Ind. Jn. of Agri.Econ.
Vol.66, No.1, Jan.-March 2011

Crop Diversification in Himachal Pradesh: Patterns, Determinants and Challenges

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I

INTRODUCTION

The proliferation of extremely small and tiny holdings on account of factors like continuing population pressure on land coupled with general lack of rural non-farm employment opportunities, liberal laws of inheritance and resultant sub-division of holdings, etc is one of the major constraints in boosting agricultural production and productivity and raising the levels of living of a typical Indian farmer. The problem is more serious in mountainous states like Himachal Pradesh where only 11 per cent of the total geographical area is available for cultivation. There is a preponderance of tiny holdings in the state; more than 85 per cent of the holdings are small and marginal owning less than two hectares of land and accounting for about 51 per cent of the operated area. The overall average size of holdings is 1.10 ha. Naturally, therefore, improving the production and productivity of these tiny holdings and, in the ultimate analysis, the level of living of marginal and small farmers is a major challenge for the planners and policy makers. The crop diversification towards selective high value crops including fruits and vegetables, compatible with the comparative advantage of the region, is recommended as an effective strategy in raising incomes, generating employment opportunities and alleviating poverty among small and marginal households (Vyas, 1996; Joshi *et al.*, 2007).

Agricultural diversification towards fruit and vegetable crops in Himachal Pradesh, especially in some areas in the districts of Shimla, Kullu, Solan, and Lahaul and Spiti, started in the late sixties and continued in the seventies and the eighties. The process of crop diversification gained momentum in the nineties and has now encompassed many new areas in the low and mid-hill districts. The crop diversification has made a profound impact on the quality of life of cultivating households of whom a preponderant majority operates less than one hectare of land. At the macro level, this impact is manifested in a number of socio-economic indicators and poverty levels that compare favourably both with the mountainous and other developed states.[1] The micro level experiences further show that crop diversification towards high value crops is economically beneficial and ameliorates

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The author is grateful to Ashok Gulati and an anonymous referee of the Journal for useful comments on the earlier draft of the paper.

stress on natural resource base (Chand, 1996; Sharma, 1996 and 2005; Sharma and Chauhan, 2008). These accomplishments have attracted the attention of development economists and policy makers, and the state has come to be known as a model for other hilly/mountainous states (Dreze and Sen, 2002).

Against this background, the present paper addresses the following issues. (i) What is the extent and nature of crop diversification in the state?, (ii) What is the extent of participation of different categories of households, in particular sub-marginal, marginal and small households, in the process of crop diversification?, (iii) What has been the impact of crop diversification on income and employment of lower category households?, (iv) What are the main drivers/factors that spurred the process of crop diversification both at the macro and micro (household) level? In other words, what are the factors that set into motion the whole process of agricultural transformation?, and (v) And, more importantly, what are the imminent challenges that endanger the economic viability and ecological sustainability of the process of crop diversification? The paper has been structured into six sections. Section I describes the data and methods that are used in writing the paper. While Section II discusses the state level macro evidence on the patterns and processes of crop diversification, Section III presents household level micro evidence on the extent of crop diversification among different categories of households and its impact on their income and employment. The drivers of the process of crop diversification both at the state and household levels have been discussed in Section IV. The imminent challenges that endanger the ongoing process of crop diversification have been brought out in Section V. The final section summarises the whole discussion and brings out the main issues emanating from the agricultural transformation experience of the state.

II

DATA AND METHODS

The paper is based both on secondary and primary data. The secondary data relating to the study have been collected from various publications of the state government and records from different departments like agriculture, horticulture and the directorates of economics and statistics and land records. The households level primary data have been collected from randomly selected 210 farm households, 70 each from three developmental blocks which are at different stages of crop diversification, namely, Kandaghat in district Solan, Banjar in district Kullu and Salooni in district Chamba through a personal interview method for the agricultural year 2007-08. The sample households have been sub-divided into three categories, namely, sub-marginal households owning up to half a hectare of land, marginal owning between one-half and one hectare and small households owning more than one hectare of land. The data have been analysed using appropriate statistical tools. The averages, percentages and growth rates have been computed to understand the emerging patterns and processes in crop diversification. The extent of crop

diversification at the state level has been studied by analysing temporal changes in the cropping pattern, area under fruit and vegetable crops and the contribution of horticulture including vegetable crops to the net state domestic product originating in agriculture. The extent of crop diversification on different categories of farm households has been estimated by computing per cent of gross cropped area under high value crops. The profitability of these crops has been examined by computing net returns over cost D which includes cash variable expenses, imputed rental value of land, interest on working capital, imputed value of family labour and managerial cost. The linear regression model of the following type has been used to quantify the contribution of different factors that triggered the process of diversification. $Y = a+b_1X_1+b_2X_2+b_3X_3+b_4X_4+$ ------ $+U$ where a is constant, b_is are regression coefficients, Y is the per cent area under high value cash crops, X_is are independent variables like size of landholdings, availability of family labour, irrigation facilities, non-farm income, etc. and U is a random term.[2]

III

EVIDENCE FROM STATE LEVEL DATA

To begin with, we discuss the performance of agriculture in the state during the last two and half decades since 1980-81. Table 1 shows that consistent with the overall pattern of structural changes associated with the process of economic development, the contribution of agriculture to the net state domestic product declined continuously; from around 35 per cent in 1980-81 to 17.89 per cent in 2006-07. The contribution of primary sector as a whole during the period plummeted from around one-half to a little more than one-fifth. Consequently, the contribution of secondary and tertiary sectors increased respectively from around 20 per cent and 33 per cent in 1980-81 to around 39 per cent and 40 per cent in 2006-07.

