very limited income before MWUS was installed.

Table 3.8: Total Income of the Direct Beneficiaries before and after MWUS Installation

(Unit: Rs.)

Name of crop	Before			After			Change in %
	Total sales volume (kg)	Price/ kg	Total Amount (Rs.)	Total sales volume (kg)	Price/ kg	Total Amount (Rs.)	
Cauliflower	50	35	1,750	6,350	38	241,300	13,689
Potato	12,250	24	294,000	27,425	17	466,225	59
Tomato	40	60	2,400	6,050	40	242,000	9,983
Cabbage	350	25	8,750	1,050	20	21,000	140
Chilly	0	0	0	125	50	6,250	***
Pea	0	0	0	-	NA**	-	***
Onion/garlic turmeric , ginger etc.	50	90	4,500	150	75	11,250	150
Other green leafy vegetable	35	40	1,400	75	22	1,650	18
Total			**312,800**			**989,675**	**216**

Source: Based on the collection center record and group discussion. NA*: Not for sale; NA**: Pea is not yet harvested; ***: New crop harvested

Drinking Water

MWUS construction enhanced the access of villagers to drinking water. There are a total of 5 outlet (10 taps) constructed aimed at supplying drinking water to the direct beneficiaries of MWUS. The following explains situation change of drinking water access at Yarsha village.

- ***Household coverage:*** **After MWUS, 17 households have direct access to drinking from the scheme.**
- ***Water availability:*** **Traditionally villagers collected water from nearby ponds and streams. Availability of water has increased after MWUS construction. They can fetch the water anytime they want from the MWUS standing taps.**
- ***Time saving and use:*** **It took about one hour for villagers to fetch water every day. But it takes less than one minute as the standing taps are adjoining to their household. Women who were the main household members collecting water feel that they have relatively less physical stress and they can spend the saved time on other livelihood activities such as vegetable farming, cattle rearing, health and hygiene, etc.**
- ***Water consumption amount:*** **The total amount of water consumption has drastically improved after the construction of MWUS. Before MWUS construction, each household used about 80**

liters of water per day for human consumption, cattle feeding and day to day household activities. This increased high to about 350 liter per day per household. Improvement in the sanitation condition of household and cattle shed was the major impact. Villagers use the surplus water to irrigate their kitchen garden as well.

3.3 H-3: Utilization of Rain-shed Plastic House

(1) Plastic house and micro irrigation

The plastic house for monsoon tomato production was constructed by each farmer according to the instruction given by SRCAMP. SRCAMP provided plastic sheets, and farmers prepared local materials such as bamboos poles and stones. A micro irrigation system, simplified drip irrigation equipment per house, was installed. The system was very simple to use and maintain, and no problems were identified.

(2) Trial production of tomato in Bocha

As Bocha farmers had no experiences in tomato production in commercial scale, a trial production was arranged before starting the full-scale actual production[8]. Seeds were sown in August 2012, and they were planned to grow and harvested in early winter 2012. Nursery production went well in general except one farmer. Soil of the farmers filed might have been infected by Phytophthora. After a while, almost all trial tomato fields in Bocha suffered from this disease.

It was found that general practice of pest control in Nepal, especially application of pesticide, is not preventive. Farmers apply pesticides when they see the disease symptoms. Most commonly used pesticides in Nepal are generally not strong enough to stop or cure the insects/diseases. Therefore, it is effective and efficient to use these pesticides for prevention. It is also important to know planed preventive application will reduce the amount of pesticide. Pilot farmers are planning to harvest this monsoon tomato for longer period, about 6 months. Infection of disease could inhibit the expected long-term revenue in tomato production. As the countermeasure, SRCAMP team instructed pilot farmers to apply preventive pest control to secure their revenue.

(3) Monsoon tomato production

Rain Shed Tomato Production in Bocha, Dolakha

The unified tomato production was started in February 2013. In Bhimkhori, Bocha and Hattitar tomato production was implemented as it planned with very minor problems. However, in Ratamata, despite following the same management techniques, several problems related to wilting and drying were observed. In Bhimkhori and Bocha started harvesting and selling tomato in June 2012. In Ratamata, following the recommendation of SRCAMP, many farmers planted

[8] The actual production started in February 2013.

new seedling of tomatoes.

Due to increase in temperature, there was high problem of wilting in tomatoes in July. Ratamata and Hattitar had major problems. Because of the excessive heat under the plastic house, there was high mortality in these areas. In Ratamata, almost all the farmers did re-seedling from their own investment during July and August. The plastic house is not suitable in the lower altitude areas targeting monsoon production. Table 3.9 summarizes site specific situation of tomato production, and Table 3.10 provides the result of the Tomato Production as of October 2013.

Table 3.9: Site Specific Situation of Tomato Production

Name of the site	Tomato Production
Bhimkhori	• Very few cases of fungus and downy mildew were observed • Many farmers planted extra seedlings both outside and inside of plastic house after the monsoon
Bocha	• Plastic house was managed properly compared to other pilot sites. • With higher altitude, it took more time for Bocha farmers for production due to lower temperature compared to lower sites • Problem of white fly and fungus were observed but not serious • Very good assistance was given by FF and JT • Farmers were highly motivated for tomato cultivation mainly due to continued nature of production/income and more efficient time management capability compared to other crops • Tomato was sold mainly to the local market
Hattitar	• Tomato production was not a successful mainly due to higher temperature inside the plastic house (max 41 degree Celsius) • Major leaf greening symptom was observed • Welding problem despite use of a drip irrigation due to shortage of water • Tomatoes were sold mainly to the local market
Ratamata	• Almost all the tomato plants under the plastic house died from excessive heat • Poor management and care of farmers mainly due to discouraging results right from the start of the cultivation • Few farmers continue growing tomatoes outside of plastic house • Tomatoes were sold to various markets through the collection center

Table 3.10: Result of Tomato Production

(Unit: Rs. 1,000/ropani)

Site		Total Sales	Input Cost	Net Income
Bhimkhori	Baseline	10.0	4.3	5.7
	Average	15.9	4.8	11.0
	Highest	23.7	4.8	18.9
Bocha	Baseline	NA**	NA**	NA**
	Average	14.0	3.8	10.2
	Highest	26.6	3.8	22.8
Ratamata	Baseline	NA**	NA**	NA**
	Average	4.2	3.8	0.4
	Highest	12.3	3.8	8.5
Hattitar	Baseline	NA**	NA**	NA**
	Average	8.4	2.9	5.5
	Highest	19.9	2.9	17.0

** No baseline information due to first time cultivation.

3.4 H-4: Quality Improvement of Seedlings and Saplings

(1) Seedling production of cauliflower

First cauliflower seeds were sowed toward the end of August, 2012. It was little late for seeding cauliflowers, and it affected their growth. In addition, the heat and lack of proper watering caused major damages to seedling rearing. Therefore, the second trial seeds were distributed to all farmers and the second nursery was developed. Pot up was recommended by SRCAMP to attain more uniformity in seedling production since the farmers are relatively reluctant to thin out the seedling from their bed. However, neither thin out nor pot up had practiced. Consequently, the growth of seedlings became uneven.

A total of 0.05 ha *(1 ropani)* of land was dedicated for the unified cauliflower production where each farmer transplanted 2,000 saplings. Not all of them survived and the survival rate varied by site and by farmers. Mortality was caused by weather, disease or poor management of the fields. Table 3.11 shows the distribution of farmers based on survival rate of cauliflower.

Table 3.11: Survival Rate of Cauliflower Saplings

Unit: No. of farmers

Survival Rate	Bhimkhori		Bocha		Hattitar		Ratamata	
	No.	%	No.	%	No.	%	No.	%
100 %	0	0	2	12	5	36	2	18
75-99%	0	0	4	24	3	27	4	36
50-74%	1	9.1	4	24	2	18	4	36
< 50 %	10	91	7	41	2	18	1	9
Total	**11**	**100**	**17**	**100**	**11**	**100**	**11**	**100**

Figure 3 shows the survival rate of cauliflower by site. The survival rate in Bhimkhori was very low. The survival of less than 50 percent of saplings was 90.9 percent. This was mainly due to poor management. Bocha also had a low survival rate compared to other two sites, and it was mostly due to the low temperature. In these two sites, this affected on the total production volume and yield.

3.5 H-7: Introduction of Unified Grading and Proper Packaging System

(1) Market reaction of grading and packaging

There are only few cases observed using carton boxes for agricultural commodities packaging in Nepal. Most commonly seen in the market is apples from China. Some domestic apples are distributed by using carton boxes as well, but it is hardly seen in the market. Packaging produce in the carton boxes was introduced to see the effect on efficiency of transportation and handling of cauliflowers. A total of 1000 boxes were prepared (Rs.30 per box) and tested by participated farmers and traders at four sites. However, expected effects were not observed from this experiment.

Cauliflowers Packaged in a Carton Box

One of the reasons was that quantity of production from the pilot was too small to realize the benefit. Loading capacity was higher by using boxes than bags on flight trucks, but pilot production was still too small to hire trucks and could not verify this point. Major shipping means for target sites at current stage is still a public transportation. Traditional plastic bags are preferred by handlers and more efficiently transported than carton boxes.

Utilization of carton box reduced the weight of transported cauliflower about 30 – 35% by removing extra leaves from the produce. But public transportation charges same amount per piece for both box and plastic bag while a plastic bag can contain 2 – 3 times more weight than a box. Thus the actual cost of transportation was increased by using carton boxes. Similar condition too was observed in handling. Almost all people involved in handling the products evaluated plastic bags are easier to carry, load and unload; therefore, the efficiency is higher in plastic bags. The result was negative in efficiency in using carton boxes at current production condition in the target area.

There were some positive aspects by using carton boxes for vegetable handling. One of them is reduced damages during transportation. However, this result was not clearly identified because the production could not unify the size of cauliflower, packing did not optimally absorb outside impact.

Another effect is improved durability of packed vegetable. This effect was observed: carton boxes protected the cauliflower from outside air from dryness. Also paper will absorb and release air moisture to stabilize the humidity inside. These factors may also improve the storing condition of a vegetable. The cauliflower lasted 2 weeks in a box while open air started to degrade after 3 days. Some traders liked this condition because duration of marketable period is one of most important factors for sellers to select a produce. Therefore, only few traders are willing to pay higher prices. One trader paid Rs.18 / kg for the boxed ones while he was only paying Rs.10 / kg for others.

Durability of vegetables varies not only by storing condition like packaging but also by the quality of the produce itself. Product from pilot with more appropriate production method may affected on the better quality for durability; therefore, it was not able to be determined this longer duration was only from carton box effect. In addition, improvement in storability in carton box was only possible under colder temperature. If a vegetable is stored in closed box under high temperature, the heat vegetable itself release will induce fumigation. It was already observed in Manthali, where temperature is already high in February. If carton box packaging is going to be tested during the monsoon season, this heat effect must be kept in mind.

Although there were also many negative aspects observed in carton box experiment, increasing production scale will definitely improve the efficiency of transportation, and so as the usage of carton boxes for packaging. Possibility of carton box should remain for further study. The negative and negative impacts are summarized in Table 3.12. The perception from the stakeholders is presented in Table 3.13.

Table 3.12: Impact of Carton Box Packaging

Positive impacts	Negative impact
• Improve product quality for sale, especially maintain freshness of cauliflower for long time • Easy to transport on bulk amount, damage can be minimized/reduced during transportation • Fetch higher price on market compared to un-packed cauliflower • Minimize labor cost on transport, especially on loading and uploading	• Often create problems of storage, mostly suitable for retailers • Poor handling by the transportation staff often results on unpacking and damage of boxes, reduce quality. This problem is further supported by poor road condition • Cost of marketing increases, especially carton price are expensive compared to plastic bags • Only small scale retailer traders demand paper boxes, wholesaler and traders often don't persist for use • Damage of cauliflower due to friction • Difficulties to reuse of the boxes.

Table 3.13: Perceptions on Carton Box Packaging from Different Stakeholders

Stakeholders	Perceptions
Farmers	• Difficult to send produce on public buses, need private vehicle. Production quantity is low to fully load a truck. • Need production on bulk amount, does not suit for small holder producer • Easy of packing of cauliflowers, demand from retailer is high since it store durability • Minimize labor cost on transport, especially on loading and uploading • Size of cauliflower should be uniform to pack and transport, size of cartoon is small • High cost of packaging material, does not sound economical when price of cauliflower is Rs. 10 • No difference on price of cauliflowers either packed or unpacked.
Local traders	• Produce quality is kept high, hence easy to sell produce • Improves durability and freshness of produce • Difficult to transport, too many small boxes • Cost of transportation is increased, often difficult to transport on public bus • Not preferred by hotels and restaurants, because of increased price • Friction during transportation often destroy both cauliflower and boxes, wrapping need to be done to avoid frictions
Whole sellers	• Not suitable for block trading, difficult to handle • Difficult on weighing and time consuming of un-packaging • Not suitable for winter season cauliflower, may be good for rainy season

3.6 H-5: Single Cropping and Tree Management for Citrus / H-6: Appropriate Pruning and Thinning for Citrus

Junar Pilot Activities started in Ratanchura VDC in November, 2012, after harvesting of fruits from previous year. Target farmers and trees to be used for experiment in order to compare the effect of the improved treatment were selected. Since there were not enough trees for proper comparison of each treatment, the design of the plot activity was modified. Farmers treat their Junar trees with 4 different kinds of treatments; 1) traditional, 2) adding fertilizer, 3) adding fertilizer plus single cropping and 4) adding fertilizer plus single cropping plus pruning/thinning). Table 3.14 presents the treatment and the number of trees selected for each treatment[9].

Table 3.14: Compared Treatment and the Number of Junar Tress Compared

Treatment Method / Farmer #	Treatment and the Number of Trees			
	1. Traditional	2. Fertilizer	3. Fertilizer + Single Cropping	4. Fertilizer + Single Cropping + Thinning & Pruning
1	5	5	5	5
2	3	3	3	3
3	2	2	2	2
4	2	2	2	2
5	2	2	-	-
6	4	4	4	4
7	2	2	-	-
8	2	2	2	2
9	2	2	-	-
10	2	2	2	2
11	2	2	2	2

The cultivation calendar, designed by SRCAMP in consultation with DADO, was provided to farmers in January, 2013. Fertilizer was distributed and farmers applied the first fertilizer as instructed in February 2013.

Most of the farmers were practicing pruning to some extent. However, they did not understand the real purpose of each method, and cutting was not properly practiced. In order to address this issue, the workshop was held on December 25, 2012 in Ratanchura pilot site to demonstrate the basic techniques for better orchard management. The instruction was given by a JOCV who was specialized in citrus orchard management dispatched to Kavre district. The workshop was consisted of lecture, including general orchard management, and technical demonstration of how to thin and prune the tree. The training materials are attached in Annex 14.

All the farmers followed the cultivation calendar. Their compliance rate was very high, under the regular supervision of FF. In October 2013, citrus greening problem was seen in few orchards below 800 meters in Sindhuli district, but it did not reach to the pilot sites. Appropriate treatment in the pilot plots significantly alleviate the pest damage from scheduled pesticide application. Physical damages on the fruits skin caused by the pest are clearly reduced. Condition of the leaves and branches are also maintained cleanly compared from non-treated trees. In November 2013, it was strongly recognized by DADO officers and target farmers that the tree condition, fruit size and fruit numbers were better in case of improved in treatment 2, 3 and 4, compared to the tradition practice 1. The cost, including

[9] It should be noted that selected sample trees of each farmer were not necessarily equal and individual differences were expected to affect on the experiment.

materials and labor, incurred for this improvement was considered as affordable by the participated farmers.

As of the date of writing this report, all Junar fruits on treated trees have not been harvested; and therefore, either qualitative or quantitative result is not clear yet. However, being encouraged by the visual result of SRCAMP pilot project, Sindhuli DADO voluntarily held a workshop to disseminate the SRCAMP example in the area on November 26, 2013.

3.7 H-8: Junar Processing for Improvement of Storability and Transportability

(1) Possibility for Junar processing

Extract from Junar currently produced in the production area had been examined by Chaudhary Group (CG) whether it was usable for their products. The result was not usable at present because of its low quality. Although Junar extract from the area is on market as "Junar squash", none of current processing facilities use appropriate sterilization process to meet international standard of hygiene. It is recommended to provide different opportunity for those processors. Currently, the construction of a Junar processing factory is ongoing by FNCCI with the cooperation with the Government, where similar type of extract will be produced. If this ongoing processing project could absorb those small private processors, it is more realistic to cooperate with this project.

Some of the lessons learned from the pilot project are summarized below.

- **Succession and Dissemination of Technology**

There has been JICA assistance in Junar improvement for many years. Many leader farmers took technical training for citrus management in and out of the country. Basic techniques were inputted and at least once the idea was practiced in the area. However, the techniques were rather fading away than adapted and improved. Although there are more organized farmers cooperatives composed of the Junar production farmers, succession of the knowledge seems very limited. Some incentives need to be developed for farmers to be more communicative at least among the farmers who seek to promote commercial production. Also, continuous guidance from DADO is required to maintain appropriate level of technique. The level of farmers' technique may fluctuate each year; and therefore, appropriate and updated techniques from the government side such as Central Horticulture Center in Kirtipur should be extended constantly.

- **Effect of Fertilizer**

SRCAMP provided information concerning safety for application of chemical fertilizer, and only those who understand the information participated to the pilot. Nevertheless, some farmers showed a small concern that their tree may wilt after the fertilizer application. As a matter of course, trees are fine and the farmers' concern has been erased.

The causes of these misunderstandings are wrong information disseminated by non-technical sources. Those farmers are not given enough basic scientific knowledge to make a fair judgment. It is an important role of DADO to extend proven scientific knowledge so the farmers can make appropriate decision based on their own benefit. Farmers are free to choose organic farming or any type of regal methods, but scientifically collected information must be clearly extended to them before they make important decisions.

- **Effect of thinning and pruning**

Long-term commitment is required to see certain results from the work of thinning and pruning. Major objective of the work is to attain stable production and keep quality at higher level. The farmers are going to face temporal reduction of production at first before they realize expected result. The effect of thinning and pruning also appears in quality improvement such as taste. However, it seems that farmers have not yet acquired adequate knowledge to evaluate the quality of fruit. There are very few fruit which is acceptable as "good", but others are relatively low quality in terms of taste. If farmers cannot identify the improvement of quality (taste) against temporal reduction in production in the first stage, they may lose their motivation and stop practicing the thinning and pruning work before seeing the actual result in the next stage. In order for the pilot farmers to maintain motivation, DADO should educate the farmers to become able to differentiate the fruit taste so that they can feel the progress and keep motivation until move onto the second stage, even with the temporal loss of their revenue.

Promotion of thinning is also an issue under current market condition in Nepal. Some farmers understand the alternate fruiting is a problem. They are experiencing severe reduction of fruit when they had abundant crops in previous season. Thinning would solve this problem, but it is not properly practiced. However, there is high demand for Junar for Dasain in October, and some farmers harvest all green fruit to sell in this season. This early harvesting reduces the burden on the fruit tree, working like thinning process, so the tree is able to maintain its capacity to generate fruit in the next season. But if farmers sell Junar as a whole tree to the traders and leave harvesting tasks for traders, this early harvesting or thinning process may not appropriately implemented.

3.8 Potato Production for Processing, Panchkhal, Kavre

This activity is executed aside from other pilot projects. This is a trial to promote the idea of contract farming and meeting industrial agricultural demands in the target area. A variety of potato used for processing into potato chips is the target crop. The Chaudhary Group (CG), one of the major companies in Nepal which also has a food processing division, is the possible purchasing firm. CG produces many food and beverage products including instant noodles, cookies, beer, fruits juices, etc. for both domestic and export markets. Most of their ingredients of food products are imported, and domestic products are hardly used. However, the company is willing to increase domestic ingredients for business benefit and also for the Corporate Social Responsibility (CSR).

In 2011, they had provided SRCAMP with seed potatoes for trial production in the target area. 200kg of seed potatoes, a special variety suitable for potato chips, were supplied at free of charge. 50kg of the seed potatoes were distributed to each DADO in 4 districts. Each DADO office selected one site in their districts for trial. Other input materials such as fertilizers and pesticides were provided by SRCAMP. The first trials were implemented in the 2011/12 season in 4 districts. 50kg of seed potatoes were planted in 1 Ropani.

The result was that potatoes from 2 districts (Sindhuli and Ramechhap) were infected by diseases, and it could not continue the trial. In Dolakha, potatoes did not do very well either. However, the performance in Kavre was satisfactory in both quantity and quality. The harvested potatoes from Panchkhal, Kavre were examined for potato chip requirements at CG laboratory. Receiving the satisfactory result of the first year trial, it is decided to implement larger scale productions for 2012/13 season at Panchkhal, Kavre where 400 kg of the potatoes were produced.

In the second year (2012/13), 400kg of potatoes were grown by 18 farmers. Inputs were procured by the participated farmers by themselves. They shared information written in the cultivation manual which was provided by CG for the first trial, and made appropriate planning for all members. SRCAMP offered technical assistance when they needed. They requested to SRCAMP to arrange a study trip to observe the Terai potato farms where the production is more advanced. A field trip for the farmers was arranged by SRCAMP on May 31 to June 1, 2013 and 28 farmers participated. The trip enhanced farmers' motivation to proceed to the contract production with CG. A brief report is attached in Annex 15.

In the end of the season 2012/13, the farmers harvested a total of 750 kg of potatoes, which will be grown by 37 farmers in 2013/14. The Table 3.15 shows that the numbers participated farmers, the volume of planted seed potatoes and cultivated areas have expanded in each year. They have not yet reached to the point where they make a contract with CG, but the farmer groups maintain contact with CG for future possible contract production. These actions are taken by the farmers should be recognized as the commercial activity.

Table 3.15: the Number of Farmers and Size of Areas for Processing Potato Production Trial in Kavre

Year	Farmers (#)	Seed planted (kg)	Area planted (Ropani)	Name of potato trail site
1	1	50	1	Mahadevsthan mandan.
2	18	400	8	Mahadevsthan mandan, panchal, Kuntabesi
3	37	750	18	Mahadevsthan mandan, panchal, Kuntabesi,Kusadevi

Lessons Learned from the contract farming trail is summarized in the following section.

- **Farmers are not used to have communication with outsiders**

It seems that farmers are reluctant to make contact with unknown outside people. SRCAMP facilitated the conversation between farmers and CG at the first stage; however, the responsibility for further contact was transferred to themselves, farmers and CG. SRCAMP strongly recommended that both parties keep the business contact, but this was done in one way, only from CG to farmers.

There might be several reasons that farmers are hesitant to communicate. They might be intimidated to talk to business persons. Moreover, they seem to have baseless distrust toward business people. They fear to be exploited. Farmers should be able to evaluate business transaction objectively, scrutinizing whether they should take it or not. Communication with any business people is important as it may increase the business chance. SRCAMP explained and recommended to the farmers that they maintain neutral position without prejudice against business people. Farmers always have a choice to do business with them or not, so it is always better to keep other opportunities in their hand.

Especially in this case, CG has capacity to guarantee to buy the whole production without any farmers' responsibility of delivery. The price is a separate issue, but it is important for farmers to understand that business opportunity is not easy to find.

Lately, the farmers are making contact with CG without any concrete promise of business. It can be considered as some improvement in commercial agriculture.

- **Difficulties to adapt the contract transaction**

The contract transaction guarantees the price but not the profit. Farmers have to accept the fixed (lower) price even when the harvest is lean and it could fetch a higher price in the market. The price for industrial demand is generally low. The factory requires good quality potatoes at low price. CG has an additional purpose to buy domestic produce: for their CSR (corporate social responsibility) policy, but that does not mean they would buy produce at high price. The Terai area has advantage of economies of scale for production to meet the processing demand. How the Kavre farmers to meet this condition is an issue to be considered. In addition, small farmers with weak background have very little leeway to bear the risk of facing this situation in contract farming. In order to secure small farmers with stable income, while promoting the contract production, some kind of risk control system needs to be offered to farmers from outside sector.

- **Marketing Development by farmers**

These Panchkhal farmers took a good action to challenge for the better profit from this potato production. It could be a good example for marketing challenge. This specific variety contains less starch than other common varieties, which is required quality for potato chip processing. The farmers found an information that diabetes is a widely spread illness in Nepal, so the many patients are instructed by doctors to reduce the consumption of potatoes since it contains high starch. However, the potato is one of the staple diets in Nepal and demand is high for even those diabetes patients. Under this situation, the Panchkhal farmers marketed and tried to sell potatoes at higher price with attractive sales message of "Low Sugar Potatoes good for diabetes patients". The result has not yet known: No matter how the result would be, this kind of effort of farmers themselves for better marketing to attain higher price is necessary, and should be disseminated to all target farmers as a good practice.

3.9 Lessons Learned from Horticulture and Fruit Pilot Project

- **Small scale farmers requires more integrated farm management for risk control**

It is known that vegetables generate more sales value than cereals for farmers. But farmers are not totally confident whether it is profitable or not. Vegetable production requires more inputs such as certified seeds, fertilizers, pesticides and even some investments in durables like plastic sheets. As profit is not guaranteed, farmers are not comfortable to spend those initial costs. Generally, the target farmers tend to use domestic inputs for their production, so their initial cost for traditional cereal production is quite low. The initial cost of inputs is the primary factor for their hesitation of vegetable production.

Not only the initial investment, but also vegetable production has higher economic risks at the same time. Vegetables, contrary to cereals, are very perishable; the price fluctuates more drastically and easily could go below the production cost. Currently the SRC farmers are not ready to fully bare those risks. Therefore, the economic capacity of farmers must be evaluated before they plan how much of traditional cereals can be converted into vegetables production.

Furthermore, vegetable production requires more intensive labor. For example, in the pilot project, conversion from cereal production to cauliflower required twice more labor, and tomato even required 10 times more. The lack of adequate labor made some pilot farmers fail the production. The required labor for other duties must be thoroughly analyzed in a household. It is especially important in traditional farm management. Domestic labor must be distributed not only to agriculture but also to livestock and others. Importance of subsistence cereal production and livestock outputs like milk and meat cannot be neglected for farmers under current situation. Increment of labor requirement in vegetable production for additional cash income needs to be managed within the available domestic labor in a household in order to maintain original duties. Basic structure of livelihood of SRC farmers consists of agriculture and livestock. In order for SRC farmers to take the economic risk of vegetable production, basic livelihood must be secured, which depends on traditional cereal production and livestock activities.

- **Vegetable Production in the SRC area is not only feasible but can be competitive**

Economic feasibility of agricultural production in the SRC areas, especially on the hill area, is considered relatively low. However, the results from the pilot project indicated that labor intensive vegetable production could attain a reasonable competitiveness for target farmers against other major production areas in Nepal. Appropriate practice with very simple and basic techniques introduced by the pilot method improved the volume of production up to 5 to 6 times of their traditional method with the same vegetable.

The participated farmers had been managing to produce vegetables at limited but somewhat feasible level, which means that their production was at least covering the production cost. One reason for this is that their opportunity cost is low enough to compete against farmers in more advanced area. Under this condition, any improvement in their production will provide extra income for them. In fact, all the activities implemented during the pilot are expanding: the number of participating farmers has increased to 3.5 times in average, without any financial support. This may be because farmers recognized possible profitability in vegetable production.

In the meantime, as described in the previous section, the risks in converting to the vegetable production have to be recognized by farmers. There are also many issues to be addressed in SRC areas to become a major vegetable production site. Therefore, follow-up support is recommended until the activity becomes a real routine for the farmers.

- **Appropriate input material has immediate high effect**

Significant effects from input application were observed in all pilot sites. The farmers in all 5 sites had some experiences in producing selected crops before the pilot project; however, their production yield was not very high. The major cause for this unsatisfactory production was improper knowledge about input application. The issue was not just a lack of knowledge, rather misunderstanding, focusing only on negative effects of chemical fertilizers and pesticides. It is true that wrong application of any chemical inputs could induce serious adverse effects on environment and human health; therefore, farmers must have some scientific knowledge of how to use them. On the other hand, the farmers must have known from the experience that even the organic materials such as livestock manures could cause bad damage as chemicals: the excess application of manures is even more toxic for the soil than chemical fertilizers. Nevertheless, basic understanding of the farmers was "chemicals are harmful but organic are safe". This basic misunderstanding had misled the target farmers to make wrong decisions in farm management. The farmers should understand that livestock manures are not appropriate organic fertilizer by themself, or not even proper compost yet. They must know it could damage the soil, although the amount of manures available at the target area is not enough to do so. Most importantly, the farmers need to understand that appropriate use of chemicals improve rather than damage their production.

The central government of Nepal has a policy to put the first priority to allocate chemical fertilizers to the terai since the terai has more potential in intensive agricultural production. However, the results from SRCAMP pilot projects proved clear economic efficiencies in use of chemical fertilizers at target areas, even at currently available prices in the local market. A significant improvement in yield was observed as a result of appropriate application of fertilizers. If appropriate organic fertilizers are available in the market, the efficiency could improve even more. Accurate application of chemical fertilization with proper organic fertilizer may reduce top dressing frequency to save farm labor as well. However, currently, there is no appropriate organic fertilizer available in the local market, and farmers must rely on chemicals. Moreover, appropriate organic fertilizers are generally much more expensive than chemical fertilizers. Producing organic vegetables with expensive organic inputs for such high-end market may not be feasible at the present stage.

In order to promote commercial agriculture in the target area, higher economic efficiencies in vegetable production need to be attained to be competitive. For that purposes, appropriate use of input materials needs to be correctly understood by the farmers.

- **Issues in production of Junar still need to be addressed**

There have been so many efforts, including donor assistance, to promote Junar as one of the HVCs in SRC area. However, the pilot project reveled that some of these efforts have not yet born fruits. Some of these issues remain in the production process.

In the pilot project, certain practices are recommended to improve the condition of tree and fruit growth. The number as well as the size of the fruit improved by the proper fertilizer application. A tree holds more fruits by better nutrients than before. Thinning was recommended at same time for the long-term benefit, but farmers were reluctant to thin out good fruits even with a training session because the effect of thinning was not visible within a short period. If the farmers do not thin out the fruits, the tree has fruits only alternate year in a long term. Currently, the periodic harvesting of premature fruits by Indian traders is somehow working equivalent to thinning, and maybe alleviating the excess burden of trees from over fruiting. This practice of premature harvesting should be continued until the farmers fully understand the importance of thinning techniques.

The greening disease infects citrus tree, which could totally deteriorate the whole production area. As described in the previous section, the problem could reach to the SRC area anytime. Currently, Junar saplings are produced and distributed from the limited numbers of sapling growers within the area. The disease could be infected from soil to sapling. If the farm of those sapling growers were infected by the virus, the disease could be quickly spread within the area through the distribution of their saplings. Sindhuli DADO suggested that more secured clean facility should be established for sapling production to protect Junar industry. At the same time, adopting appropriate nursery practice, in which the saplings are grown for at least 3 years, is also desirable to extend more adequate sapling utilization for better growth in orchards.

CHAPTER 4 LIVESTOCK PILOT PROJECTS

Five activities in the goat (meat) package and six activities in the dairy (milk) package were implemented for the livestock sector. While both goat and dairy packages were implemented in 3 sites, Ratanchura VDC in Sindhuli district, Bocha VDC in Dolakha district and Bhimkhori VDC in Kavre district, only goat package was implemented in Bhaluwajor VDC in Ramechhap district.

These livestock pilot activities consist of two types: one is on-farm trials and the other is collecting information to understand the actual situation. The on-farm trials aim to demonstrate a benefit of improved technologies as well as to spread those technologies to the area.

4.1 L-1: Effective Use of Low-Quality Roughage by Urea Treatment

This program was designed to improve feeding value of crop residues such as rice straw and maize stover by treating with urea. However, this experiment was canceled according to the decision made at the kick-off meeting held on July 30, 2012. A few staff members of DLSO expressed strong concerns about urea intoxication to the animals. There were also other concerns that made this activity canceled, i.e. difficulty in procurement and low quality even if urea is available.

4.2 L-2: Development of Roughage and Concentrate Mixed Feeding

The purpose of this pilot is to improve feed intake and milk productively, by feeding dairy animals with sustainable forage (crop residues, native pasture, fodder tree leaves, etc.) and concentrate feed efficiently and effectively.

The activities started in November, 2012. Ten heads samples per site consist of 24 buffalos and 6 cows were selected (30 in total)[10]. Their lactation stages were as follows; 1 in early lactation stage, 9 in early-mid lactation stage, 9 in mid lactation stage, 7 in mid-late lactation stage, and 4 in late lactation stage. The beneficiaries started the milk production record keeping prior to the trial.

(1) Hand chopper development

SRCAMP manufactured the prototype hand chopper to cut maize stover and rice straw, and feeding trough for trial. The hand choppers were improved based on the beneficiaries' comments, and 30 pieces were produced in Kathmandu and distributed to the beneficiaries. Farmers needed some time to get used to the operation of the chopper. However, no problem was mentioned by beneficiaries. It took about 15 to 30 minutes to chop one day worth of roughage for the pilot. No farmer expressed any burden for working time on chopping.

(2) Improvement of feeding trough

The production of prototype feeding trough initially manufactured in Ratanchura was also prepared in other pilot sites by pilot farmers. These feeding troughs were made of cement because of the request

[10] Experimental animal: 10 dairy animals with 10 households each site; 8 buffaloes and 2 cows (1Jersey cross, 1 Local) in Ratanchura, 6 buffaloes and 4 cows (3 Brown Swiss cross, 1 Jersey cross) in Bocha, 10 buffaloes in Bhimkhori.

from participants. The cement troughs are heavy and difficult to move, but farmers favored the design because they will be never turned over and feed will not be wasted. In addition, feeding is more sanitary as feces will not be mixed together with feed. Almost all participated farmers had common favorable impressions about the trough.

(3) Mixed feeding

The experiment was conducted over 3 month period (Dec. 1, 2012 – Feb. 28, 2013). From December 1, 2012, pilot dairy animals were fed twice a day with formula feed dissolved in the warm water (traditional method) mixed with chopped roughage. Amount of the concentrated feed to be given was determined based on the Nepali standard of feeding (1% of estimated body weight) since it is difficult to estimate the required nutrients for each cow at different stages of milk secretion at different environment of feeding. Feeding quantities given to each sample cow are listed on the table in Annex 3-8.

The amount of feed and its left overs were supposed to be recorded, but only observation of farmers was recorded because it was too difficult for JT/JTA to stay close to samples and measure the leftovers. Fed amount was sufficient for most sample cows, and they ate all supplied feed.

(4) Result: Milk yield

The result showed that improving the feed quality and quantity contributes to increasing milk yield. By chopping the roughage and mixing with the concentrated feed, many beneficiaries felt that leftovers of the feed were decreased compared to before although actual increase and decrease amount of leftovers is not clear because of lack of record keeping.

In order to see the mixed feeding effects on buffalos, the actual measured milk yield by each pilot household per day is compared with the general lactation curve[11] of Murrah crossbred species, during the same lactation period and lactation stage. If the improved feed effect was observed, the actual measured milk yield would exceed the projected milk yield on the curve.

The measured milk yield of 9 out of 10 buffalos in Bhimkhori and 8 out of 8 buffalos in Ratanchura exceeded the projected yield from the general lactation curve. In these two sites, statistically significant mixed feeding effect was seen ($p<0.01$[12]). In Bocha, the actual milk yield of 4 out of 5 buffalos exceeded the projected milk yield, but there is no significant difference.

Likewise, in case of cows, the lactation curve[13] of the crossbred dairy cattle was used. The actual milk yield of 4 out of 5 cows[14] exceeded the projected milk yield.

(5) Economic Efficiency

In order to see the economic efficiency, the actual feeding cost and the income from increased milk

[11] 1,164 liters/300 days, NARC report

[12] $p<0.01$: statistically two samples have significant difference in more than 99 percent probabilities. Likewise, $p<0.05$ means that two samples have significant difference in more than 95 percent probabilities.

[13] 1,774 liters/300 days, NARC report

[14] Only 6 cows were used for the pilot project. One cow was excluded from the analysis because it was in the late lactation stage.

yield was compared. Only 3 buffalos (30%) in Bhimkhori and 5 buffalos (62.5%) in Ratanchura exceeded the profitable line. In Bocha, there was no buffalo exceeding the profitable line. There was only one cow out of 5 exceeded profitable line (20%). As for the labor cost, the process of chopping and mixing of roughage was added to the usual work. According to the interviews with pilot farmers, this additional work took only 15 to 30 minutes and was not a burden for them. Tables 4.1 and 4.2 summarize the result of the pilot project, including effect on milk yield and economic efficiency of mixed feeding.

Table 4.1: Effect on Milk Yield and Economic Efficiency of Mixed Feeding: Buffalos

					Milk yield								Milk yield		
	Name	Days after calving	Lactation stage	Measuring period (day)	Estimated (1,164 L)	**Actual (L)**	Effect of supplement (L)	Profitable line (L)	Ration (kg/day)	Unit price (Rs./kg)	Feeding cost (Rs.)	Milk Price (Rs./L)	Estimated (1,545 L)	**Actual (L)**	Effect (L)
					①	②	②-①	⑤/⑥	③	④	⑤(③＊④＊90)	⑥	⑦	⑧	⑧−⑦
K1	Sagar L	97～196	Mid-Late	100	368.7	**590.5**	221.8	246.9	4.8	26.0	11,232	45.5	517	**590.5**	73.5
K2	Patna K S	54～153	Early-Mid	100	439.6	**803.6**	**364.0**	144.0	2.8	26.0	6,552	45.5	586.5	**803.6**	**217.1**
K3	Bimala G	69～168	Mid	100	414.7	**429.8**	15.1	277.7	5.4	26.0	12,636	45.5	560.7	**429.8**	-130.9
K4	Ganga M P	48～147	Early-Mid	100	449.0	**354.2**	-94.8	164.6	3.2	26.0	7,488	45.5	598.1	**354.2**	-243.9
K5	Yubraj S	69～168	Mid	100	414.7	**533.2**	118.5	236.6	4.6	26.0	10,764	45.5	560.7	**533.2**	-27.5
K6	Man K R	142～241	Late	100	321.6	**691.5**	**369.9**	236.6	4.6	26.0	10,764	45.5	443.1	**691.5**	**248.4**
K7	Raj K K	112～210	Mid-Late	99	349.6	**622.5**	**272.9**	236.6	4.6	26.0	10,764	45.5	493.9	**622.5**	128.6
K8	Ram K S	92～164	Mid	72	290.8	**483.8**	193.0	218.1	5.3	26.0	9,922	45.5	400.3	**483.8**	83.5
K9	Ram B L	36～134	Early-Mid	99	462.4	**536.4**	74.0	221.1	4.3	26.0	10,062	45.5	617.4	**536.4**	-81
K10	Prem K L	97～192	Mid	96	359.2	**525.2**	166.0	221.1	4.3	26.0	10,062	45.5	503.1	**525.2**	22.1
S1	Santa M K	97～196	Mid	100	371.9	**583.8**	211.9	297.0	4.0	33	11,880	40	521.6	**583.8**	62.2
S2	Man K T	124～223	Mid-Late	100	339.4	**589.0**	249.6	304.4	4.1	33	12,177	40	797.2	**589**	-208.2
S3	Ambika S	160～259	Late	100	306.7	**695.3**	**388.6**	304.4	4.1	33	12,177	40	406.2	**695.3**	289.1
S4	Manoj K	50～149	Early-Mid	100	445.9	**812.2**	**366.3**	356.4	4.8	33	14,256	40	594.2	**812.2**	218
S5	Anita K T	84～183	Mid	100	390.9	**786.4**	**395.5**	304.4	4.1	33	12,177	40	539.3	**786.4**	247.1
S6	Binod M	93～186	Mid	94	358.4	**540.0**	181.6	326.7	4.4	33	13,068	40	498.6	**540**	41.4
S7	Hari B G	112～211	Mid -Late	100	352.7	**740.5**	**387.8**	304.4	4.1	33	12,177	40	497.9	**740.5**	242.6
S8	Dambar B B	166～265	Late	100	302.0	**714.9**	**412.9**	326.7	4.4	33	13,068	40	392.9	**714.9**	322
D1	Chitra B T	36～135	Early-Mid	100	466.2	**457.0**	-9.2	304.2	5.2	26.0	12,168	40	622.7	**457**	-165.7
D2	Santi K.C	130～229	Mid-Late	100	333.1	**396.1**	63.0	239.9	4.1	26.0	9,594	40	466	**396.1**	-69.9
D3	Krishna B T	130～229	Mid-Late	100	333.1	**410.4**	77.3	239.9	4.1	26.0	9,594	40	466	**410.4**	-55.6
D4	Bal R R	134～206	Mid-Late	72	247.1	**102.3**	-144.8	228.2	3.9	26.0	9,126	40	356.3	**102.3**	-254
D5	Tara K.C	83～182	Early-Mid	100	392.4	**409.5**	17.1	286.7	4.9	26.0	11,466	40	540.6	**409.5**	-131.1
D6	Bishnu K K.C	114～213	Mid-Late	100	350.4	**450.0**	99.6	286.7	4.9	26.0	11,466	40	494.5	**450**	-44.5

K1-K10: Bhimkhori VDC, S1-S8: Ratanchura VDC, D1-D6: Bocha VDC

Table 4.2: Effect on Milk Yield and Economic Efficiency of Mixed Feeding: Cows

					Milk yield								Milk yield			Milk yield			
	Name	Days after calving	Lactation stage	Measuring period (day)	Estimated (1,774 L)	**Actual (L)**	Effect (L)	Profitable line	Feeding cost (Rs.)	Ration (kg/day)	Unit price (Rs./kg)	Milk Price (Rs./L)	Estimated (2,000 L)	**Actual (L)**	Effect (L)	Estimated (2,499 L)	**Actual (L)**	Effect (L)	
					①	②	②−①	③/⑥	③(④＊⑤＊90)	④	⑤	⑥	⑦	⑧	⑧−⑦	⑨	⑩	⑩−⑨	
D1	Bir B T	71～170	Mid	100	622.2	**536.2**	-86	210.6	6,318	2.7	26	30	707.2	**536.2**	-171.0	881.9	**536.2**	-345.7	
D2	Makar B T	27～126	Early	100	675.4	**779.3**	104	218.4	6,552	2.8	26	30	778.6	**779.3**	0.8	966.7	**779.3**	-187.4	
D3	Bal B T	46～145	Early-Mid	100	652.5	**930.8**	278	241.8	7,254	3.1	26	30	747.7	**930.8**	183.1	930.2	**930.8**	0.6	
D4	Chitra B S	36～135	Early-Mid	100	664.7	**713.9**	49	171.6	5,148	2.2	26	30	764.1	**713.9**	-50.2	949.6	**713.9**	-235.7	
S1	Meshar B K	50～149	Early-Mid	100	633.6	**763.6**	130	277.2	8,316	2.8	33	30	724.8	**763.6**	38.8	902.1	**763.6**	-138.5	
S2	Dinesh S	158～257	Late	100	517.5	**282.0**	-235	405.9	12,177	4.1	33	30	573.0	**282.0**	-291.0	722.4	**282.0**	-440.4	(Local)

D1-D4: Bocha VDC, S1-S2: Ratanchura VDC

Roughage is cheaper feed under the grazing system, but it is not so in the stall feeding system as labor cost for cutting and carrying roughage is added. Therefore, efficient use of roughage would lead to the cost reduction. In this pilot, the amount of feed given to the dairy animals was decided according to their weight regardless of their lactation stage. In spite of this method in which little attention to the economic efficiency was paid, actual measured milk yield of 8 buffalos and 1 cow exceed estimated profitable line. Further improvement of economic efficiency would be possible by introduction of an appropriate feed formulation compatible with lactation stages and milk production. It should be noted that improvement in lactation for Murrah variety of buffalo is infeasible under low temperature in higher altitude area such as Bocha. It is recommended to shift to cows from buffalos for improvement of dairy income.

4.3 L-3: Fodder Yield Improvement by the Establishment of Technique with Utilizing Slop Area

Increasing self forage production is an important issue for improving the cost efficiency in milk production. Appropriate variation of seasonal feeding resources is required to establish the roughage-based feeding system.

(1) Trial in 2012

In first year of 2012, only a trail production was conducted in Hattitar[15]. The Study Team obtained the fast growing fodder tree seedlings such as Bakaino (*Melia azedarach*), Saijan (*Moringa oleifera*) and Ipil (*Leucaena leucocephala*), 20 seedlings each, from the nursery of the Forest Department of Mantali in Ramechhap district on July 18, 2012, and distributed the fodder trees seedlings to five beneficiaries of Hattitar. The growth of these fodder trees was monitored. In Hattitar site, there was a fear that the rooting of seedlings is difficult because of limited precipitation. However, three species of fodder tree seedlings took roots well in spite of transplanting in almost end of monsoon season[16]. The growth situation of seedlings varies depending on transplanted place: Seedlings transplanted in house yard are growing much better than those planed along the road. However, in the end, the majority of plants were totally eaten by livestock and almost blighted. Protection from livestock damages must be taken at Hattitar and Ratanchura where goats are left grazing.

(2) Winter forage crops

Based on the suggestion by DLSO, the winter forage crops such as Oats and Berseemare were experimentally sown in the paddy field after rice was harvested. They could make nutritious feeds for dairy animals during winter. SRCAMP provided 30 daily farmers in three sites with 2.5 to 5 kg of Oats (*Avena sativa*) seeds and Berseem (*Trifolium alexandrinum*) seeds 0.2 to 1kg each, depending on their farm size and capacity. Farmers sowed seeds between early October and late November. There were differences in growth depending on the soil moisture and sowing time: the growth was better in the irrigated paddy field. One farmer in Ratanchura finished harvesting by November 27, 2012 and the total yield from three time harvesting was 3.2 kg/㎡ (32tons/ha). The majority of the participants (4 in Ratanchura, all 10 in Bocha and 7 in Bhimkhori) harvested seeds and continue to sow in winter 2013.

(3) Nursery establishment

SRCAMP planned implementing nursery management as a group; however, it was decided by farmers request that nursery should be managed by individuals, considering the location and responsibility. One or two individuals were selected to rear the saplings, and the rest of the members purchased the saplings from them. Varieties of trees, size of nurseries and selected farmer are shown in Table 4.3. The variety was decided in the group meeting and each member planted 10-20 plants in their private

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[15] In the first year (2012), activities of L-3 was modified because the preparation of fodder tree seedling production could not be in time (the pilot started in July which was little too late).
[16] July 19, 2012

land.

Table 4.3: Selected Fodder Tree and Grass Species

VDC	Bhimkhori		Ratanchura		Hattitar		Bocha	
	Fodder tree	Grasses	Fodder tree	Grasses	Fodder tree	Grasses	Fodder tree	Grasses
Preferd and demanded species by the farmers	Rai-khanyu	Amriso	Rai-Khanyu	Amriso	Gajuma	Napier	Rai-Khanyu	Amriso
	Kutmiro	CO3(Napier)	Kimbu	CO3(Napier)	Kimbu	Forage peanut	Kimbu	CO3(Napier)
	Gogan	Napier	Kutumiro	Sumba-Seteria	Moringa		Kutumiro	Sumba-Seteria
	Mendula	Sumba-Seteria	Gogan	Napier	Tamarind		Gogan	Napier
	Timali		Mendula	Molasses	Ipil		Mendula	Molasses
					Bakaino			
Proposed farmer for Nursery	Man Kumari Ruchal		Meshar Bahadur Karki		Kale Majhi (Mill), Kale Majhi		Bil Bahadur Thapa	
Size of nursery	400 seedling		400 seedling		400 seedling		400 seedling	
	10-20 seedling for 20 farmers		10-20 seedling for 20 farmers		10-20 seedling for 20 farmers		10-20 seedling for 20 farmers	

Sloped and privately owned land not adequate for agricultural fields was mainly selected for the transplantation of fodder trees. When cultivating forage using the slope, however, traditional seedling technique which uses pot-seedling, cannot be applied as straight roots do not develop on the slope and roots cannot play a role of the anchor to secure the ground. Instead, "soil block" nursery technique, which was developed by Yamadera[17], was introduced in the pilot project (see below pictures).

Soil block making in Bhimkhori

Nursery in Hattitar

(4) Planting and growing the fodder trees

Selection of the planting place and the protection from animals were very important for fodder tree establishment because most of the farmers let their animals gaze outside. Result of the pilot project suggested that the fodder tree development is possible as long as there is no browsed damage by livestock, even in Hattitar which has lowest amount of rainfalls among the 4 districts.

In Hattitar, the trees were transplanted at the edges of fields surrounded by stone walls and fences, in order to protect them from browsed damage by livestock. Judging from the growth rate of the fast growing tree transplanted at the end of July 2012 (Bakaino (*Melia azedarach*): 5m, 3.7m, 3m,1.3m; Ipil (*Leucaena leucocephala*) : 3.4m, 2.7m; Saijan (*Moringa oleifera*) : 1.3m,0.9m; survival rate 13%). The results are as summarized in Table 4.4.

[17] Yamadera, 2010

Table 4.4: The Result of the Fodder Tree Development

	Ratanchura		Bhimkhori		Hattitar		Bocha		Total
Paticipant (HH)	19		12		10		20		61
Average transplanting per HH	20		6		22		11		Av.15
Total number of planting	373		71		218		227		889
Total number of losses	24		26		50		19		119
Survival rate (%)	92		64		77		91		Av. 81
Transplanted location		%		%		%		%	
Steep slope	5	26	0	0	1	9	0	0	6 (9%)
Road slope	5	26	6	40	0	0	3	13	14 (20%)
Road side	2	11	0	0	1	9	3	13	6 (9%)
Terrace slope	2	11	4	27	0	0	6	25	12 (17%)
Terrace edge	0	0	0	0	0	0	7	29	7 (10%)
Field edge	3	16	4	27	8	73	3	13	18 (26%)
Field slope	1	5	0	0	1	9	0	0%	2 (3%)
Vally line slope	1	5	0	0	0	0	0	0	1 (1%)
Backyard slope	0	0	1	7	0	0	1	4	2 (3%)
Centre of field	0	0	0	0	0	0	1	4	1 (1%)
Nursery									
No. of soil block produced	2,000 (2 sites)		700		600		930		4,230
Fodder tree species	Tanki		Tanki		Rai-Khanyu		Tanki,	Gogan	
	Gazuma		Gazuma		Gazuma,	Tanki	Dudilo		
					Saijan,	Kimbu			
Price of seedling	Rs.10		Free		Free		Rs.4		
Sales to others (seedling)	Tanki	530					Tanki	200	
							Gogan	200	
							Dudilo	100	
Price	Rs.10/seedling						Rs.5/seedling		

Availability of various fodder trees in the hill area provides a large potential for feeding ruminant animals. However, the labor requirement for collecting those fodders from mountains is also heavy task for the farmers. Farmers expressed significant interests in the pilot project of planting fodders within the private land for efficient feed collection.

Farmers have knowledge of traditional fodders, but not for newly introduced fodders in the pilot project. It is important to introduce fodder planting; however, the sustainability depends on the result from this pilot project. In order to prove that this pilot is effective, appropriate technical assistance for maintenance of the newly introduced fodders and more efficient feeding techniques need to be extended to the farmers. There are already a few nursery farmers, who can select the variety and grow fodders, in the area. Training those nursery farmers to promote the program of fodder planting may improve the coarse feed supply condition in the future.

4.4 L-4: Evaluation of Dairy Performance of Distributed Stud Bulls by Government / L-5: Monitoring of Candidate Breeding Buffalo Bull and Breeding Bull by Using Frozen Semen (AI) for the Efficient Implementation of Genetic Improvement

Two pilot projects were combined. In these pilot projects, an in-depth study by interviewing with the beneficiaries was conducted. In addition, lactation of the pilot dairy animals was measured, comparing with the improved lactation curve[18]: if the genetic improvement is progressed in the area, those dairy animals' milk yield would exceed the projected milk yield of the improved dairy animals[19]. The results suggested that genetic improvement of buffalos may have been extended to some extent in the area. The interview also revealed that there are serious issues that are in the way for the genetic improvement in the area. Generally, in the case of buffalos, the first heat after delivering a calf tends to delay, and it is usual for many of them to have silent-heat. Therefore, they become pregnant at the later stage of lactation period. In addition to these factors, the farmers avoid making their buffalo pregnant in early stage of lactation as they believe that would decrease milk production. There are also cases that milking buffalos are dried off with no pregnancy and sold. The farmers who sold their empty dry buffalos also need milk and manures for their livelihood, and they buy the lactating buffalos that just gave a birth for the replacement. This practice happens daily, and even genetically superior female buffalos are culled like waste buffalos. This is a serious issue on breeding the buffalos. The pilot VDCs had no experience of receiving the superior buffalo stud bulls distributed by the DLSO, and farmers breed using fertile buffalo bulls owned by individuals whose ability is not clear.

In the case of cows, AI is becoming outspread in recent years, but it remains limited in the area near the livestock service centers even though three districts, namely Kavre, Sindhuli, and Dolakha, are designated by national government as the promotion area for artificial insemination (AI). Currently, only Ratanchura VDC has AI services. It is pointed out that low ratio of successful conception is a reason for AI not being widespread. Because using fertile bulls for conception remains as mains services, genetic improvement of dairy animals is progressing very slowly in the area.

In addition to the interview, in order to speculate the progress of genetic improvement of the dairy animals in the area, like L-2 pilot, the actual measured milk yield by each pilot dairy animal was compared with the improved lactation curve[20] in the same lactation period and lactation stage. If the genetic improvement is progressed in the area, those dairy animals' actual measured milk yield would exceed the projected milk yield of the improved dairy animal curves[21].

Compared with lactation curve of improved buffalo[22], actual milk yield of 6 out of 10 buffalos in Bhimkhori and 7 out of 8 buffalos in Ratanchura were exceed the estimated milk yield ($p<0.05$). On the other hand, the actual milk yield of 5 out of 5 buffalos in Bocha were below the projected milk yield ($p<0.05$). It is presumed that energy was consumed for keeping animals' body temperature rather than for generating milk because mean minimum temperature reaches below zero degree in the night during the trial time from December to February in Dolakha. (see the temperature Figure 4.1 of Jiri which has almost same altitude as Bocha). Improvement in lactation for Murrah variety of buffalo is infeasible under low temperature in higher altitude area such as Bocha.

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18 1,164 liters/300 days, NARC report

19 According to NARC, the desired milk yield of the improved buffalos and cows are between 1,500 and 2,000 liters / 300 days and 2,500 liters / 300 days, respectively.

20 1,164 liters/300 days, NARC report

21 According to NARC, the desired milk yield of the improved buffalos and cows are between 1,500 and 2,000 liters / 300 days and 2,500 liters / 300 days, respectively.

22 1,545 liters/300 days, NARC report

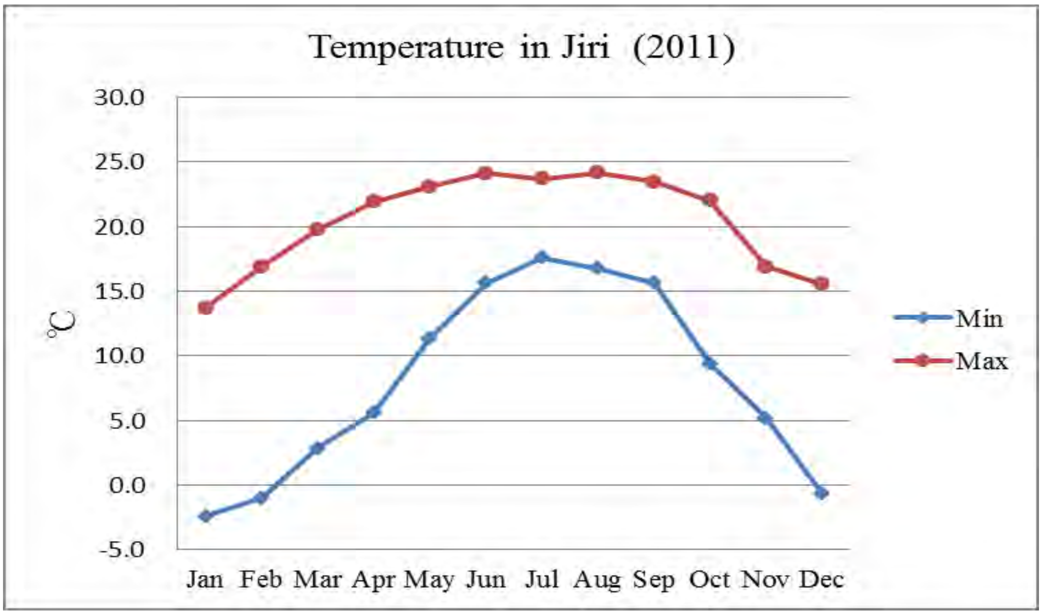

Figure 4.1: Temperature in Jiri in 2011

There are also considerable deviations among individuals in lactation: -21.1～115% (average 47.6%) in Bhimkhori, 50.7～136.7% (average 92.2%) in Bocha and -58.6～28.4% (average 2.4%) in Ratanchura. The result of cow was -13.8～42.6% (average 14.4%). These deviations were mainly caused by individual genetic difference.

In the case of cows, compared with the lactation curve of 2,000 liters (little improved), the actual milk yield of 3 cows exceeded the projected milk yield[23] but was below the improved species (2,500 liters) ($p<0.05$). Among the tested cows, there was one cow in Bocha that produced milk almost the same amount as the projection of 2,500 liters lactation curve.

4.5 L-6: Liver Fluke / Internal Parasite Control

The result of the pilot project indicated that infection rate of Liver Fluke (LF) was significantly higher in dairy animals than goats. Effects of administration of anthelmintic on dairy animals were not observed, but LF is curable by the single dose of the medicine for goat.

(1) Dairy Animals

In the baseline fecal examination of a total of 30 dairy animals[24], liver fluke (LF) infection was found in 23 (19 buffalo, 4 cows), and 8 were infected with roundworm (RW). After the first anthelmintic administration, 86% were re-infected. In Ratanchura, 7 out of 10 were negative after 1 month of the first treatment, but 5 animals returned to positive (3 with LF and 2 with RW) after 2 months. In Bocha, all were re-infected by LF (4 of which also had RW) after 1 month of the treatment, some were new infection. All 10 animals stayed negative for 2 months after the treatment in Bhimkhori. This fact indicates that there were no significant regional differences in terms of numbers and patterns in

[23] Statistically speaking, no significant difference was observed, but this may be because of the small samples (1 local cow out of 6 was rejected as outlier).
[24] 10 per district in 3 districts

parasitic infection. However, in the low altitude areas of Ratanchura and Bocha, ridge grasses of paddy field that serve as an infection route of LF are used as green forage from July through November. Additionally, rice straw which is also an LF infection route is utilized as winter roughage in all 3 districts. These different factors may have been causing the parasitic infection in different area.

(2) Goats

In the case of goats, the fecal examinations were implemented twice in 19 months in 4 districts (August-December 2012, May-October 2013). A total of 160 goats[25] over 19 months, were examined. In all districts, LF infection in goats was controlled with the administration of anthelmintic. The goats had a low LF infection rate of 5 to 10% for both years in Hattitar and Bocha. The infection rates in first year in Bhimkhori and Ratanchura were high as 100% and 80% respectively, but dropped to 0% and 40% in the second year. As for the RW infection that was tested 5 times, the results showed 10 to 35% in Hattitar[26], 5 to 90% in Bocha, 0% in Bhimkhori and 5 to 100% in Ratanchura.

This may be because the dairy animals are fed by more infectious rice straw and paddy grasses, while goats are mainly fed by non-infectious fodders all year round. Therefore, there is no need to worry about infection from roughage for goats. However, goats and dairy animals are kept in the same shed, especially in the areas with lower night temperature, it may increase the risk of infection to goats. In particular, Murrah variety buffalos are generally raised in the lower paddy region where the infection is already common; therefore, the risk of introducing infected buffalos may exist, and these buffalos may spread the disease.

Also, it is difficult to control parasitic diseases by treating only experimental goats because beneficiaries are raising a large number of goats per household, and other goats and housings may be contaminated by internal parasites. According to the parasitology specialist in Nepal, although the parasitic disease infection route has been roughly understood, it is difficult to control internal parasite in rural area. The only way to control it is to repeat the fecal test twice a year, especially in February and August, and to administrate effective drugs. There are some commercial goat farms carrying out the fecal test and drug administration four times a year.

If the fecal test and anthelmintic administration are to be programmed as a regular practice, the regional efforts would be required. In order to disseminate this program in the region, the government led awareness campaigns may be necessary. It is expected that pilot projects' repeated fecal tests and drug administration would give information/data on effective resistant drugs. These data would also be the basic information for preparing effective deworming programs.

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[25] 20 goats per district

[26] In the second year, the DLSO carried out a Goat Internal Parasite Control Campaign on the 13th of July 2013 in Hattitar. 205 goats were administered anthelmintic. Fecal examinations conducted after the campaign still showed a 10 to 15% RW infection rate.

4.6 L-7 Improvement of Housing of Milking Animal for Hygiene Control and Prevention of Mastitis

(1) Improvement of Dairy Shed

The dairy animal facilities are generally separated into the night-shed and daytime-shed in the project area. Conditions of animal houses for milking vary depending on location and seasonality. The types of dairy animal houses also vary by each household. Improvement of the sanitary conditions as major target for this activity, each beneficiary farmer performed the renovation of the roof, floor, ventilation, lighting and trough of their animal housing as pointed out by SRCAMP in the baseline survey. Drainage and waste reserve for urine were installed at each farmer's facility. A total of 15 sheds were renovated. For this improvement, SRCAMP subsidized Rs. 20,400 at flat rate for construction materials (corrugated iron sheets, cement, GI wire, nail, etc.) and any costs exceeding were borne by each beneficiary. Throughout the pilot project, the sheds were maintained well and kept clean by the participated farmers, and animals were in comfortable conditions.

(2) Mastitis Examination

As for the disease control, CMT kits for Mastitis test were distributed to DLSOs in 3 pilot sites, and a total of 30 dairy animals, 15 reared under improved sheds and 15 reared in unimproved sheds, were tested.

As a result, mastitis was seen among the dairy animals reared under the unimproved sheds, but no correlation between shed renovation and mastitis was identified. The result of the CMT in Bhimkhori showed that 4 buffalos were positive, and 3 out of them were reared in the unimproved shed. In Bocha and Ratanchura, one buffalo from each site was positive, and they were also reared in the unimproved shed. 6 out of 30 buffalos (20%) were positive in CMT, and 83% of them were fed in the unimproved shed. Mastitis decreases the lactation as well as quality of milk; therefore, the periodical check-ups should be continued.

(3) Hygiene score

To see the improvement of hygiene, hygienic score for buffaloes and cows were measured to compare the differences between before and after the improvement. The result of hygiene score[27] showed that there was no significant difference between the improved shed group and unimproved shed group. Comparing the score of before (Nov. 2012) and after (Dec. 2012) the shed improvement, the score became better soon after the improvement and kept that level afterwards. However, this tendency was seen not only with the improved group. It suggests that improving the shed solely may not result in the improvement of hygienic environment of the dairy animals.

[27] The hygiene score indicate how dirty the body of a dairy animal is. Smaller number shows less dirtiness.

Table 4.5 Monthly Average Hygiene Score

		2012		2013									Total
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Dec12 -Sep13
Bhimkhori Average score	Improved shed	15	10	9	8	9	9	8	9	9	8	8	86
	Comventioanl shed	18	13	13	9	9	9	8	9	9	9	8	97
Ratanchura Average score	Improved shed	19	10	9	6	6	6	7	7	7	8	8	72
	Comventioanl shed	17	13	10	7	7	7	7	7	9	9	8	83
Bocha Average score	Improved shed	13	9	9	10	11	11	10	9	12	12	11	103
	Comventioanl shed	12	9	11	10	10	11	12	9	12	11	10	104

(4) E-coli and Bacteria Examination

For the E-coli and bacteria count test in milk, the result turned out that these samples were not measurable since the number of colonies exceeded the capacity of the equipment except one sample from Bocha. Seven milk samples were collected; 3 samples (3buffaloes) from Bocha and 4 samples (4 buffaloes) from Bhimkhori. Average of E-coli count of Bocha sample was 9 colonies per 1mg.

(5) By-Product: Urine Collection

Urine collecting system which was developed with the improved shed was used continuously by all beneficiaries. They said that vegetables were grown well by spreading the diluted urine[28].

As for the improvement of the sanitary condition of shed, it was difficult to motivate the farmers since the action doesn't generate direct increase in productivity and income at least for a while. The result of pilot project revealed that frequent replacement of bedding material will improve sanity even without shed improvement. Shed improvement, especially the floor, will definitely alleviate the mastitis and improve milk quality, but it might be rather important to educate first about importance of basics sanity concerning daily lactation practice.

4.7 L-8: Improvement of Rearing Environment for Goats

(1) Goat shed improvement

The goat housings in the pilot area either integrated into farmer's home or built independently. The integrated goat housings are classified into two: inside type and attached outside type. Likewise, the independent ones are also classified into stilted houses on flatland and stilted houses on slope land. Therefore, improvement points for four types, considering the climate and locally available materials, for each pilot site were suggested by SRCAMP.

For the first trial in June 2012, a total of 20[29] goat housing were renovated in 4 sites. SRCAMP subsidized NRs. 14,400 per beneficiary for the construction materials (corrugated iron sheets, cement,

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[28] The dilution rate: 1 liter of urine for 2 or 3 liters of water.
[29] Five goats (households) were selected in each pilot site.

GI wire, nail, etc.), and the rest was borne by beneficiaries. The contribution from beneficiaries varied depending on the size and design of the housing. The contribution ratio for the total construction cost ranged from 13% to 68%.

For the second year, the improvement of goat housing was repeated, and further 20 goat housings were renovated in 4 sites.

(2) Effect on the weight gain

For the first year, the experiment in all 4 sites started in September 2012. Ten farmers provided sample goats (2 goats / HH) at each site. Out of 10 beneficiaries, five farmers improved their goat shed (a total of 20 goats as treatment) and 5 did not improve the shed (a total of 20 goats as control), and weigh gain for 3 months of both cases were compared.

For the second year, reflecting the first trial's result, only improved shed goats were monitored.

In both trials, the quantitative effect, nor economic efficiency, of the shed improvement on productivity such as the growth rate or possible prevention of respiratory diseases did not become clear. However, qualitative effect was proven as majority of beneficiaries gave their opinion of ”the goats became healthy”, ”the goats did not get mud on the body”, “it became easier to clean the floor”, “amount of manure was increased (because the manure can be collected)”, ”the goats stopped coughing” and ”the goats grow better”. Only few beneficiaries showed negative opinions of shed improvement, but overall, the beneficiaries recognize improvement of sanitation of goat housings and goat health.

4.8 L-9: Improving Local Practice of Goat Selection (Collection of Basic Information on Goat Breeding History)

The goats reared in the project sites are Khari and Jamnapari cross breed, and in some part of Bocha VDC, there are Khari/Jamnapari cross breed and Sinhal cross breed. Farmers in the area never practiced selection and culling of goats based on the certain criteria. Therefore, genetically promising buck goats are often culled after castrated, and non-superior buck goats are left and used for breeding. Selection of superior buck goats from cross breeds is urgent issues. This pilot activity aimed to collect data of goats regarding breeding in order to develop a selection and breeding technology to be exercised in district level. Information on goats' quantitative characteristics such as breeding history, kidding rate, weight gain, reproductive capacity and milk yield were collected by interviews with farmers in each site.

It became clear that lack of interest of farmers in selecting and producing the superior buck goats and delayed castration seem have influenced on improvement of goats in the study area. Most of the beneficiaries remember the breeding history of parents of rearing goats for at least three generations. Farmers generally select the breeding female goats by considering their genetic traits, including the number of kids, twinning rate per birth, etc. On the contrary, introduced breeding buck goats are generally sold after 2 years to avoid inbreeding. Even though the demand for the superior buck is high, no systematic effort is taken in selecting and producing superior buck goats for breeding inside the area in these four districts. According to the interview with farmers, producers do not have appropriate data concerning selection of genetically preferred species of stud goats. Even after the implementation of the pilot, farmers' understanding about selection and introduction of genetically preferred stud is still insufficient. Farmers do not have strong interest in selection either, although they prefer goats with characteristics of Jamnapari such as long ears, aquiline nose called Roman nose, tall height, and long legs. The shortage of the superior bucks is one of the main reasons for the longer kidding interval. For the timely breeding and genetic improvement, introducing the superior bucks is important issues in the study districts[30]. Technical assistance through OJT by the government officers is recommended to give farmers knowledge or experiences about selection and castration[31]. Collected data concerning ability of weight gain in individual goat expected to be utilized for the selection of elite buck in the area.

4.9 L-10: Establishment of Roughage Based Stall Feeding Technique

Around October when green pasture runs short, the branches and leaves of fodder trees become the main source of feed for goats. However, collecting these fodders is heavy burden for the farmers. Also, the nutrition of these fodder trees is low, which slows down the growth of goats. This pilot activity tries to address this issue.

(1) Experiment

Concentrated feed was supplementary given to the treatment goats, in addition to the fodder trees, and the effect on goats' weight gain was observed. As a comparison, the control goats were fed with only fodder trees (no supplemental feed was added). The trial was implemented twice in 19 months in 4 districts. The first trial was implemented from September 1 to December 10, 2012 (about 100 days), and the second trial was conducted from July 20 to September 16, 2013 (about 100 days), using different goats. A total of 80 goats (49 male and 31 female, 20 heads (10 HH) per site per trial) were selected and applied for the experiment. In the first year, as supplemental feed, the commercial concentrate feed was used. The chemical composition and price of the commercial feeds were listed in Table 4.6. In the second year, in order to lower the cost of the supplemental feed, the self-processed concentrate feed was used. The self-processed concentrate feed consisted of maize (80%), mustard seed oil cake (20%) and mineral mix (1%).

[30] Most of the beneficiaries in Bhimkhori, Hattitar and Ratanchura prefer the Khari (indigenous breed) and Jamnapari (Indian breed) crossbred. In Bocha, they prefer the crossbred among the Sinahal (indigenous breed) which is crossbred between Khari and Jamnapari, adoptable for high altitude environment.

[31] Castration after one year imposes strong stress for goat left out of selection. As late castration inhibits the growth of left out goats, the practice for early stud selection, within 6 months, need to be introduced to this area.

Table 4.6: Composition and Price of Commercial Feed

						2 Dec.2012
Formula feed	Dry matter (DM) %	Crud Protein (CP) %	As DM basis CP %	Ether extract (EE) %	As DM basis EE %	Price Rs./kg
Mash type (Bhimkhori)	81.07	18.10	14.67	1.00	0.81	20.00
Mash type (Boach)	81.50	18.04	14.70	1.00	0.82	20.00
Mash type (Bhaluwajor)	79.94	18.27	14.61	1.50	1.20	20.00
Pellet type (Ratanchura)	87.17	23.91	20.84	2.00	1.74	33.00
	Analyzed by Livestock Quality Management Laboratory - GON, Hariharbhawan					

The weight of all goats was measured at least once a month, using a digital or hanging scale. Information such as health conditions, disease treatments, pregnancy, and castration record was also recorded.

(2) Result: Weight Gain

In the beginning, there were some problems of intake of concentrated feed and mild diarrhea in all sites. But it stopped while later and did not affected to the result so much.

In the first trial, the weight gain was dispersed in the individual difference such as castration, anthelmintic administration and inadequacy of feeding, and significant difference in the treatment was not observed. In the second year, significant differences were observed between groups in Bhimkhori ($p<0.05$), Hattitar ($p<0.05$) and Ratanchura ($p<0.01$). The result is summarized in Table 4.7 and 4.8 below.

(3) Economic Efficiency

The results showed that giving the supplemental feed is worth the cost, even with the commercially available concentrate feed. In the first year, the commercially available concentrate feed was used, and in the second year, the self-processed concentrate feed which consisted of maize (80%), mustard seed oil cake (20%) and mineral mix (1%) was used. This self-processed concentrate feed is supposed to be much cheaper than the commercial feed and higher economic efficiency was expected[32]. From the calculation based on the result of pilot project showed that, in case of second year in Ratanchura, the income per goat increased by Rs. 1,908 with the commercially available concentrate feed and by Rs. 3,310 with the self-processed feed: The average daily gain was 62.7 g. Aiming that the weight of the goat at the shipment time at 30 kg (grade 1), 447 days are required to rear a goat until shipment (30 kg - 2 kg (weight at birth) / 62.7 g/day = 447 days). The cost of supplemental feed would be Rs. 2,127 (447 days x 0.195 kg x Rs. 24.4 /kg = Rs.2,127). Suppose the unit price of grade 1 goat is Rs. 410/kg, then a live goat price could be Rs. 12,300. The estimated gross income would be Rs. 10,173. On the other hand, without supplemental feed, the daily gain of goat fed normal feed is 36 g on average. If the goat was fed with normal feed and reared 447 days, the weight would reach only to 16.05 kg. In this case, the unit price could be only Rs. 380/kg because the goat would be classified lower. Therefore, the

[32] The cost of the self-processed feed could be much lowered by using lower grade ingredients.

price of this goat would be Rs.6,863. The difference would be Rs. 3,310. In other sites, the similar results were observed. The more profit would be gained if the portion of the self-processed compound feed is increased as compared with the commercial feed.

Table 4.7: Result of Supplemental Feed: 1st Year

1st year (1 Sep. 12 ～ 10 Dec. 12)												
	Treat-ment	Average ration (g / head /	Average weight gain (kg /	Average daily gain (g / day)	Concentrate unit price (Rs./ kg)	Goat unit price (Rs./ kg)	Weight before shipment (kg)	Shipment age (day)	Feed cost (Rs.)	Sales price (Rs.)	Income (Rs.)	Age (day) until target weight (30kg)
		①	②	③(②/100)	④	⑤	⑥(③NF＊⑦+2)	⑦(30−2)/③SF	⑧ (①＊⑦＊④)	⑨ (⑤＊⑥)	⑩ (⑨−⑧)	⑪
Bhimkhori	NF *1	0	4.0	40		320	24.72	568	0	7,910	7,910	700
	SF *2	205	4.93	49.3	20 (mash)	360	30 (Target)	568	2,329	10,800	8,479	568
Bocha	NF	0	3.24	32.4		320	17.97	493	0	5,750	5,750	864
	SF	195	5.68	56.8	20 (mash)	360	30 (Target)	493	1,923	10,800	8,877	493
Hattitar	NF	0	3.35	33.5		320	21.3	575	0	6,816	6,816	836
	SF	205	4.87	48.7	20 (mash)	360	30 (Target)	575	2,358	10,800	8,442	575
Ratanchura	NF	0	5.62	56.2		320	20.99	338	0	6,717	6,717	498
	SF	195	8.28	82.8	33 (pellet)	360	30 (Target)	338	2,175	10,800	8,625	338
	*1:Normal feed only											
	*2:Supplemental feed and normal feed											

Table 4.8: Result of Supplemental Feed: 2nd Year

2nd year (20 Jun 13 ～ 28 Sep.13)												
	Treat-ment	Average ration (g / head /	Average weight gain (kg /	Average daily gain (g / day)	Concentrate unit price (Rs./ kg)	Goat unit price (Rs./ kg)	Weight before shipment (kg)	Shipment age (day)	Feed cost (Rs.)	Sales price (Rs.)	Income (Rs.)	Age (day) until target weight (30kg)
		①	②	③ (②/＊3)	④	⑤	⑥(③NF＊⑦+2)	⑦(30−2)/③SF	⑧ (①＊⑦＊④)	⑨(⑤＊⑥)	⑩(⑨−⑧)	⑪
Bhimkhori	NF *1	0	3.2	32.69		380	20.47	565	0	7,779	7,779	857
	SF *2	205	4.93	49.59	32.4	410	30 (Target)	565	3,753	12,300	8,547	565
Bocha	NF	0	5.78	55.6		380	23.68	390	0	8,998	8,998	504
	SF	195	7.48	71.88	32.4	410	30 (Target)	390	2,464	12,300	9,836	390
Hattitar	NF	0	4.26	49.49		380	23.58	436	0	8,960	8,960	566
	SF	205	5.53	64.26	32.4	410	30 (Target)	436	2,896	12,300	9,404	436
Ratanchura	NF	0	3.76	35.93		380	18.06	447	0	6,863	6,863	779
	SF	195	6.56	62.7	24.4	410	30 (Target)	447	2,127	12,300	10,173	447
	*1: Normal feed only				*3: Feeding period							
	*2: Supplemental feed and normal feed											

From another perspective of economic efficiency, for example, it took only 447 days to rear a goat to 30 kg with the supplemental feed, but 779 days would have been required if the same goat was fed by the normal feed in the second year in Ratantura. It means that it would take almost only a half time until the shipment if the goat was fed with the supplemental feed.

According to the interviews with beneficiaries, farmers spent very little time in the morning and evening for adding supplemental feed. So that time spent for the activity did not become burden for the family.

From this experience, only adding commercial formula feed to the roughage based conventional feed, weight gain worth the cost of feed was observed. Increasing the daily weight gain of goat shortens the period of rearing until shipment, and also decreases the risk of catching diseases and accidents. Therefore, it is an appropriate measure for commercial production.

Like dairy animals, the weight gain of each individual goat was significantly different. Daily gain of weights at each site were 20.8～69.3g/day in Bhimkhori, 40.4～101.9g/day in Bocha and 39.5～

87.3g/day in Ratanchura. These differences may have been induced by the different feeding practice of each farmer, but genetic ability of individual goat may also have affected on the result.

In order to establish the goat production techniques for commercialization in the hill area where agriculture, livestock and forestry are organically synchronized, it is necessary to establish feeding technique in combination with production of high nutritious value fodder trees.

4.10 Lessons Learned from Livestock Pilot Projects

(1) Daily Package

The result showed that improving the feed quality and quantity contributes to increasing milk yield. By chopping the roughage and mixing with the concentrated feed, many beneficiaries felt that leftovers of the feed were decreased compared to before although actual increase and decrease amount of leftovers is not clear because of lack of record keeping. Roughage is cheaper feed under the grazing system, but it is not so in the stall feeding system as labor cost for cutting and carrying roughage is added. Therefore, efficient use of roughage would lead to the cost reduction. In this pilot, the amount of feed given to the dairy animals was decided according to their weight regardless of their lactation stage. In spite of this method in which little attention to the economic efficiency was paid, actual measured milk yield of 8 buffalos and 1 cow exceed estimated profitable line. Further improvement of economic efficiency would be possible by introduction of an appropriate feed formulation compatible with lactation stages and milk production. It should be noted that improvement in lactation for Murrah variety of buffalo is infeasible under low temperature in higher altitude area such as Bocha. It is recommended to shift to cows from buffalos for improvement of dairy income.

The result from the mixed feeding pilot project also suggests that genetic improvement of buffalos may have been extended to some extent in the area. Compared with lactation curve of 1, 545lites, actual milk yield of 6 buffalos out of 10 were exceed the estimated milk yield in Bhimkhori and actual milk yield of 7 buffalos out of 8 are exceed the estimated milk yield. However, there are still significant deviations observed among individuals in the increment rate of lactation. Figures were -21.1～115% (average 47.6%) in Bhimkhori, 50.7～136.7% (average 92.2%) in Bocha and -58.6～28.4% (average 2.4%) in Ratanchura. The result of cow was -13.8～42.6% (average 14.4%). These deviations were mainly caused by individual genetic difference. Further study may be required to reach the conclusion; however, the genetic improvement in dairy animal is strongly recommended for improvement of farmers' income.

As for the improvement of the sanitary condition of shed, it was difficult to motivate the farmers since the action doesn't generate direct increase in productivity and income at least for a while. The result of pilot project revealed that frequent replacement of bedding material will improve sanity even without shed improvement. Shed improvement, especially the floor, will definitely alleviate the mastitis and improve milk quality, but it might be rather important to educate first about importance of basics sanity concerning daily lactation practice.

(2) Goat Package[33]

Only adding commercial formula feed to the roughage based conventional feed, weight gain worth the cost of feed was observed. Increasing the daily weight gain of goat shortens the period of rearing until shipment, and also decreases the risk of catching diseases and accidents. Therefore, it is an appropriate measure for commercial production.

Like dairy animals, the weight gain of each individual goat was significantly different. Daily gain of weights at each site were 20.8～69.3g/day in Bhimkhori, 40.4～101.9g/day in Bocha and 39.5～87.3g/day in Ratanchura. These differences may have been induced by the different feeding practice of each farmer, but genetic ability of individual goat may also have affected on the result.

Deficiency of elite bucks is also significantly affecting the kidding interval; therefore, the first priority should be put on the selection of elite bucks within the area. Farmers have not enough knowledge or experiences about selection and castration; therefore, technical assistance through OJT by the government officers is recommended. Collected data concerning ability of weight gain in individual goat expected to be utilized for the selection of elite buck in the area.

In order to establish the goat production techniques for commercialization in the hill area where agriculture, livestock and forestry are organically synchronized, it is necessary to establish feeding technique in combination with production of high nutritious value fodder trees.

(3) Fodder Tree Development

Availability of various fodders in the hill area provides a large potential for feeding ruminant animals. However, the labor requirement for collecting those fodders from mountains is also heavy task for the farmers. Farmers expressed significant interests in the pilot project of planting fodders within the private land for efficient feed collection.

Farmers have knowledge of traditional fodders, but not for newly introduced fodders in the pilot project. It is important to introduce fodder planting; however, the sustainability depends on the result from this pilot project. In order to prove that this pilot is effective, appropriate technical assistance for maintenance of the newly introduced fodders and more efficient feeding techniques need to be extended to the farmers. There are already a few nursery farmers, who can select the variety and grow fodders, in the area. Training those nursery farmers to promote the program of fodder planting may improve the coarse feed supply condition in the future.

(4) Liver fluke (LF) and Internal Parasite Control

The pilot project result indicates that LF is curable by the single dose of the medicine. It is recommended that periodic examination and medication should be performed for the prevention. It is also important to avoid feeding the animals with contagious rice straws and paddy grasses.

Effects of anthelmintic, together with fecal examination and prescription, need to be tested by each

[33] The results of "Fodder Yield Improvement by the Establishment of Technique by Utilizing Slope Area" and "Liver Fluke and Internal Parasite Control" regarding goats were summarized in the Dairy Package section.

district laboratories, and then extended to the public.

(5) Conclusion

In the pilot project, improvement of livestock techniques was tested from various aspects, including improving feed, reproduction and breeding, feeding environment, control of internal parasite and strengthening fodder production. If the goal is set to achieve the increasing livestock productivity and agricultural income by 2020, the master plan should put a first priority on feed improvement activity which is easy to achieve the output in the short term, and then put a second priority on activities such as improving reproduction, breeding and fodder tree production as they take a longer time to achieve the outcome. Lower priorities may be put on the activities like improving feeding environment and rearing healthy livestock that concern a quality of livestock products because the market in Nepal has not mature enough to reflect the quality to products on their price.

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Annex 1: Profile of Selected Pilot Sites

1. Bhimkhori (Ward 1-Pauwa, 3 & 4), Kavre

<table>
<tr><td colspan="2">Total No. of HH</td><td>340HH
(95+25HHs are commercial farmers cultivating tomato etc.)</td></tr>
<tr><td rowspan="8">Horticulture</td><td>Presence of ASC</td><td>No
(ASC located in Mangaltar (12~15km far) is in charge of the area.)</td></tr>
<tr><td>Major crops</td><td>
<table>
<tr><td></td><td>Vegetables</td><td>Plantation</td><td>Harvesting</td></tr>
<tr><td></td><td>Tomato
*Tomato can be produced throughout the year.</td><td>April/MAy</td><td>June/July to Jan./Feb</td></tr>
<tr><td></td><td>Cauli</td><td>April/may and August-Oct</td><td>June/July and Dec-Feb</td></tr>
<tr><td></td><td>Cowpea</td><td></td><td></td></tr>
<tr><td></td><td>Radish</td><td></td><td></td></tr>
<tr><td></td><td>Garlic</td><td></td><td></td></tr>
<tr><td></td><td>Cucumber</td><td>Feb/Mar</td><td>May/June</td></tr>
<tr><td></td><td>Pumpkin</td><td></td><td></td></tr>
<tr><td></td><td>Akhbare Chilli</td><td>March/April</td><td>July/August</td></tr>
<tr><td></td><td>Bitter Gourd</td><td></td><td></td></tr>
<tr><td></td><td>Potato</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Presence of collection center</td><td>Collection points without facility (e.g. in front of Pauwa Agriculture Cooperative Shop) exist.</td></tr>
<tr><td>Presence of Agro-vets</td><td>Pauwa Agriculture Cooperative is trying to function as agro-vets. This cooperative already started to sale chemical fertilizer to their member and non member farmers.
(Agri-input services are available in Bhakundabeshi.)</td></tr>
<tr><td>Presence of irrigation facility</td><td>Substantial area of irrigated lands exist along the irrigation pipes (see hand-written map on flipchart)</td></tr>
<tr><td>Presence of farmer organization</td><td>Two (2) cooperatives exist. One being Pauwa Agricultural Cooperative established two years ago with nearly 300 members (saving & credit, cheap general store, some agricultural activity e.g. agro-inputs supply), another being Youth Cooperative which allegedly is inactive.</td></tr>
<tr><td>Marketing system</td><td>Pauwa Agricultural Cooperative functions as local collector. This cooperative has connection with a trader coming from outside. Allegedly twice to three times this trader will come to the area to collect tomatoes (during rainy season the access road sometimes become impassable).</td></tr>
<tr><td rowspan="5">Livestock</td><td>Presence of LSSC</td><td>No
(ASC located in Bhakundabeshi is in charge of the area.)</td></tr>
<tr><td>Dairy</td><td>➢ 3-10 Ltrs./day/HHs produce buffalo milk
➢ Three (3) dairy collection points (DDC x 2, Private x 1)
➢ Chilling center in Khanalthok @ Bhakundebesi, it is 25 Km far from the production site.
➢ Prime Bank is now preparing to introduce Livestock Caretaker Insurance through DDC, combining with introducing 50 dairy cows to this area.</td></tr>
<tr><td>Goat</td><td>➢ 100% HHs have livestock
➢ 3-4 (max. 20) goats/HHs</td></tr>
<tr><td>Presence of Agro-vets</td><td>No but Pauwa Agricultural Cooperative tries to function as Agro-vet
(Agri-input services are available in Bhakundabeshi.)</td></tr>
<tr><td>Presence of</td><td>Livestock group need to explore more information about the</td></tr>
</table>

	farmer organization	livestock present status.
Willingness of farmers		DADO has conducted since last year the program to provide plastic sheet and micro irrigation with 50% cost sharing and seeds for free. Response was very good and now 140 plastic tunnels and 10 MIT Drip systems are installed and 20 MIT will be installed in upcoming seasons. This program will be shifted to other place from July 2012. SRCAMP may implement the activities to (1) strengthening marketing aspect, (2) some advice on cultivation techniques, (3) further expansion of number of commercial farmers by continuing similar program DADO has conducted.
Others		➢ Access road was completed in 2011. ➢ Priority : irrigation, marketing, pest control ➢ Majority of residents in this area are Tamang, Mughal and Newari ethnic groups ➢ Electricity in this area is supplied by a local hydropower plant (sufficient for household needs, e.g. lighting only) ➢ JT looking after this area is the best awarded person among all JTs in Central Development Region ➢ Irrigation system (and drinking water) in this area is supported by a piped water system diverting small flows from slopes into tanks, which is constructed about 30 years ago with Swiss fund.

2. Bocha (1, 2 ,3 &5), Dolakha

Total No. of HH		295HH (142HHs are producing vegetables in commercial level)
Horticulture	**Presence of ASC**	There is a Gov. farm in the area.
	Major crops	(see crop table below)
	Presence of collection center	Informal type of collection is existed so high potential to established collection center
	Presence of Agro-vets	No. There is one in Charikot and farmers depend on it.
	Presence of irrigation facility	Good irrigation in ward 2 and 3, and potential in other wards
	Presence of farmer organization	➢ 13 vegetable groups ➢ One vegetable cooperative

Major crops:

	Vegetables	**Plantation**	**Harvesting**
	Potato	Aug./Sept. Feb. Dec.	Dec. June/July May
	Caulis and cabbage	June/July Oct./Nov.	Sept./Oct. Feb./March
	Peas	Aug. March	Dec. May/June
	Green Leafy veg.		
	Onion / Garlic		
	Beens		
	Kiwi	Just started	
	Plum		

	Marketing system	➢ 70-80% vegetables esp. potato go to Kathmandu ➢ Local traders collect/purchase potato and send to Ktm. by trucks ➢ 40% cauli/cabbage goes to Ktm., and 60% is consumed in Chariko/local market ➢ Around 10-12 big containers (trucks) of vegetables go to Ktm. in a season ➢ Some farmers sale their products themselves
Livestock	**Presence of LSSC**	No (ASC located in Charikot is in charge of the area.)
	Dairy	➢ Most of the HHs have cow or buffalo ➢ One dairy collection center exists ➢ 80-200 ltrs. milk per day is collected at the collection center and taken to the Dolakha Dairy ➢ Enough land for fodder and in some area has already been introduced improved grass ➢ Potential to plant improved grass in the community forest ➢ AI program exists
	Goat	➢ 95% HHs have goat ranging, 5-25 goats per house ➢ Presence of improved breeding buck
	Presence of Agro-vets	No (Agri-input services are available in Charikot.)
	Presence of farmer organization	➢ 2 livestock groups exists ➢ 6 goat rearing groups
Willingness of farmers		➢ Farmers are willing to make labour and kind contribution, 5-10% cash per cash in individual support programs (plastic house, etc.)
Others		➢ Land is available for the collection center ➢ There is a community forest and it is yearly open.

3. Hattitar, Ramechhap

Total No. of HH		220HH (50 HHs are producing vegetables in commercial level)
Horticulture	**Presence of ASC**	No. (ASC in Manthali covers this area.)
	Major crops	see table below
	Presence of collection center	No collection center. Except chills, individual farmers take their own products to Haat Bazaar in Manthari or Khurkot.
	Presence of Agro-vets	No. There is one in Manthari and farmers depend on it.
	Presence of irrigation facility	Irrigation exists for maize. After irrigation is introduced, tomato production could be very high.
	Presence of farmer organization	➢ 3 Agri. Groups (inactive) ➢ A registered saving and credit cooperation exist
	Marketing system	➢ Manthali (Monday) and Khurkot (Wed & Sunday) are the main

Major crops:

Vegetables	Plantation	Harvesting
Chili	Feb./March	June/Sept. .
Cauli/Cabbage	June/July/Sep (year around production)	Sept/Oct. Feb./March May/June
Tomato No plastic houses (about 6 KG per plant)	March July	May/June Sept./Dec.
Cucurbits		
Potato		
Brinjal		
Lady finger		
Green leafy		

		Haat bazzar locations ➢ Outside traders come and take chili to Jiri, Tatopani. ➢ 90-95% HHs sales of chili Nrs. 2000 to 200000 per year (about Nrs. 500 per kg) ➢ Almost all the Cauli/Cabbage is sold in the local market, Manthali (Haat Bazzar), carried by farmers with Doko. ➢ 50 HHs produce Cauli/cabbage and sale Nrs. 30000 to 150000 per year ➢ Tomatoes are also sold at the local haat bazzar ➢ Each HH sale Nrs. 30000 to 150000 tomato per year
Livestock	**Presence of LSSC**	No (LSC located in Manthari is in charge of the area.)
	Dairy	➢ 75% HHs have cow or buffalo ➢ One HH has 15 buffalos (average about 4) ➢ No milk collection, no milk is sold but some ghee
	Goat	➢ 98% HHs have goat (range 9/10 to30 goats per HHs) but all local breed ➢ No local or regular traders for goat ➢ In an average 300 goats from this area are sold each year ➢ Main market for goat is Kathmandu via Khurkot
	Presence of Agro-vets	No (Agri-input services are available in Manthari.)
	Presence of farmer organization	No livestock groups
Willingness of farmers		Farmers are willing to make labor and in-kind contribution
Others		There is a community forest exist, but not enough forage because of lack of water.

4. Ratanchura (Khaniyakharka), Sindhuli for Junar

Total No. of HH		Existing Junar commercial production 125 HHs (50-450 trees)
Horticulture	**Presence of ASC**	
	Citrus Production	➢ Every HHs have at least 10-20 Junar trees ➢ Existing 125 Orchards (>25 tress is regarded as orchards) ➢ Total area of orchards 1200 – 1500 Ropanis ➢ Time for Junar harvest is Nov./March
	Presence of collection center	
	Presence of Agro-vets	
	Presence of farmer organization	➢ Three Junar production cooperatives (27, 43, and 55 members) ➢ One processing cooperative (Pragati Juice, Jam production, saving and credit) ➢ One Junar Nursery cooperative
	Marketing system	➢ Processing cooperative along with District Junar Association is marketing ➢ Outside traders buy unripe Junar and sale as Mausam before Dasain ➢ Villagers/producers have started stopping to sale unripe Junar to outside traders (because about the quality of the Sindhuli Junar is negative perception to customers from the unripe Junar) ➢ Producers in cooperatives discuss and decide monthly to decide when to harvest ➢ Cooperatives sale grade A and B Junar in the market, and C for the processing ➢ Private traders take all grades ➢ Producers can sale their production to private traders or to

		cooperative on their own decision ➢ 50% HHs themselves sale their production in the market (they sale on the road to vehicle passengers as souvenir) , 30% to the cooperative and 20% to outside traders (this is the last year information but cooperative is planning to buy all production from the producers especially no for outside traders in coming days) ➢ Cooperative sale only 2-3% Junar in the Kathmandu market ➢ Main market is Sindhulimadhi to Terai to Biratnagar and Pokhara ➢ Local technical person can manage cooperative ➢ Tentative 50,000 to 60,000 Junar fruits are being collect daily from this area ➢ Cooperative can manage the collection center ➢ Collection center can be used for vegetables in rest of the time (4 months for Junar) ➢ Land can be accumulated
Willingness of farmers		Highly committed farmers
Others		OVOP for Junar is being implemented

5. Ratanchura (Khaniyakharka), Sindhuli for livestock

Total No. of HH		350 HH
Livestock	**Presence of LSC**	Livestock service center exist
	Presence of collection center	➢ No collection center for goat. ➢ There is Mahabharat Milk Collection Center.
	Presence of Agro-vets	No Agro-vets (in Sindulhimadi)
	Presence of farmer organization	Mahabharat Dairy Production Cooperative Ltd. (established in BS 2065, covers four VDCs (Ratanchura, Tinkanya, Bhimeswar, and Jalakanya) and has 450 members in total.
	Dairy	➢ 80% HHs have buffalos (1-3 in each house) ➢ 90-95% buffalo keeping HHs sale milk ➢ Milk price is Nrs. 35/ ltr. ➢ Daily 3-4 ltrs./HH milk is sold ➢ Nrs. 3000/month earned every milk selling HH ➢ AI service exists (last year, cow 7 out of 7 and buffalo 4 out of 8 AI have succeed)
	Goat	➢ 50% HHs have goat ➢ Demand for cross breeding, new species ➢ There are local traders (2) collect from the villagers ➢ 35-40 goats weekly taken to the market (Ktm. and Sindhulimadi/terai) by public vehicles ➢ Every HH earns 20000-25000 Nrs. per year from the goat. ➢ Breeding buck is there (Jamunapari)
Willingness of farmers		➢ Farmers are willing to participate in pilot project ➢ Ready to participate in cost sharing, and other activities of PP
Others		➢ Leaseholder forest and 3 groups (9, 11, 16 members) ➢ A large amont of grass (Amriso and other grass) are growing in the forest ➢ Existing grass (Rai Khanyoo, Bamboo, Brachiaria, Bakaino)

6. Ratamata (1, 2, 3 & 5), Sindulhi

<table>
<tr><td colspan="2">Total No. of HH</td><td>490 HH
(50% HHs have producing potato in commercial level, and 10% HHs are producing tomato.)</td></tr>
<tr><td rowspan="8">Horticulture</td><td>Presence of ASC</td><td>There is an ASC facility (but no service officer is staying.)</td></tr>
<tr><td>Major crops</td><td>
<table>
<tr><th></th><th>Vegetables</th><th>Plantation</th><th>Harvesting</th></tr>
<tr><td></td><td>Potato</td><td>Nov./Dec.</td><td>March/April</td></tr>
<tr><td></td><td>Tomato
(Hybrid Anita)</td><td>Year round</td><td>Year round</td></tr>
<tr><td></td><td>Onion/ Garlic</td><td>Dec./Jan.</td><td>May/June</td></tr>
<tr><td></td><td>Cucumber</td><td></td><td></td></tr>
<tr><td></td><td>Better Guard</td><td></td><td></td></tr>
<tr><td></td><td>Beens / Cow pea</td><td></td><td></td></tr>
<tr><td></td><td>Cauli/ Cabbage</td><td></td><td></td></tr>
<tr><td></td><td>Ginger</td><td></td><td></td></tr>
<tr><td></td><td>Pumpkin</td><td></td><td></td></tr>
<tr><td></td><td>Bottle Guard</td><td></td><td></td></tr>
<tr><td></td><td>Green Leafy</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Presence of collection center</td><td>No collection center existed but farmers are thinking/planning establishment under the cooperative management</td></tr>
<tr><td>Presence of Agro-vets</td><td></td></tr>
<tr><td>Presence of irrigation facility</td><td>➢ Main problem is irrigation for horticulture
➢ Currently farmers are pumping water from Sunkoshi river, for that user should pay Nrs. 50 per hour (20 for operator and 30 for others)</td></tr>
<tr><td>Presence of farmer organization</td><td>A well established cooperative exists</td></tr>
<tr><td>Marketing system</td><td>➢ Potential market in Sindhuli, Ramechhap, Kavre and Kathmandu
➢ No market problem till the date
➢ Most of the producers sale their products by themselves, as well as 10 local collectors collect products
➢ Outside traders/wholesalers (5-6) also collect the potato
➢ Traders come if the tomato production is at least 50 carets/ per day. If less than 35 carets, farmers themselves have to manage to send potatoes to KTM
➢ 1000-15000 kgs potato are send to Banepa and KTM
➢ For tomato, no market problem till the date
➢ Price of tomato Rs. 10-60 per kg</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Willingness of farmers</td><td>Ready to share the cost, and participate in other activities of PP</td></tr>
<tr><td colspan="2">Others</td><td>➢ PLAN international, an INGO is also working in this area (Sectors: Health, education, women & children, disaster management, irrigation and income generation : Contact person-Shree Niwas Baitha, Programme Coordinator, Cell 9804808145)
➢ Others Organiztions/programmes: SAHAMATI, Girl Power Project</td></tr>
</table>

Annex 2: Terms of Reference (TOR) for Pilot Project Field Facilitator

1. SRCAMP Pilot Project Field Facilitator is expected to perform the following tasks:
   - Understand detailed plan (contents) of the pilot projects being implemented in the District.
   - Establish good work relationships with all stakeholders concerning pilot projects, including SRCAMP Team, National Consultant Team, DADO/DLSO (JT/JTA), pilot project beneficiaries, local agricultural related businesses, etc.
   - Assist to coordinate and execute pilot project activities in the field, including procurement and distribution of materials, coordination with DADO/DSLO (JT/JTA) and other stakeholders, and monitoring the pilot projects, under the direction of the SRCAMP Team and National Consultant Team.
   - Encourage and ensure JT/JTAs to visit the pilot project sites for the periodical monitoring and record keeping.
   - Assist SRCAMP Team and National Consultant Team to conduct a series of baseline survey.
   - Prepare and submit monthly activity reports that will be regarded as monthly working records, summarizing progress and achievements of the pilot projects.
   - The tasks other than stated above (e.g. information/data collection, occasional meeting with related parties, arrangement of appointments and booking accommodations for SRCAMP Team, reporting activities conducted and updating the progress, etc.)
2. Duration of Service:
   - The pilot activities of SRCAMP will last approx. 15 months from August 2012 to October 2013. However, due to the Japanese financial system the contract of Field Facilitators will be terminated once at the end of March and new contract will be executed from April or May for the remaining period. Therefore, the tasks mentioned above shall be carried out from ___July 2012 until ____March 2013. (Approx. 9 months)

Annex 3: Selection Criteria of Target Farmer for the Vegetable Package

	Criteria for Vegetable Package
1	Experience vegetable farming in >1 ropani since past three years
2	Experience on tomato production for sale (in tomato PP like Katunjebesi)
3	Committed to contribute in individual farmers support program as follows:
	a. Seed, seedling and fertilizer - 25% cash (up front)
	b. Plastic houses - bamboo and labor
	c. MIT (drip) - 10 % cash (up front)
	d. Rain water Harvesting Tank or pond - materials and labor
4	Capability to keeping record keeping for the pilot activities (for example; expenses in seed, fertilizer, labor, application date/schedule, production and marketing)
5	Willing to work in group (Either farmer Group or Cooperative)
6	Producer must sale their produce through collection center
7	Committed to adopted new agriculture technologies as required (like; Drip, Sprinkler, Plastic House, F1 hybrid seed etc.)
8	Must participate for establishment, management and regular operation of collection center and other related activities (like; MUS, water Harvest tank, Plastic Pond etc.)
9	Must to share and disseminate skill & knowledge to interested people recommended by DADO/DLSO as well as SRCAMP
10	Farmers must accept the risk associated with new technologies application
11	Committed to contribution in collective farmers support activities as follows:
	a. Collection center - labor and local materials
	b. MWUS - labor and local materials (among beneficiaries)
12	Farmers must agree to pay service charge to collection center

Annex 4: Selection Criteria of Target Farmer for the Fruit Package

	Criteria for Fruit Package
1	Farmers must have at least 200 matured Junar trees within one place for improve technology demonstration (like; thinning - Pruning etc)
2	Farmers should not do early or late harvesting from the experiment farm
3	Committed to contribute at least 25% direct cash in individual farmers support program
4	Capability to keeping up to date data of pilot activities (for example; expenses in seed, fertilizer, labor, production and marketing)
5	Must to share and disseminate skill & knowledge to interested people recommended by DADO/DLSO as well as SRCAMP
6	Farmers must have accept the risk associated with new technology
7	Committed to adopted new technology as required
8	Farmers must give off inter cropping system (Just grow Junar)
9	Farmers must agree to supply for Junar processing from this pilot projects
10	Farmers must fallow project instruction and time schedule

Annex 5: Scoring Sheet for Vegetable Package Individual Farmer Interview

A. Vegetable farmers

1. General Characteristics

<table>
<tr><th>SN</th><th>Particulars</th><th></th></tr>
<tr><td>1</td><td>Name of farmers</td><td></td></tr>
<tr><td>2</td><td>Address</td><td></td></tr>
<tr><td>3</td><td>Total land Area (Ropani)</td><td></td></tr>
<tr><td>4</td><td>Education level of HHs head/ farmers</td><td></td></tr>
<tr><td>5</td><td>Main source of HHs income</td><td></td></tr>
<tr><td>6</td><td>Number of family member</td><td><table><tr><th></th><th>Total</th><th>Working age (15-60)</th></tr><tr><td>Men:</td><td></td><td></td></tr><tr><td>Women:</td><td></td><td></td></tr><tr><td>Children:</td><td></td><td></td></tr></table></td></tr>
<tr><td>7</td><td>Area under vegetable crops</td><td><table><tr><th>Commodities</th><th>Area(Ropani)</th><th>Production</th></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>8</td><td>Sale of vegetables</td><td><table><tr><th>Commodities</th><th>Market</th><th>Approx quantity(Kg)</th><th>Approx sales amount (Rs)</th></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>9</td><td>Total income from sale of vegetables (Rs)</td><td></td></tr>
</table>

	How do you manage following?	Responses (Yes/No)	If "No", give reasons	Remark
10	JICA/SRCAMP is piloting of vegetable project in your locality. You have been identified as one of the potential farmers. Are you willing to participate in piloting activities?			If farmer don't express interest or willingness then move to other farmers

2. *Farming practices*

SN	How do you manage following?	Responses
1	Seeds	
2	Chemical fertilizers	
3	Irrigation (Water)	
4	Weeding, fertilization practices	
5	Selling of produce	
6	Major problems and challenges	

3. *Willingness and commitment to participate in piloting activities*

SN		Responses	Give reason
1	Do you agree to contribute following amount for participation on piloting activities?		
	a. Seed, seedling and fertilizer - 25% cash (up front)	1. Yes 2. No 3. No idea	
	b. Plastic houses - bamboo and labour	1. Yes 2. No 3. No idea	
	c. MIT (drip) - 10 % cash (up front)	1. Yes 2. No 3. No idea	
	d. Rain water Harvesting Tank or pond - materials and labour	1. Yes 2. No 3. No idea	

2	Do any of your family member is capable of keeping record of pilot activities (for example; expenses in seed, fertilizer, labour, application date/schedule, production and marketing) etc	1. Yes 2. No	
3	Are you willing to work in group (Either farmer Group or Cooperative)?	1. Yes 2. No 3. No idea	
4	Do you agree to sell your produce through collection center which is being established?	1. Fully agree 2. Partially agree 3. Disagree 4. No idea	
5	Are you committed to adopt new agriculture technologies as required (like; Drip, Sprinkler, Plastic House, F1 hybrid seed etc.)?	1. Fully 2. Partially 3. No	
6	Do you fully participate for establishment, management and regular operation of collection center and other related activities (like; MUS, water Harvest tank, Plastic Pond etc.)	1. Fully 2. Partially 3. No	
7	Are you willing to share and disseminate skill & knowledge to interested people recommended by DADO/DLSO as well as SRCAMP ?	1. Yes 2. No	
8	Do you agree to bear risk associated with the application of new technologies?	1. Yes 2. No 3. No idea	

9	Do you agree to pay service charge for use of collection center	1. Yes 2. No 3. No idea	
10	Do you agree to contribute on following activities?		
	a. Collection center - labour and local materials	1. Yes 2. No 3. No idea	
	b. MWUS - labour and local materials (among beneficiaries)	1. Yes 2. No 3. No idea	

4. Assessment of farmers (Assess farmer considering farming practice, economic conditions, risk bearing capacity, interest and willingness to participate in programme)

Tick the most appropriate one	Explanation	Special observation if any
1. Selected 2. Selected with reservation 3. Not selected		

Annex 6: Selection Criteria of Target Farmer for Dairy Package

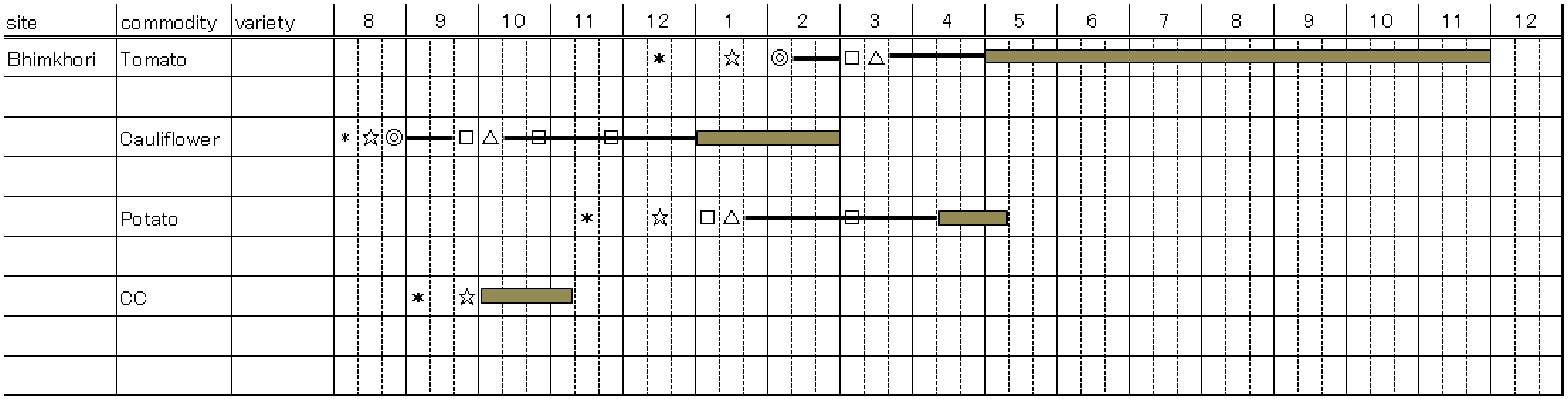
	Livestock Dairy Program criteria
1	Must have at least 1 lactating cow or buffalo with calves age less than 5 months
2	Must not sale their animal after registration at least for the period of 15 months
3	Committed to share 10% direct cost to improvement of animal environment (feeding and shed management such as trough, chopper, cement etc.)
4	Capable and committed to keeping record of animal farming.
5	Committed and must share to forage seed as revolving basis
6	Must accept to the visitor as recommended by DADO/DLSO and SRCAMP
7	Must adopt new technologies for livestock introduce by SRCAMP
8	Farmers must have accept the risk associated with new technologies
9	Must support to SRCAMP member to measure milk and size of buffalo and cow as required
10	Willing to grow grass for stall feeding in private land.

Annex 7: Selection Criteria of Target Farmer for Goat Package

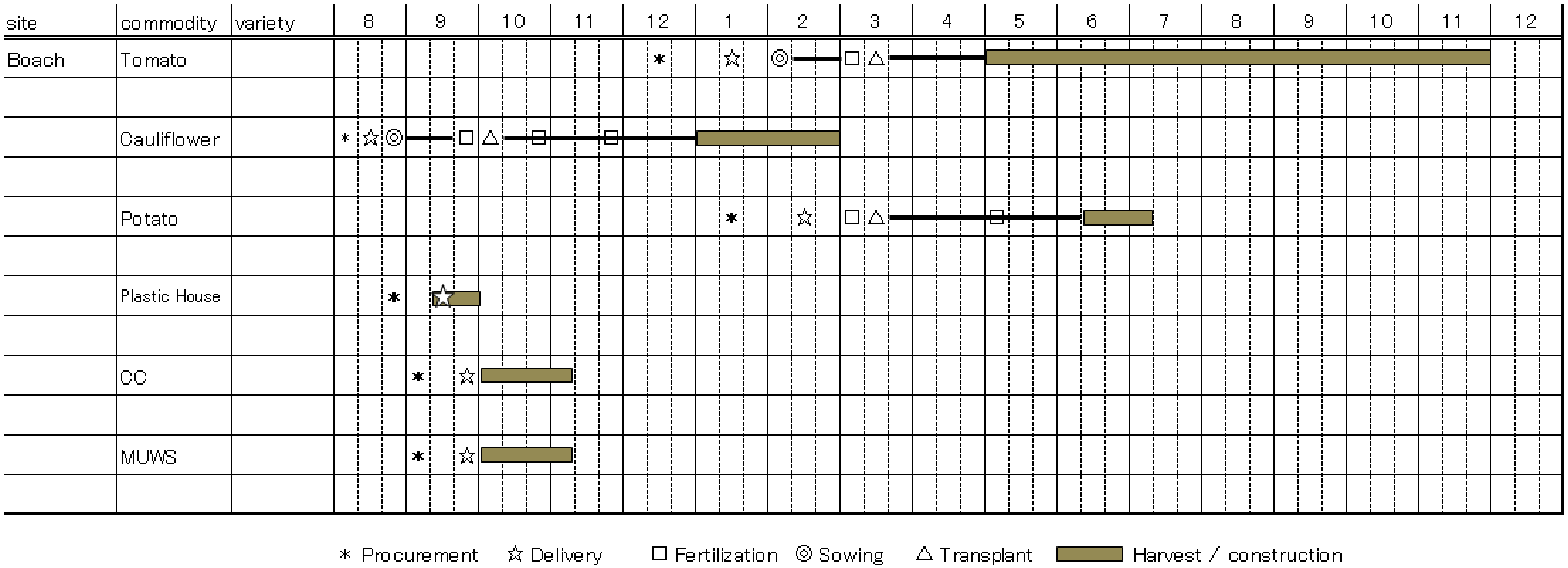
	Livestock Goat Program criteria
1	Farmers must have at least two breeding female goats (Dam)
2	Must not sale their registered mother goats after registration at least for the period of 15 months and kids must not be sold at least 8 months
3	Must accept the risk associated with new technology
4	Capable and committed to keeping record of goats
5	Committed and must share to forage seed as revolving basis
6	willing to grow grass for stall feeding in private land
7	Must agree and participate to weighing registered goat as per required
8	Farmers should de-worming and vaccinate every six months for external and internal parasite control
9	Farmers must vaccinate their registered goats against pest des petits Rumineants (PPR)

Annex 8: Work Schedule for Vegetable/Fruit Package at each Pilot Site

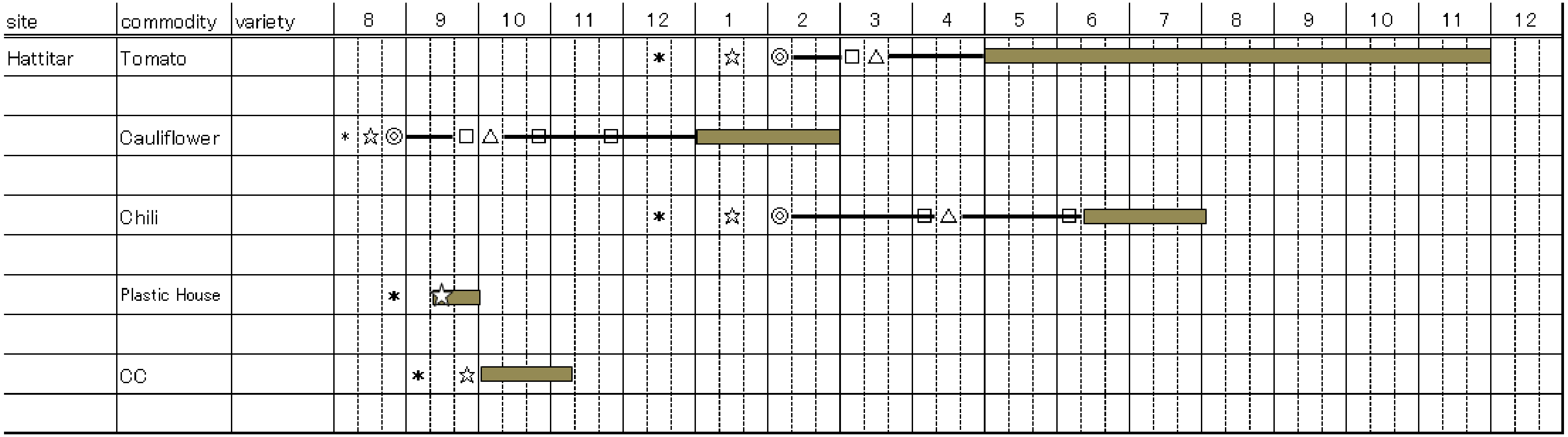
Bhimkhori (vegetable package)



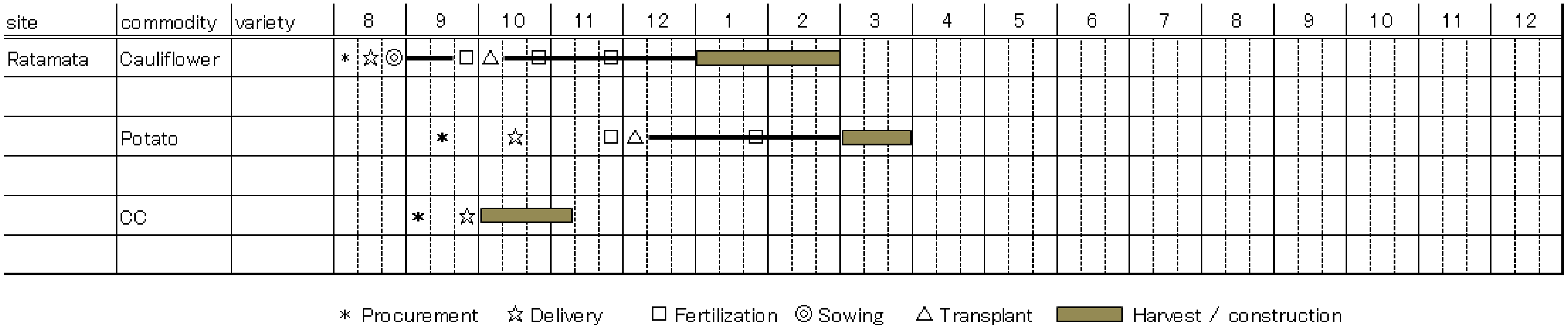
Bocha (vegetable package)



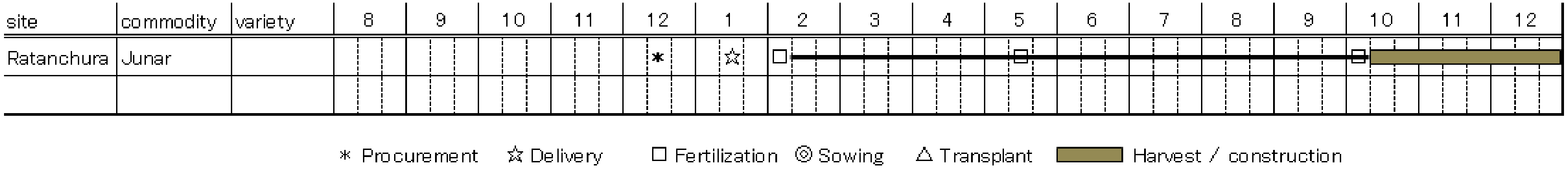
Hattitar (vegetable package)



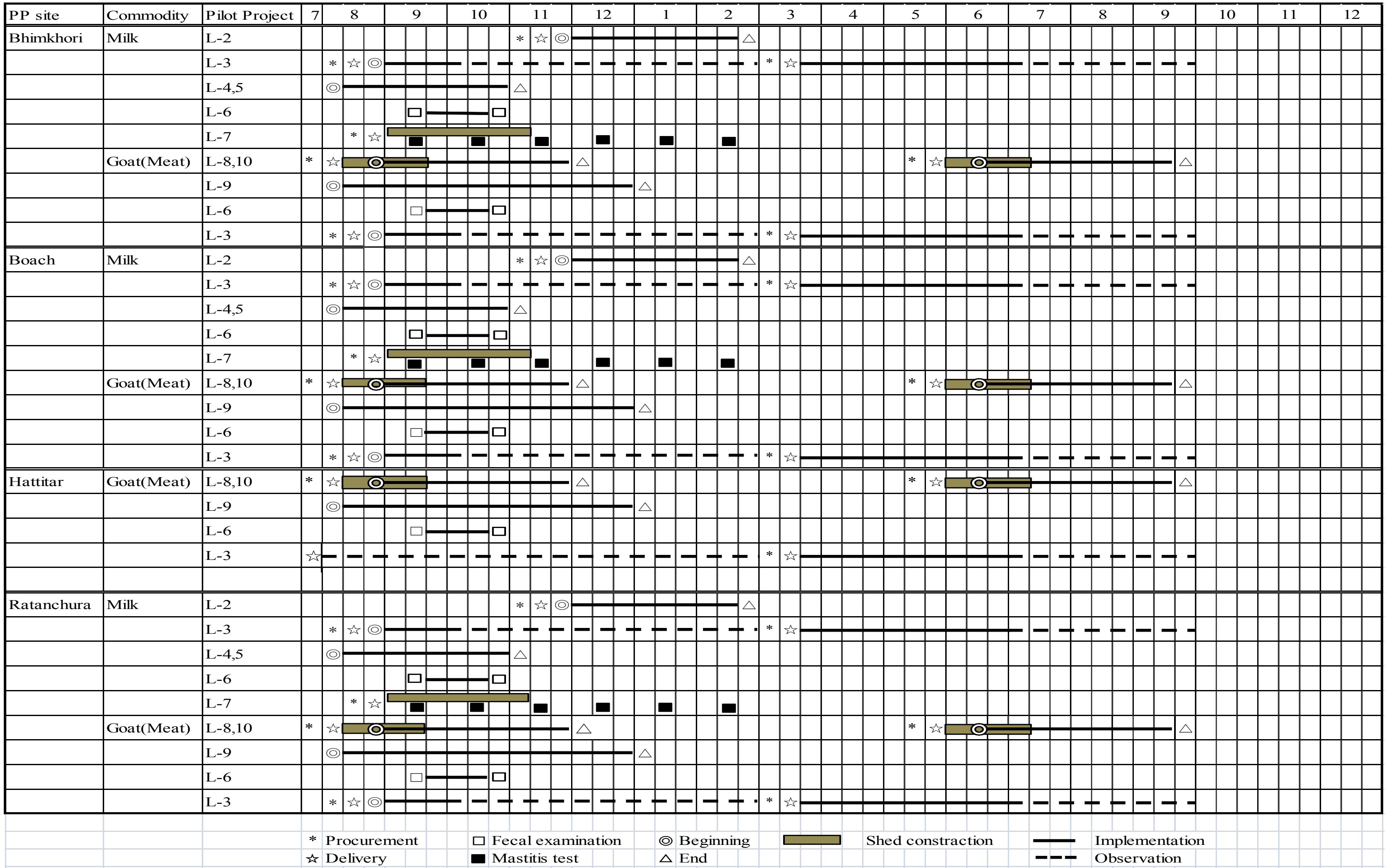
Ratamata (vegetable package)



Ratanchura (fruit package)



Annex 9: Work Schedule for Goat/Dairy Package at each Pilot Site



Annex 10: Program Schedule of the Study Trip to Kaski

February 28 – March 2, 2013

Program Schedule

Date	Time	Description	place	Objective and Observation area	Responsible
28 Feb. 2013	8:00	Gathering at Khalanki	Khalanki Chock (towards Balkhu)		Raghav Kayestha
	8:15 -14:30	Travel to Pokhara	Pokahara		
	14:30 - 16:00	Observe the livestock farm	Pokhara @ Bhendikharka	Observe the livestock farm and discuss with the farm management staff about the management system	Bhoj Bdr. Chettri
	16:00 - 16:30	Arrival to the hotel	Pokhara	Goldengate Hotel, Lake Side	Raghav Kayestha
	16:30	end of the day program	Pokhara		
1-Mar-13	7:00 - 7:30	Breakfast			
	7:30 - 8:00	Departure from hotel	Bhalam		
	8:00 - 10:00	Interaction with Deurali krishi Upaj Marketing Planning Committee members and key farmers	Bhalam @ Rayalechaur	To learn about the Collection center operation, record keeping and management system	Bharat Nepal and iDE Nepal Pokhara Team
	10:00 - 10:30	Returned back to Pokhara			
	10:30 - 11:30	Lunch time			Raghav Kayestha
	11:30 - 13:00	Travel to Lumle	Lumle		
	13:30 - 15:30	Observe the vegetable collection system, MUS scheme and interaction with MPC members	Lumle	To learn about the Collection center operation, record keeping and management system. Observe the Multiple use water scheme and drip technology.	Bharat Nepal and iDE Nepal Pokhara Team
	15: 30 - 16: 45	Returned back to Pokhara		Goldengate Hotel, Lake Side	
	16:45	end of the day program			
2-Mar-13	8:15	gathering at Hotel lobby	Pokhara		
	9:00 - 13:00	Departure to Dhading Charaundi	Charaundi		
	13:00 - 15:00	Charaundi Vegetable collection center	Dhading @ Charaundi	Monitoring and Observation of Vegetable collection center and interaction with the cooperative member	Bharat Nepal
	15:00 - 17:00	Travel to Kathmandu			Raghav Kayestha

Note: 45 minutes Lunch break during travel (both ways)

Annex 11: Cropping Calendar: Uniform Production – Cauliflower

Planting and Work Calendar

Name		Code			Contract #	
Commodity	Cauliflower	Variety			Commodity Code	002
Address		Area	1	ropni	Farm Code	
Form of Shipment						

Work	Material/Application	Quantity		Purpose	scheduled date	applied date
Nursery Preparation					08/05/12	
Reseive Material	Seed, Fertilizer, Pot, etc				08/25/12	
Raising seedling	Sowing	1	L		08/25/12	
	Pot up	2,500	plant		09/05/12	
Tiller					09/25/12	
Soil improvement	Compost	1000	kg		09/25/12	
Fertilization	Urea	9.8	kg	basal Fertilizer	09/25/12	
Fertilization	DAP	10	kg	basal Fertilizer	09/25/12	
Fertilization	MOP	8.3	kg	basal Fertilizer	09/25/12	
Transplant		1,900	plant		10/01/12	
R*R Distance	60 – 70cm					
P*P Distance	40cm					
Pest Control						
Fertilization	Urea+MOP	5.4 + 4.2	kg	Topdressing 1st irrigation	10/25/12	
Fertilization	Urea+MOP	5.4 + 4.2	kg	Topdressing 2nd irrigation	11/25/12	
Pest Control						
Harvest			kg		01/15/13	
Harvest			kg		02/15/13	

I agree to grow and deliver the commodity to the designated collection center as stated above.

adress

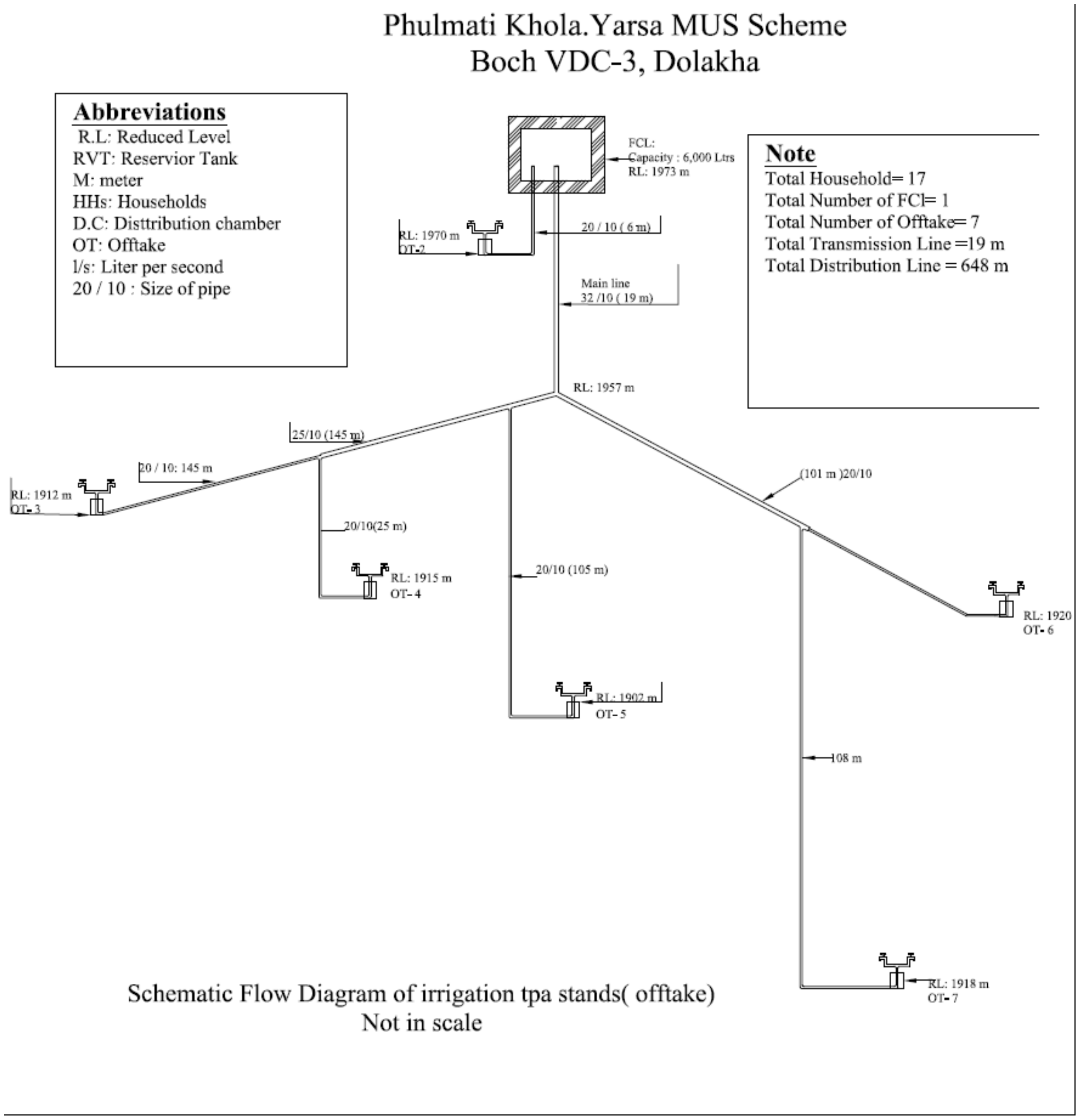
name Sign

Annex 12: Cost of production for cauliflower by pilot sites

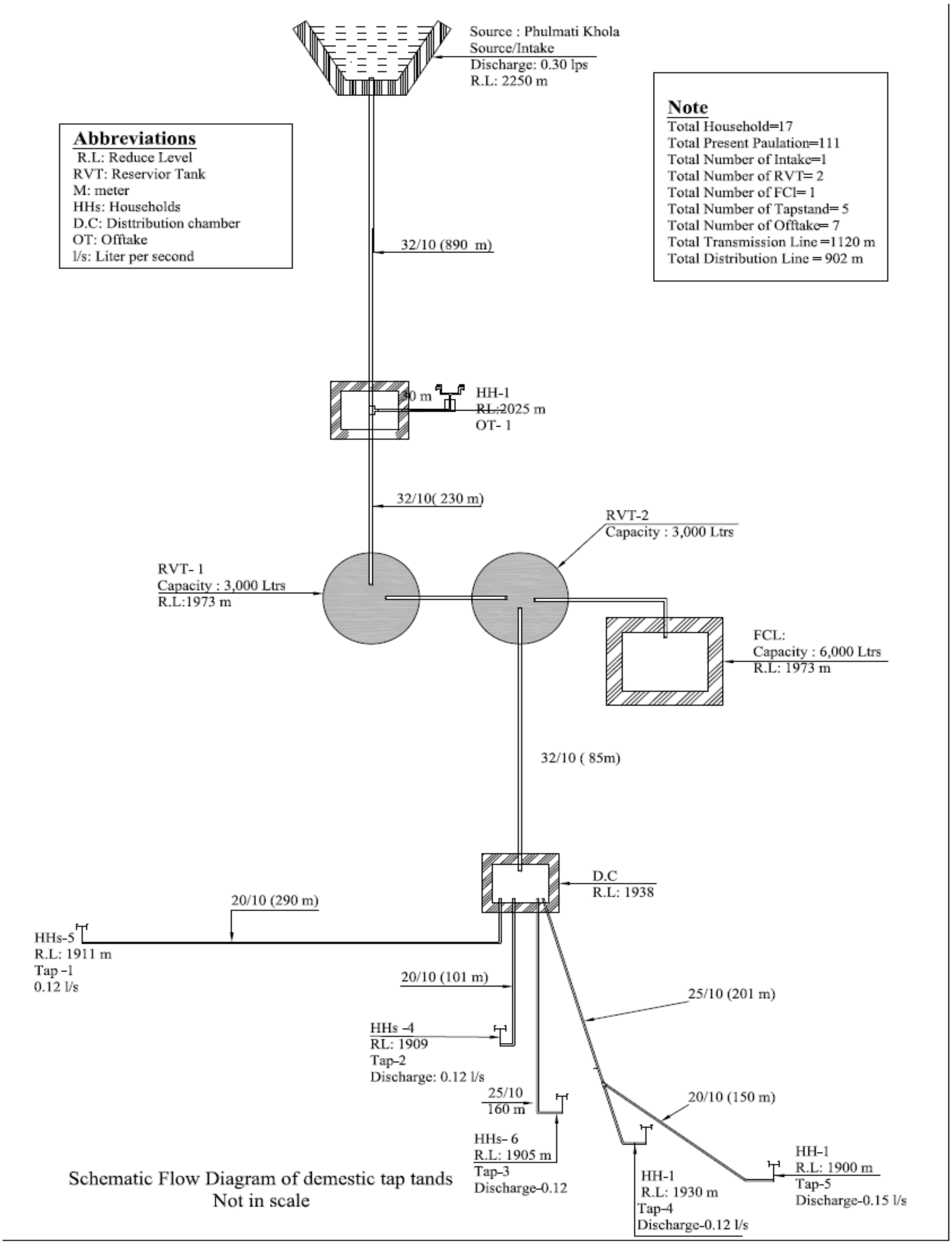
Unit: Rs/Ropani

SN	Items	Cost of production per Ha (Rs/Ha)				
		Bhimkhori	Bocha	Hattitar	Ratamata	Average
1	Variable Cost					
1.1	Labor					
1.1.1	Human	3,150	9,550	8,050	10,300	7,763
1.1.2	Bullock	1,800	0	3,000	1,200	1,500
1.2	Production Inputs					0
1.2.1	Seed	250	250	250	250	250
1.2.2	FYM	1,250	1,250	1,250	1,250	13250
1.2.3	Fertilizer	1,940	1,940	1,940	1,940	13940
1.2.4	Pesticide	200	200	200	300	225
1.2.5	Micro-nutrients	100	100	150	150	125
	Total Variable Cost	8,690	13,290	14,840	15,390	13,053
2	Fixed Cost	175	175	175	175	175
3	Marketing	200	500	1,000	800	625
4	**Total CoP**	**9,065**	**13,965**	**16,015**	**16,365**	**13,853**

Annex 13: a) Technical design of irrigation water flow scheme



Annex 13: b) Technical design of drinking water flow scheme



Annex 14: Junar Thinning and Pruning Training Material

Objectives of pruning

1. Trim the tree to lower height in order to improve the work efficiency.
2. Cut off the unnecessary branches in the tree crown to improve aeration and sunlight reception
   (Improved aeration and sunlight reception reduce the disease infections caused from humidity)
3. Stabilize the annual fruiting and also avoid the biannual alternate fruiting

Timing of pruning

Period is between the end of harvest and bud formation. Or it is possible to do the cutting of unnecessary aurum branches before harvest.
Dead branches should be cut out at any time since these will cause the diseases.

Classification of branches

Main branch, Sub branch
The branches which are compose a main frame of the tree. Not to be cut.
Lateral branch
The branches which are grown from sub branches
Introversion branch
The branches which are growing toward inside of tree crown. These branches may bear fruits but not a good quality. It is also easily wilt.

Priority order of pruning

1. Dead branch
2. Branches growing below the division of main branch
3. Branch growing straight up from tip of main branch
4. Branch growing straight up from sub branch
5. Strong introversion branch
6. Weak introversion branch
7. Branch growing parallel to overlap with sub branch

Procedure of pruning

1. Observe the tree in overall to select which to be cut (dead, straight up, introversion branch) and not cut (main, sub branch)
2. Cut out all the dead branches on the tree
3. Cut the tip of main branch. Cut the branches competing with main branch.
4. Thin out strong introversion branch or cut back to slimmer part of the branch
5. Thin out the weak introversion branch.

6. Thin out the branches hanging down on the sub branches to intercepting the sunlight
7. Thin out the branches competing with growing tip of sub branch
8. Thin out the branch with succulent growth (autumn branch)

    ※ Quantity of the branches to be cut off should not be exceeded more than20% of its volume.

What is fruit thinning?

Citrus varieties such as Junar and Suntara have a character to bear large number of fruits. Over borne fruits on a same tree will not grow well from competition between each other for necessary nutrient. At same time, the tree suffers from overload, so the strength of tree get weaker and inhibits the flowering for next season.

Fruits thinning alleviate the overload of the tree to avoid alternate fruiting (quantity of fruit bore on a tree alternate high and low each year), and improve fruit quality in size and also its appearance.

Operation of fruit thinning

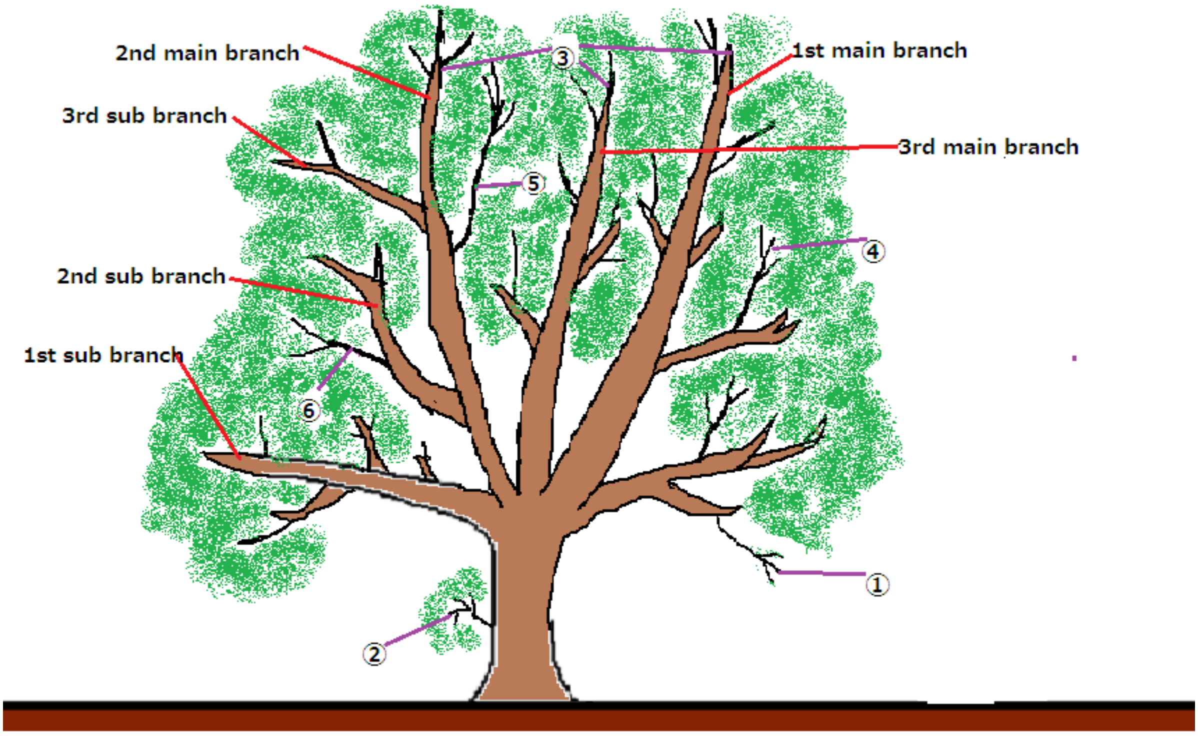
Fruit thinning should be done 2 to 3 times before harvest but not until physiological natural thin out had over. Thinning criteria is different for each variety. For example, Leaf – Fruit Ratio (number of leaves per fruit) is 25 for the Unshu orange (Japanese variety). 80 leaves per fruit will be applied to Junar and Suntara.

Priority order of fruit thinning

1、 Fruits which are obviously smaller than others in size
2、 Damaged from insects and diseases
3、 Bad in appearances with scars and other visual damages
4、 1 or 2 fruit will be thinned out if multiple fruits are on a same branch

<u>※Leaf-Fruit Ratio cannot be counted precisely during the operation; operator must understand the appropriate condition at a sense by observing the overall picture of the tree from the distance.</u>

<u>※Fruit thinning may reduce the single year harvest; however, it will improve the average quantity of harvest for multiple years by avoiding alternate fruiting, and consequently it will attain more stable production for long term.</u>


2nd main branch
3rd sub branch
2nd sub branch
1st sub branch
1st main branch
3rd main branch
③
⑤
④
⑥
①
②

Annex 15: Brief Report of the Chaudhari Group factory exposure visit, Nawalparasi

1. General Introduction

SRCAMP pilot project introduce new variety of potato with collaboration Chaudhari Group (CG) to promote commercial potato production. This new variety potato mostly use in Chips production and basically this variety potato demonstration is to focus to increase production. After trail/demonstration in the initial year production area and no. of farmers are also increased to production of this potato as trail. After harvest the trail Potato SRCAMP facilitate to send the sample potato in CG factory for test of quality chips. As per the provided information by the CG respective staff Mr. Ram Bhakta KC the result of Process Potato is good and they can buy this variety potato if farmer provide.

2. Objective of the exposure

The main objectives of this exposure are;

- Encourage to the potato Producer farmers to produce Himsona variety potato as commercial and developed sustainable marketing mechanism.
- To learn detail information about the variety and production system of this variety potato and Face to face interaction with the commercial producer of Chitawan pocket.
- Observation of chips production system and to know the actual size and quality of the potato for processing to make the chips.

3. Participant's selection

As SRCAMP and CG group suggestion Potato production group select the farmers for this exposure. After FG finalize the selected farmers name, detail information, other meeting decision and purpose date for the exposure, group leader send those information to the SRCAMP National Consultant (NC). As their meeting decision SRCAMP, NC facilitate to this exposure program consultation with CG concern staffs. Following are the participated farmers of this Visit;

1. Potato producer farmers from Kavre - 28
2. SRCAMP - 2
3. Agriculture Service Center, Panchakhal, Kavre -1

Total participants – 31

4. Date and duration of the exposure

As per the meeting between the SRCAMP Horticulture specialist including National Consultant and potato producer farmers finalized the exposure visit procedure. After get the detail information and purpose date from the farmers side NC inform to the CG staff and request to manage the program as per the planned date and time. After our information CG staffs were also agreed to support and facilitate to this exposure as per the planning.

- The exposure date is 31st may – 1st June 2013

5. Financial management

SRCAMP support on Transportation cost from Panchkhal @ Ranitatr to CG factory @ Chaudharygaun Nawalparasi and Vice Versa. During this visit period Day one dinner with accommodation and day second breakfast & Lunch cost supported by Chaudhary Group and travel time other required logistic cost manage by the farmers by themselves.

6. Observation and learning

6.1 Observation and short orientation about the chips variety Potatoes.

After reach the Chaudhari Factory participants gather at Chaudhary Group training & learning center. Mr. Ramchandra Dhital has been facilitating to this introduction program. After introduction he has present the rules and regulation of the observer in the production area. To learn the basic norms and rules of this factory and role and responsibility of the observer, participants were start to observe the noodles production unit and continue observe chocolate, Potato Chips, Juice etc.

After observation of the different product production units the exposure team and CG concern staffs returned back and gathered at the learning center. After gather all respective member of this program CG provided basic information about the Chips variety Potato. During this meeting Mr. Ram chandra Dhital Present the CG history and conducting activities related with the Corporate Social Responsibility (CSR). Similarly, CG supporting the community people to promotion of agriculture production as commercial business and also providing the education scholarship as well as skill development training to the poor and marginalized people.

Another session Mr. Ram Bhakta KC facilitate to the session with presenting the chips variety of potato such as Himsona and Chipsona. He further added the characteristic of these two varieties, production process, required fertilizer and micronutrient, irrigation and other weeding process. Mr.Sarad Ghimire, Agriculture and forest program implement staff gave answer of farmers query and question. During the Ram bhakta KC presentation inbuilt points are;

- CG Started to produce potato chips from 2062 Bs.
- Total employee of this factory - 1650 person but in the starting time CG appointed only 72 employees in 2052 BS.
- Annual demand of potato 12 lakhs Kg.
- CG received only 3, 25,000 kg potato from nearby the factory from this year and 8,75000 kg Potato imported from India.
- Basically from April/may to October/November CG demand Potato from hilly area producer and rest of the month they will purchase potato from Tarai area farmers.

Basic Requirement of CG before purchase of Potatoes

- Potato size should be at least 1.5 inch round
- Potato must be grading and should pack inthe jute bags

- Farmers need to store at least 1 week after harvest
- Minimum quantity at least 15000 Kg (i.e one truck)
- CG will paid the payment after 15 day through the group leader

Following are the participant's member of this introduction and orientation program

a. 28 farmers from Potato producer Kavre Ranitar
b. 6 members from chaudhary Group
c. 1 staff of DADO Kavre
d. 1 - Staff member from SRCAMP
e. 1 – National Consultant of SRCAMP

6.2 Interaction with the potato producer farmers of Nawalparasi

Chaudhary Group organized and facilitates a short interaction program with chipsona and himsona potato producer farmers of Nawalparasi District. During this interaction meeting two potato producer farmers group members were represent. Mr Sarad Gimire shares their experience about the chips variety tomato production practices and also provide the differences between himsona and Chipsona variety. As per the information of Mr. Ghimire himsona variety is more suitable for hilly and Mountain area and chipsona for lowland field.

Farmers of the Nawalparasi Pocket area share their experience about the chips variety potato production. During the interaction period they are express their own practical experience of chipsona variety potato. Basically farmers share the basic production practices and production difference between the local variety and these chips variety potatoes. One farmer Mr. Damodae pandey has successfully harvest the potato upto 51 kg from one kg seed (i.e 1:51 kg). During this interaction Nawalparasi Farmers share the general crop calendar of potato production and management. From this interaction kavre farmers highly motivated with the chipsona variety potato and they are planning to demonstrate this variety in upcoming seasons beside the Himsona variety seed.

Attendance participants during the interaction meeting

a. 28 - Potato producer farmers from kavre Ranitar
b. 4 - Staff members from chaudhary Group
c. 6 - Potato producer farmers from Nawalparasi.
d. 1 - Staff member from SRCAMP
e. 1 – National Consultant of SRCAMP

6.3 Major learning

Potato Producer Farmers know about the following points;

- Characteristics of the Chips variety potatoes
- Production process and methodology
- Land preparation and seed selection (Required Size for seed)
- Required temperature for potatoes production

- Minimum required dose of fertilizer and irrigation
- Weeding and other management practices and harvesting technique
- Requirement of grading and packaging system
- Chaudhary Group demand size of potato, quantity and demand seasons
- Processing method of the Potato to product chips

7. Conclusion

Chaudahary Group request to SRCAMP and DADO Kavre to Demonestrate himsona potato during the off seasons (from July August seedling and October November Production) inter cropping with Maize in Kavre district, Nala area. For this season himsona variety seed will be provided by the CG and need to facilitate for introduce with CG as well as Himsona potato to the new are farmers by SRCAMP and DADO staffs Kavre.

Before departure to participant's destination we have done short discussion with Kavre farmers and made conclude that they will discuss in their groups and make the necessary plan to produce potatoes and deliver to chaudary group coordination with chaudhary Group for coming seasons.

If Kavre Nala farmers are agree to demonstrate to produce Himsona variety CG will be provided potato seeds in near future. Similarly CG has also interested to demonstration potato production in Dolkha different pocket as our suggestion. Beside this potato CG also agree to purchase herbal product (like; Amala, Harrow, barro etc.) at plentiful amount is possible

Similarly we (NC & SRCAMP team) also discussion about the Junar Juice making process and it tentative cost considered with the Morita san concept and Mr. Rambhakta KC will send the quotation after one week incorporate all the possible matter.

Section 6
Indian Border Agriculture Market Survey

Section 6: Indian Border Agriculture Market Survey

Table of Contents

CHAPTER 1 INTRODUCTION

1.1 Background

Sindhuli Road Corridor High Value Agriculture Master Plan (SRCAMP) intends to promote agricultural commercialization in the Sindhuli Road Corridor (SRC) area. Visit of market centers and interaction with the traders reveal that there is high demand for off-season vegetables in Indian cities, which can be seen from price trends of these commodities along the Indian border market. Hence, Rapid market appraisal of Indian border market was carried out with a view to explore export potentiality of exporting off-season vegetables on bordering cities.

The study mainly focused on exploring monthly price fluctuation of off-season vegetables that can be produced in SRC districts (at least cabbage, cauliflower and tomato) in selected wholesale markets in Bihar, India.

1.2 Study Methodology

1.2.1 Selection of Market

The selection of the wholesale market was based on the volumes that particular wholesale market handles. Vegetable wholesale markets serving certain size of population in the cities and that not too far from the Nepali border was the main criteria for selection of market. Apart from this, Traders interaction was carried out in Dhalkevar market to identify prospective Indian market for the study. Following markets were selected for the study based on consultations with traders and number of populace served.

- Jayanagar
- Madhubani
- Sursand
- Sitamarhi

Interaction with the traders further reveals that two off-season vegetables, namely cauliflower and cabbage are exported from Nepal to above market. Apart from this, tomato is also exported to neighboring Indian border market center. Hence, the study focused on only these three commodities though few commodities such as pointed gourd, beans, pea, chili, coriander and capsicum are also imported from Nepal. ***Annex 1*** presents preliminary rapid market appraisal report for selection of Indian border market and the commodities.

1.2.2 Study Methods

Rapid Appraisal of the Indian border Agriculture Markets was carried out from ***23 to 26 September, 2013***. ***Annex 2*** presents schedule of the visit. There is neither market management committee nor mechanism of recording price information system on the all studied market center. The markets are mostly managed by the contractors. Hence, the study had to generate the seasonal price information based on consultations with the traders. Nevertheless, attempts had been made to validate information from different traders. Apart from this, large number of traders also observed the interactions and provided their view during discussions with the respondents. They mainly clarified on seasonal price information and seasons of import. Attempts were made to validate market price information as far as possible such that reliable and accurate information could be collected. All agriculture commodities price are converted on Nepalese Rupees (NRs), where conversion rate of Indian currency to Nepalese currency is 1.6.

The study mostly relies on primary sources of information. Interaction with traders operating on the studied market was carried out. ***Annex 3*** presents list of traders consulted for the purpose of study. Interview with the traders was carried out to explore commodities which are imported from Nepal, seasonal price trends etc.

Apart from this, the study also reviewed the seasonal price trends of agriculture commodities at Kalimati and Dhalkevar Wholesale market to assess average price differences on Indian border Markets and major market centers of Nepal.

1.2.3 Limitations

The study did rapid price survey of only those off-seasonal vegetable commodities, which have export potentialities such as tomato, cauliflower and cabbage during off-seasons. Other commodities such as pointed gourd, capsicum and corianders are also exported from Nepal, however survey did not cover those commodities. These commodities are exported on limited scale on the SRCAMP districts and also have less export potential.

There is no proper market information recording system on all the four studied markets. Hence, study generated seasonal market price information based on consultations with traders operating on these markets center. Data have been validated with interaction with retailers and other traders especially on wholesale price to ensure reliability. Nevertheless, few traders also participated during the consultations and provided the price information as well.

1.3 Organization of Report

This report is organized in four sections. With this introductory section presenting study background, methodology and limitations, section two presents characteristics of studied markets. Section three presents seasonal market price variations including season of export of selected study commodities especially tomato, cauliflower and cabbage. Section four draw conclusions and provide recommendations.

CHAPTER 2 STUDIED INDIAN BORDER MARKETS

2.1 Location

Table 2.1 along with Map 2.1 presents location of studied Indian market. Of the four studied markets, two markets are located nearby Nepalese border, namely Jayanagar and Sursand whereas two other market (Madhubani and Sitamarhi) are located away from borders of Nepal. These are relatively bigger markets located on district headquarter which are supplying agriculture commodities to nearby towns and village markets. Approach road to these border market from Nepal are relatively poor. There is alternative route to go the Madhubani market from Janakpur as well. People from Janakpur mostly goes to Jayanagar, Madhubani and Sitamari to purchase clothes, vegetable and other essential items in bulk quantity, especially during ceremonies such as marriage and funerals.

Map 2.1: Studied Indian Markets

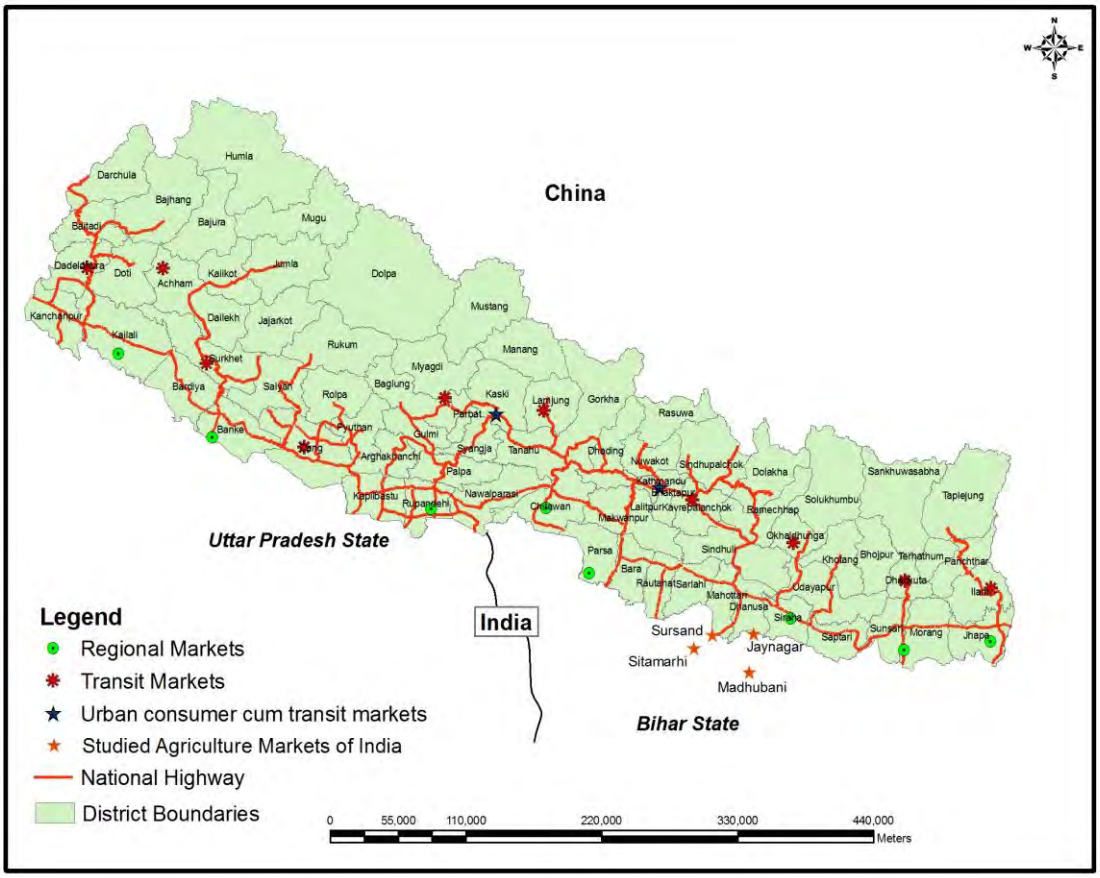


Table 2.1: Location of Studied Markets

	Jayanagar	Madhubani	Sitamarhi	Sursand
Location of market	Border of Nepal	District head quarter	District head quarter	Border of Nepal
Point of entry from Nepal	Maadar, Siraha	Maadar, Siraha	Vitthamod, Jankapur	Vitthamod, Jankapur
Distance of Nepal border (km)	Around 7 km	Around 60 km	Around 40 km	Around 15 km
Route	Maadar, Siraha-Jayanagar	Maadar, Siraha - Jayanagar - Madhubani	Janakapur - Vitthamod - Sursand - Sitamarhi	Janakapur - Vitthamod - Sursand -
Road conditions from Nepal to the market	Poor,	Poor, upto Nepal border	Poor up to Nepal border	Poor up to Nepal border

Source: Consultation with traders

2.2 Market Characteristics

Table 2.2 presents characteristics of the studied market. Of the four markets, Sitamarhi is the only wholesale market whereas both the retail and wholesale trading of agriculture commodities is carried out on Jayanagar, Mudhabani and Sursand. There are retail markets nearby Sitamarhi wholesale market. Traders from nearby towns and villages also visit to Madhubani and Sitamarhi market to purchase agriculture commodities. All the four studied market are managed by the private traders. Market committee has not been formed or established on any of these markets. According to the traders, the market management committee was formed earlier, however it was abolished recently by the government. No market committee exists in Bihar. As a result of this, price information are neither collected nor updated regularly. Of the four markets studied, Sitamarhi is the only wholesale market where trading of only green seasonal vegetables are carried out whereas in rest of the market, fresh green vegetables along with onion and potato are also sold from the same market places.

There is no mechanism of market price information collection on all of these market centers. Traders are collecting price information on the basis of last day/last week market price from the wholesalers/traders and brining produce from nearby locality. Few traders from Sursand and Jayanagar market visit to nearby market places such as Dhalkevar, Dharat (Amarhaat market) to purchase seasonal vegetables whereas traders from Sitamdadhi visit to Palung area to purchase of green vegetables.

Table 2.2: Characteristics of Studied Indian Markets

	Jayanagar	Mudhubani	Sitamarhi	Sursand
Type of market	Retail & wholesale	Retail & wholesale	Wholesale	Retail & wholesale
Number of traders operating on market	15 - Wholesale 100 - Retail	10 - Wholesale 150 - Retail	20 - Trading 150 - Retail	10 - Trading 30 - Retail
Market command or niche area	Jayanagar area	Mudhabani and nearby town	Sitmadi and nearby town	Sursand area
Market management	By traders, only	By traders, only	By traders, only	By traders, only
Existence of market management committee	No	No	No	No
Major vegetable sold	Green seasonal vegetables, potato & onion	Green seasonal vegetables, potato & onion	Green seasonal vegetables only	Green seasonal vegetables, potato & onion
Price and record keeping system	None	None	None	None
Price determination system	Based on cost of purchase	Determined by collectors, sale on commission	Determined by collectors, sale on commission	Based on cost of purchase
Market turnover (NRs/day)	240,000	500,000	1,500,000	NRs 100,000

Source: Consultation with traders

2.3 Import of Agriculture Commodities from Nepal

Table 2.3 presents details of commodities which are imported from Nepal including place of purchase, point of entry and bordering town of Nepal. Cauliflower, cabbage and pointed gourd are the main commodities which are imported from Nepal. Amarhaat, Dharan is main place of purchase in Jayanagar market whereas vegetables from Palung area are coming at Sitamarhi market.

Table 2.3: Commodities Imported from Nepal

	Jayanagar	Mudhubani	Sitamarhi	Sursand
Name of major Nepalese vegetable commodities imported	Cauliflower, Chilly, Cabbage, pointed gourd	No idea about export from Nepal, but come from Silughadi, West Bangal (cabbage, cauliflower)	Cauliflower, cabbage, chilly, corianders, , peas, capsicum, carrot, beans	Cauliflower, cabbage, pointed gourd, tomato, peas, corianders, capsicum, carrot, beans
Places of purchase from Nepal	Dhakevar market, Amarhaat (Dharan)	No idea	Palung area, Hetauda	Dhakevar market, Amarhaat Dharan
Point of entry of agriculture commodities to studied market	Jayanagar	Silughadi	Bargania	Vittamod
Bordering town & district of Nepal	Madar, Siraha district	Kakarvitta, Jhapa district	Gaur, Rauthat district	Jaleshwor, Mahottari district

Source: Consultation with traders

2.4 Major Imported Commodities

Table 2.4 presents ranking of commodities which are imported from Nepal. Cauliflower, cabbage and pointed gourd are main commodities imported from Nepal on all the studied market. Traders and wholesalers don't directly import from Nepal on Madhubani market, however they are purchasing from Silugadhi market. It is more likely that off-season vegetables in Madhubani market may come from Nepal. Silugadi is main place of import of cabbage and cauliflower, which are grown on eastern part of Nepal, mostly from Ilam, Dhankuta and Teharathum districts.

Table 2.4: Rank of Agriculture Commodities Imported from Nepal

Commodities	Jayanagar	Mudhubani	Sitamarhi	Sursand
Cauliflower	II	NA	I	II
Cabbage	III	NA	II	III
Tomato	-	NA	Negligible	
Pointed gourd	I	NA	III	I
Peas	-	NA	Negligible	-
Green chilly	Negligible	NA	Negligible	-
Coriander leaf	-		Negligible	-
Capsicum	-		Negligible	Negligible
Carrot	-		Negligible	Negligible

Source: Consultation with traders

CHAPTER 3 SEASONAL WHOLESALE PRICE TREND ANALYSIS OF SELECTED AGRICULTURAL COMMODITIES

3.1 Cauliflower

3.1.1 Import Situation

Table 3.1 presents import situation of cauliflower on studied market. Cauliflower is imported for six months on these market from June to November. Cauliflower is directly imported from Nepal on Sitamarhi, Jayangar and Sursand whereas cauliflower is imported from Silugadi in Madhubani market. Average quantity of import of cauliflower ranges between 90 Mt in Sursand market to 540 Mt on Mudhubani market. Of the total import of cauliflower more than 70% are coming from Nepal on these markets except on Madhubani.

Table 3.1: Import Situation of Cauliflower on Studied Market

	Jayanagar	Mudhubani	Sitamarhi	Sursand
Number of import months	6 months	6 months	5 months	5 months
Seasons of import of vegetables	June - November	June - November	June - October	June - October
Number of traders visiting production area during vegetable season	Daily, half of traders visit every alternative day	NA, traders from Kolkata send consignment	Daily, half of traders visit every alternative day	Daily, half of traders visit every alternative day
Number of traders involved	8- 10 traders	5-7 traders	5-7 traders	10- 12 traders
Daily import/sales of studied commodities (quantity) from Nepal	600 -800 kg	2,000 -3,000 kg	2,000 -3,000 kg	500 -700 kg
Total import per season from Nepal	108 - 144 MT	360 - 540 MT	300 - 450 MT	90 - 120 MT
Proportion of import from Nepal	90- 100%	-	70-80%	90-100%

Source: Consultation with traders

3.1.2 Import Seasons

Table 3.2 presents import season of cauliflower. Cauliflower is imported from June/July till Oct/Nov. All market are importing cauliflower from Nepal except Madhubani, which is importing from other part of India. Local cauliflower come from November onwards till February/March.

Table 3.2: Major Import Seasons of Cauliflower on Studied Market

Months	Jayanagar	Madhubani	Sitmadi	Sursand	Import season from Nepal
April/May	-	-	-	-	
May/June	-	-	-	-	
June/July	Nepal	-	Nepal	-	***Nepal***
July/Aug	Nepal	Other part of India	Nepal	Nepal	***Nepal***
Aug/Sept	Nepal	Other part of India	Nepal	Nepal	***Nepal***
Sept/Oct	Nepal	Other part of India	Nepal	Nepal	***Nepal***
Oct/Nov	Nepal	Other part of India	Local	Nepal	***Nepal***
Nov/Dec	Local	Other part of India	Local	Local	Local
Dec/Jan	Local	Local	Local	Local	Local
Jan/Feb	Local	Local	Local	Local	Local
Feb/Mar	Local	Local	Local	Local	Local
Mar/Apr	-	Local	Local	-	Local

Source: Consultation with traders

3.1.3 Monthly Wholesale Price Trends

Table 3.3 presents average monthly seasonal wholesale price trend of cauliflower. Wholesale price of cauliflower is high during June/July while it is low on February/March. This situation remains similar on all the studied market. Average wholesale price of cauliflower ranges between NRs 88.0/kg to NRs 15.2/kg. Price of cauliflower is relatively high in Madhubani market, which might be because of transport and other associated cost to brining produces. All cauliflower sold on Madhubani are coming from Silugadhi, West Bangal.

Table 3.3: Average Seasonal Monthly Wholesale Price (NRs/kg) of Cauliflower

SN	Months	Jayanagar	Madhubani	Sitamarhi	Sursand	Average
1	April/May					
2	May/June					
3	June/July	88.0		80.0		84.0
4	July/Aug	80.0	128.0	72.0	72.0	88.0
5	Aug/Sept	72.0	128.0	72.0	64.0	84.0
6	Sept/Oct	64.0	96.0	59.2	51.2	67.6
7	Oct/Nov	48.0	64.0	43.2	28.8	46.0
8	Nov/Dec	19.2	40.0	20.8	27.2	26.8
9	Dec/Jan	16.0	32.0	20.8	12.8	20.4
10	Jan/Feb	12.8	28.8	11.2	8.0	15.2
11	Feb/Mar	12.8	22.4	19.2	8.0	15.6
12	Mar/Apr		19.2	16.0		17.6
	Average Price	**45.9**	**62.0**	**41.4**	**34.0**	**46.5**

Source: Consultation with traders
Note: Shaded color shows months of cauliflower import from Nepal

3.1.4 Price Comparison

Table 3.4 presents average wholesale price comparison of cauliflower between Indian market, Dhaklebar market and Kalimati market. Price of cauliflower is relatively low in Nepal compared Indian border prices. Price difference is relatively high during June to September. Hence, cauliflower export can be done during this month.

Table 3.4: Comparison of Average Seasonal Monthly Wholesale Price (NRs/kg) of Cauliflower in India, Dhalkevar and Kalimati Market

Months	Nepal (NRs/kg)		Average Indian border market (NRs/kg)	Price difference (NRs/kg) between Indian border market and	
	Dhalkevar Market	Kalimati Market		Dhalkevar Market	Kalimati Market
April/May	21.6	31.5	-		
May/June	31.0	36.6	-		
June/July	44.7	39.5	**84.0**	**39.3**	**44.5**
July/Aug	67.6	30.5	**88.0**	**20.4**	**57.5**
Aug/Sept	49.6	43.2	**84.0**	**34.4**	**40.8**
Sept/Oct	47.6	49.5	**67.6**	**20.0**	**18.1**
Oct/Nov	35.9	29.0	46.0	10.1	17.0
Nov/Dec	14.9	19.8	26.8	11.9	7.0
Dec/Jan	19.2	20.5	20.4	1.2	(0.1)
Jan/Feb	17.7	23.6	15.2	(2.5)	(8.4)
Feb/Mar	14.8	14.6	15.6	0.8	1.0
Mar/Apr	19.0	20.6	17.6	(1.4)	(3.0)

Source: Consultation with traders

3.2 Cabbage

3.2.1 Import Situation

Table 3.5 presents cabbage import situation on studied market. Cabbage is imported for six months from June to November. Cabbage is directly imported from Nepal on Sitamarhi, Jayangar and Sursand whereas it is imported from Silugadi in Madhubani. Average quantity of import of cabbage ranges between 54 Mt in Jayanagar to 450 Mt on Madhubani and Sitamarhi. Of the total import of cabbage, more than 60% is coming from Nepal on all the studied markets except Madhubani.

Table 3.5: Import Situation of Cabbage on Studied Market

	Jayanagar	Madhubani	Sitamarhi	Sursand
Number of import months	6 months	6 months	5 months	5 months
Seasons of import of vegetables	June - November	June - November	June - October	June - October
Number of traders visiting production area during vegetable season	Daily, half of traders visit every alternative day	NA, traders from Kolkata send consignment	Daily, half of traders visit every alternative day	Daily, half of traders visit every alternative day
Number of traders involved	8- 10 traders	5-7 traders	5-7 traders	10- 12 traders
Daily import/sales of studied commodities (quantity)	300 -500 kg	2,000 -2,500 kg	2,000 -3,000 kg	400 -500 kg
Total import per season	54 - 90 Mt	360 - 450 Mt	300 - 450 Mt	90 - 120 Mt
Proportion of import from Nepal	90- 100%	-	60-70%	80-90%

Source: Consultation with traders

3.2.2 Import Season

Table 3.6 presents import season of cabbage. Cabbage is imported from June/July till Oct/Nov. All market are importing cabbage from Nepal except Madhubani, which is importing from other parts of

India. Local cabbage come from November onwards till February/March.

Table 3.6: Major Import Seasons of Cabbage on Studied Market

Months	Jayanagar	Madhubani	Sitamarhi	Sursand	Import seasons from Nepal
April/May	-	-	Local	Local	
May/June	-	-	Local	-	
June/July	Nepal	-	Nepal	-	Nepal
July/Aug	Nepal	Other part of India	Nepal	Nepal	Nepal
Aug/Sept	Nepal	Other part of India	Nepal	Nepal	Nepal
Sept/Oct	Nepal	Other part of India	Nepal	Nepal	Nepal
Oct/Nov	Local	Local	Local	Nepal	Nepal
Nov/Dec	Local	Local	Local	Local	
Dec/Jan	Local	Local	Local	Local	
Jan/Feb	Local	Local	Local	Local	
Feb/Mar	Local	Local	Local	Local	
Mar/Apr	Local	Local	Local	Local	

Source: Consultation with traders

3.2.3 Monthly Wholesale Price Trend

Table 3.7 presents average monthly seasonal wholesale price trend of cabbage. Wholesale price of cabbage is high during June/July while it is low on March/April. This situation remains similar on all the studied markets. Average wholesale price of cabbage ranges between NRs 7.6/kg to NRs 65.6/kg. Price of cabbage is relatively high in Madhubani, which might be because of transport and other associated cost to brining produce. All cabbage sold on Madhubani are coming from Silugadhi, West Bangal.

Table 3.7: Average Seasonal Monthly Wholesale Price (NRs/kg) of Cabbage

SN	Months	Jayanagar	Madhubani	Sitamarhi	Sursand	Average
1	April/May			14.4	11.2	12.8
2	May/June			14.4		14.4
3	June/July	67.2		64.0		65.6
4	July/Aug	67.2	64.0	56.0	44.8	58.0
5	Aug/Sept	35.2	64.0	40.0	40.0	44.8
6	Sept/Oct	35.2	56.0	32.0	36.8	40.0
7	Oct/Nov	22.4	24.0	32.0	32.0	27.6
8	Nov/Dec	20.8	16.0	32.0	14.4	20.8
9	Dec/Jan	14.4	11.2	16.0	11.2	13.2
10	Jan/Feb	11.2	11.2	12.8	8.0	10.8
11	Feb/Mar	6.4	8.0	8.0	8.0	7.6
12	Mar/Apr	4.8	8.0	14.4	11.2	9.6
	Average price	**28.5**	**29.2**	**28.0**	**21.8**	**27.1**

Source: Consultation with traders
Note: Shaded color shows months of cabbage import from Nepal

3.2.4 Price Comparison

Table 3.8 presents average wholesale price comparison of cabbage between Indian Market, Dhalkevar market and Kalimati market. Price of cabbage is relatively low in Nepal compared Indian border prices. Price difference is relatively high during June to September. Hence, export of cabbage can be prompted during this month.

Table 3.8: Comparison of Average Seasonal Monthly Wholesale Price (NRs/kg) of Cabbage in India, Dhalkevar and Kalimati Market

Months	Nepal (NRs/kg)		Average Indian border market (NRs/kg)	Price difference (NRs/kg) between Indian border market and	
	Dhalkevar Market	Kalimati Market		Dhalkevar Market	Kalimati Market
April/May	12.7	17.1	12.8	0.1	(4.3)
May/June	15.3	25.4	14.4	(0.9)	(11.0)
June/July	16.5	34.3	65.6	**49.1**	**31.3**
July/Aug	24.2	26.0	58.0	**33.8**	**32.0**
Aug/Sept	39.6	20.8	44.8	**5.2**	**24.0**
Sept/Oct	29.6	27.8	40.0	10.4	12.2
Oct/Nov	18.0	24.3	27.6	9.6	3.4
Nov/Dec	22.2	21.1	20.8	(1.4)	(0.3)
Dec/Jan	14.2	11.7	13.2	(1.0)	1.5
Jan/Feb	11.2	10.5	10.8	(0.4)	0.3
Feb/Mar	9.4	7.5	7.6	(1.8)	0.1
Mar/Apr	7.6	7.9	9.6	2.0	1.7

Source: Consultation with traders

3.3 Tomato

3.3.1 Import Situation

Table 3.9 presents import situation of tomato on studied market. Negligible amount of tomato is imported on these markets from Nepal and mostly between June to August. However tomato is sold on these markets throughout the year.

Table 3.9: Import Situation of Tomato on Studied Market

	Jayanagar	Madhubani	Sitamarhi	Sursand
Number of import months	3 months	2 months	2 months	3 months
Seasons of import of vegetables	June - August	July - August	July - August	July - August
Number of traders visiting production area during vegetable season	None	None	None	None
Number of traders involved	8- 10 traders	5-7 traders	5-7 traders	10- 12 traders
Daily import/sales of studied commodities (quantity) from Nepal	Negligible (around 100 kg)	None	Negligible (around 200 kg)	Negligible (around 100 kg)
Tomato import of tomato per season	90-120 MT	180-240MT	240-300 MT	80-100 MT
Proportion of import from Nepal	2- 3%	-	2-3%	2-5%

Source: Consultation with traders
Note: They don't specifically visit for purchase of tomato but might bring small quantity of tomato depending on price on Indian market or demand and supply situation at the market .

3.3.2 Import Season

Table 3.10 presents import season of tomato. Tomato is imported from May/June till Oct/Nov. All market are importing from nearby Indian cities mostly from southern state of India. Local tomato come from October onwards till April/May.

Table 3.10: Major Import Seasons of Cabbage on Studied Market

Months	Jayanagar	Madhubani	Sitamarhi	Sursand	Import seasons from Nepal
April/May	Local	Local	Local	Local	
May/June	Other part of India	Other part of India	Other part of India	Other part of India	
June/July	Other part of India	Other part of India	Other part of India	Other part of India	Negligible
July/Aug	Other part of India	Other part of India	Other part of India	Other part of India	Negligible
Aug/Sept	Other part of India	Other part of India	Other part of India	Other part of India	Negligible
Sept/Oct	Other part of India	Other part of India	Other part of India	Other part of India	
Oct/Nov	Other part of India	Other part of India	Other part of India	Local	
Nov/Dec	Local	Local	Local	Local	
Dec/Jan	Local	Local	Local	Local	
Jan/Feb	Local	Local	Local	Local	
Feb/Mar	Local	Local	Local	Local	
Mar/Apr	Local	Local	Local	Local	

Source: Consultation with traders

3.3.3 Monthly Seasonal Wholesale Price Trends

Table 3.11 presents average monthly seasonal wholesale price trend of tomato. Wholesale price of cabbage is high during June/July in Indian market while it is low on April/May. This situation remains similar on all the studied market. Average wholesale price of tomato ranges between NRs 12.0/kg to NRs 59.6/kg. Price of tomato is relatively high in Madhubani market, which might be because of transport and other associated cost of brining produce.

Table 3.11: Average Seasonal Monthly Wholesale Price (NRs/kg) of Tomato

SN	Months	Jayanagar	Madhubani	Sitmarhi	Sursand	Average
1	April/May	12.8	9.6	16.0	9.6	12.0
2	May/June	32.0	32.0	28.8	40.0	33.2
3	June/July	72.0	72.0	38.4	56.0	59.6
4	July/Aug	67.2	64.0	32.0	48.0	52.8
5	Aug/Sept	59.2	64.0	48.0	51.2	55.6
6	Sept/Oct	40.0	40.0	35.2	48.0	40.8
7	Oct/Nov	24.0	24.0	24.0	19.2	22.8
8	Nov/Dec	19.2	19.2	24.0	16.0	19.6
9	Dec/Jan	16.0	19.2	19.2	16.0	17.6
10	Jan/Feb	12.8	16.0	16.0	12.8	14.4
11	Feb/Mar	12.8	16.0	16.0	12.8	14.4
12	Mar/Apr	9.6	11.2	19.2	11.2	12.8
	Average	**31.5**	**32.3**	**26.4**	**28.4**	**29.6**

Source: Consultation with traders

3.3.4 Price Comparison

Table 3.12 presents average wholesale price comparison of tomato between Indian market, Dhalkevar market and Kalimati market. There is no such indicative price difference between India and Nepal on tomato prices. Likewise, a price difference is not so much which indicates less potential for export of agriculture commodities.

Table 3.12: Comparison of Average Seasonal Monthly Wholesale Price (NRs/kg) of Tomato in India, Dhalkevar and Kalimati Market

Months	Nepal (NRs/kg)		Average Indian border market (NRs/kg)	Price difference (NRs/kg) between Indian border market and	
	Dhalkevar Market	Kalimati Market		Dhalkevar Market	Kalimati Market
April/May	19.1	35.6	12.0	(7.1)	(23.6)
May/June	38.6	45.9	33.2	(5.4)	(12.7)
June/July	45.9	30.3	59.6	13.7	29.3
July/Aug	39.6	47.9	52.8	13.2	4.9
Aug/Sept	48.8	37.8	55.6	6.8	17.8
Sept/Oct	41.4	27.4	40.8	(0.6)	13.4
Oct/Nov	39.4	31.9	22.8	(16.6)	(9.1)
Nov/Dec	22.5	32.9	19.6	(2.9)	(13.3)
Dec/Jan	16.5	28.0	17.6	1.1	(10.4)
Jan/Feb	11.6	31.1	14.4	2.8	(16.7)
Feb/Mar	12.4	27.6	14.4	2.0	(13.2)
Mar/Apr	14.0	31.4	12.8	(1.2)	(18.6)

3.4 Problems and Challenges

Major problems and challenges by the traders/importers while importing agricultural commodities from Nepal includes:

- Poorly organized market with limited information about traders and trade capacity
- Less demand of off-seasonal vegetables or limited market absorption capacity on market
- No proper market price information collection and dissemination system, had to rely on traders and previous day market prices
- Poor road conditions, which may create damage of products while transporting and handling
- Security issues especially carrying money as well as bringing produce, often had to face several hassle at borders
- Un-official import and use of alternative routes, less data and information availability, no mechanism to pay taxes and other costume duties
- Non compliance of quarantines and other human health safety requirements

CHAPTER 4 SUMMARY AND CONCLUSIONS

Table 4.1 compares make assess cost and sale price of studied agriculture commodities to explore potentialities of export to India from Nepal. Comparison with the cost of productions, marketing and other associated cost reveals that Nepal have comparative advantages to export agriculture commodities if targeted during the peak price season or off-seasons. Wide variability of agro-climatic zone on the SRC area, especially on Ramechhap and Dolakha offers possibility of producing off-season vegetables targeting this market.

Table 4.1: Assessment of Cost and Wholesale Price

SN		Unit	Cauliflower	Cabbage	Tomato
1	Cost of Production#	NRs/kg	5.37^	5.41*	5.98*
2	Transport and other cost associated cost @	NRs/kg	12.8	12.8	14.5
3	**Total cost**	**NRs/kg**	**18.17**	**18.21**	**20.48**
4	Lowest wholesale price in India (seasonal price)	NRs/kg	15.2	9.6	12.0
5	Maximum wholesale price in India (off-seasonal price)	NRs/kg	88.0	65.6	59.6

Note: # Cost of production computed from Agriculture Marketing Information Bulletin, 2012, Agribusiness promotion and Marketing Directorate, Nepal (includes production cost of * Kavre and ^ Makwanpur)
@ consultation with the traders

There is high demand for off-season vegetables in Indian cities as indicated by price trends. The study reveals that cabbage and cauliflower export can be promoted during off-seasons (June/July to September/October), however export of tomato is less likely considering less price differences and perishability nature. Nevertheless, off-season tomato can also be exported to India considering cost of production and price differences.

Cauliflower and cabbage are going through different production pockets of Nepal, especially from Dharan, Palung area and Birtamod area of Jhapa on these markets. With the opening of the Sindhuli road corridor, it is more likely that off-season cauliflower, cabbage and tomato might come to Dhalkevar market. According to traders, costs of transportation reduced by almost half of the products are traded from Dhalkevar market. Hence, there is also possibility of export of these commodities from Dhalkevar market to border cities. Trade relationship already exists on Dhalkevar market, which further reveals possibility of export. However, relationship between Indian and Nepalese traders should be strengthened and mechanism should be developed for sharing comparative price information at different market locations of Nepal to attract traders on Dhalkevar market.

Prices of the market are determined by demand and supply situation. Hence, traders are controlling price through regulating supply on the market, especially of off-seasonal vegetables. Traders are importing commodities based on absorption capacity of the market. Traders cannot control price when produce started coming from nearby local area. There is need for regulating supply of off-seasonal vegetables if exports are to be promoted.

Annex 1: Preliminary report of Dhalkevar market visit

Participants

- Bijendra Basnyat, Project Manager NARMA Consultancy Pvt Ltd
- Bharat Nepal, Market Management Specialist, IDE-Nepal

Purpose of visit

- Collect preliminary information about trade of vegetables on neighboring Indian cities from Dhalkevar market
- Identify major market places along the boarded cities where trading of Nepalese agriculture commodities are being carried out
- Plan for visit of Indian market to collect information about produce

Travel Schedule

Date		
18 June, 2013 Tuesday	:	• Travel to Dhalkhabar Market • Interaction with Market Manager, appointment of meeting
19 June, 2013 Wednesday	:	• Visit of Dhankabar market • Interaction with Market Manager, computer operator and market management committee
20 June, 2013 Thursday	:	• Return to Kathmandu

Major findings and observation

Interaction with the traders and market management committee members were carried out to identify commodities which are either exported or imported from market center to neighboring Indian bordering market.

Commodities and market: Interaction with the traders reveal that very few commodities are exported to Indian market and that too depend on seasons. Major commodities which are exported to India include (a) gourd (b) tomato (c) cucumber and (d) ginger. Cauliflower and cabbage are less exported because of high demand on surrounding market. Likewise, tomato, potato and onion come from these markets. Tomato goes upto the Sillugadi market (end border of Nepal). The produces are mostly traded on Sursand (near Jaleshwor border) and Jaya nagar (Janakpur border).

About 10- 15 traders from neighboring cities namely Jaya Nagar and Sonabarsa are coming regularly to collect agriculture produce during market days (Sunday and Wednesday). They come together on a group and collect produce. They collectively rent a jeep/pick-up for transport. Market management committee have made two rooms for accommodation of traders with about 25 beds and charging nominal fee. They charge NRs 25 per bed per night for traders from India and neighboring cities.

Name of Indian market places	Distance form Dhalkevar market	Import from market	Export to market
Kanpur	About 500 km	• Potato • Onion • Chilly • Tomato	• None
Jayanagar	About 80 km	• Tomato • Seasonal vegetables	• Tomato • Seasonal vegetable, mainly cucurbits • Jack fruit
Sursand	About 60 km	• Tomato • Seasonal vegetables	• Tomato • Seasonal vegetable, mainly cucurbits • Jack fruit
Silughadi		• None	• Tomato

According to the Indian traders expect for tomato, export quantity of vegetable is very less. It is only sufficient to fulfill local demands on these border cities. Likewise, price is very expensive in Nepal when compared to Indian market. Seasonality of produce is the main reasons for visiting Nepal. Likewise, they also bring few Indian produce when coming from India. There is high demand for off-season vegetables, especially cabbage and cauliflower on local market, however produce is not sufficient. It is mostly consumed within the local market and on Janakpur. These commodities are exported on very less amount.

Major market places: During interaction traders were also asked about the major nearby market center where there is high possibility of exporting of agriculture produce if trade volume is large. Trader indentified following market place on surrounding of the four districts.

- Jayanagar
- Madhubani
- Sursand
- Sitamarhi

The traders were also asked about market information system keeping mechanism (price and volume) on above market. However, they are not aware of such procedures though they reported that these are organized market. The market management committee exists on these markets. Market Manager of Dhalkevar also informed that some sort of information keeping is there and have some network and connects with the management authority of this market. We requested him for accompany with us considering his public relations with the market authority. He agreed and accepted our request. We decided to conduct visit of these market place if required by last week of July considering flood situation and farming season. We will fix date considering rainfall and other priority work.

Key findings

- Tomato is major commodities which are now being traded, followed by seasonal vegetables. Trade amount of seasonal vegetables is very less and sold on local bordering market only.
- About 2 dozen of traders are visiting Dhalkevar market for sale of vegetables on boarding cities of India. This is the only market place on nearby Janakpur area where Indian traders come for purchase of vegetables. None of the traders goes beyond this market considering security situation. They have been looted on few production areas.
- Tomato is exported from Nepal to neighboring market and Silugadi. It is mainly during winter when there is less production of tomato.
- It is very difficult for Nepalese commodities such as tomato, potato, cabbage and cauliflower to compete with price on boarding Indian market. This is also evident from analysis to retail price of data of major agriculture commodities (value chain studied products and pilot products) of SRC district, terai district (Dhanusha and Mahottari), Indian border market (eight market center) and two market adjoining Janakpur. Price information was obtained from Agriculture marketing bulletin published by Agriculture Market Development Directorate on 2012. Excel sheet compare average price by month
- Off-season vegetable promotion could be one option to export vegetables. Price of cauliflower and cabbage are high during winter season and summer season. If cabbage and cauliflower can be produce during this month, it has potentiality to capture Indian market.
- Trades don't face any problems to export or import vegetables to Nepal since quantity is very less and mostly used on local nearby market. There is less trade related problems for transport.

If Indian markets are to be visited, then commodities and market place need to be defined. Table below presents market center and commodities which are selected for study.

Name of Indian market places	Commodities	Key aspects
• Jayanagar • Madhubani • Sitamarhi • Sursand	• Tomato • Cauliflower • Cabbage	• Seasonal price information • Volume of trade (%) from Nepal • Transportation cost from Nepal to bordering market including tariff charges if any

Annex 2: Schedule of Indian market borders visit

Purpose:

- Find out the monthly price fluctuation trends of the off-season vegetables that can be produced in SRC districts (at least cabbage, cauliflower and tomato) in one of the major vegetable wholesale markets in Bihar, India

Participants

- Bijendra Basnyat (NARMA)
- Bharat Nepal (IDE)
- Binod Gurung (SRCAM)
- Sambhu Das (Marketing Manager, Dhalkevar Market)

Schedule

Travel Schedule

Date		
23 September, 2013 Monday	:	• Travel to Dhalkhabar Market • Interaction with Market Manager over telephone • Planning of travel schedule and discussion among members • Night stay at Janakpur
24 September, 2013 Tuesday	:	• Visit of Dhankabar market • Visit to Jayanagar market • Visit to Madhubani market • Return to Janakpur • Night stay at Janakpur
25 September, 2013 Wednesday	:	• Visit to Sitamarhi market • Visit to Sursand market • Return to Janakpur • Night stay at Janakpur
26 September, 2013 Wednesday	:	• Team meeting and discussions • Preparation of draft outline, validation of information collected and preliminary report • Return to Kathmandu

Information to be collected

- Major commodities and seasons of import
- Average monthly annual price of selected commodities
- Problems and challenges of export/import of agriculture commodities

Method of collection

- Interaction with traders/market management committee with the help of checklist

Annex 3: List of trader interview during survey

1. Dhakebar Market

- Ram Shrawan Mahatoo, Chairperson
- Shabhu Nath Das, Marketing Manger
- Neelam Kumari Roka, Computer Manager

2. Jayanagar Market

- Shyam Panjiwar, Wholesaler/ Importer
- Vijay Panjiwar, Wholesaler/ Importer
- Mohamad Ahiab, Wholesaler/ Importer

3. Madhubani Market

- Ram Dev Chaturvedi, Retailer
- Ram Narayan Deo, Wholesaler/Trader
- Santosh Dev, Wholesaler/Trader
- Yogesh Kumar, Wholesaler/Trader

4. Sitamarhi Market

- Mohamad Basir, Retailer
- Ram Kumar, Wholesaler/Trader
- Satosh Kumar, Wholesaler/Trader
- Deepak Kumar, Wholesaler/ Importer

5. Sursand Market

- Ram kumar Shah, Wholesaler/ Importer
- Basistha Shah, Wholesaler/ Importer
- Saroj Shah, Wholesaler/ Importer