TABLE 1. SECTORAL COMPOSITION OF NET STATE DOMESTIC PRODUCT (NSDP) IN HIMACHAL PRADESH: 1980-81 TO 2006-07

(per cent)

Sr. No. (1)	Particulars (2)	1980-81 (3)	1990-91 (4)	2000-01 (5)	2006-07 (6)
1.	Primary sector	47.22	37.67	23.75	21.47
(i)	Agriculture and animal husbandry	35.16	30.60	19.00	17.89
(ii)	Forestry	11.48	6.07	4.14	3.07
(iii)	Fishing	0.17	0.22	0.16	0.12
(iv)	Mining and quarrying	0.41	0.80	0.45	0.40
2.	Secondary sector	19.70	24.58	37.02	38.88
3.	Tertiary sector	33.08	37.75	39.24	39.65
4.	All sectors	100	100	100	100
5.	Net state domestic product (NSDP) at 1999-2000 Prices (Rs. in lakh)	525736	7934440	1326223	1915710
6.	Per capita NSDP at 1999-2000 Prices (Rs.)	12391	14926	21824	28415

Source: Directorate of Economics and Statistics, Government of Himachal Pradesh, Shimla.

Insofar as the growth of agricultural sector is concerned, Table 2 shows that it recorded a rate of growth of 3 per cent during the eighties, the rate of growth turned negative during the nineties but accelerated to as high as 6.32 per cent per annum between 2000-01 and 2006-07. The overall growth rate during the period 1980-81 and 2006-07 averaged at 2.82 per cent per annum. The primary sector as a whole clocked a growth rate of 1.59 per cent per annum during the eighties which decreased to 0.51 per cent per annum during the nineties. However, there was a marked acceleration in the rate of growth to 5.55 per cent per annum between 2000-01 and 2006-07. The rate of growth for the whole period between 1980-81 and 2006-07 averaged at 2.60 per cent per annum. The total net state domestic product registered a growth rate of 4.54 per cent during the eighties and around 6 per cent during the subsequent periods while the rate of growth for the whole period turned out to be 5.75 per cent per annum. The growth rate in per capita income hovered around 4 per cent during all the three sub-periods.

TABLE 2. COMPOUND GROWTH RATES OF NET STATE DOMESTIC PRODUCT (NSDP) IN HIMACHAL PRADESH: 1980-81 TO 2006-07

Sr. No.	Particulars	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2006-07	1980-81 to 2006-07
(1)	(2)	(3)	(4)	(5)	(6)
1.	Primary sector	1.59	0.51	5.55*	2.60*
(i)	Agriculture and animal husbandry	3.09	-0.01	6.32*	2.82*
(ii)	Forestry	-5.76	2.20	1.88*	1.68*
(iii)	Fishing	6.43*	-0.95	1.10	2.77*
(iv)	Mining and quarrying	19.25*	7.24	4.93*	4.50*
2.	Secondary sector	6.67*	12.08*	7.20*	9.07*
3.	Tertiary sector	7.22*	6.95*	6.338	6.50*
4.	Total NSDP	4.54*	6.26*	6.44*	5.75*
5.	Per capita NSDP	3.58	4.45*	4.62*	4.05*

Note: * Denotes significance at 0.05 level of probability.

The temporal changes in the cropping pattern at the state level (Table 3) bring out the process of crop diversification towards fruits and vegetable crops. For example, while the area under crops like rice, wheat, barley, other cereals and pulses declined by varying degrees, the area under fruit crops and vegetable crops increased over the period. However, the extent of process of crop diversification varies across districts depending upon the agro-climatic conditions. In this context, Table 4 shows that there has been a significant increase in the per cent share of gross cropped area under non-foodgrain crops, which mostly includes area under fruit and vegetable crops, in Kullu, Shimla, Kinnaur and Lahaul & Spiti followed by Solan, Sirmaur and Chamba. Among remaining districts, while Bilaspur and Una also experienced some increase in the proportion of area under non-foodgrain crops, the proportion of gross cropped area under these crops in fact registered a small decline in Kangra and Hamirpur. Table 5 further shows that area under fruit crops increased from 86.23 thousand

hectares in the triennium ending 1980-81 to 1.87 lakh hectares in the triennium ending 2005-06. The fruit production during the corresponding period rose from 1.46 lakh tonnes to 3.68 lakh tonnes. The yield levels, however, remained low and continued to fluctuate, primarily because of erratic weather conditions. Another notable feature is that apple remained the most important fruit crop accounting for more than two-fifths of the total area under fruit crops and around three-fourths of the total fruit production. In terms of growth rates, area under apple, other fruits and total fruits recorded positive growth rates during all the sub-periods except for the most recent period from 2000-01 to 2005-06 when it clocked a negative growth rate (Table 6). The growth rates of fruit production were also positive except for apple production which registered a very high negative growth rate during the nineties. Broadly similar pattern was also discernible in the growth rates of yields of apple, other fruits and total fruits.

TABLE 3. TEMPORAL CHANGES IN CROPPING PATTERN IN HIMACHAL PRADESH: 1982-83 TO 2004-05

(*per cent)*

Crops/Year	1982-83	1992-93	2004-05
(1)	(2)	(3)	(4)
Rice	9.45	8.42	8.34
Maize	30.10	38.90	31.31
Wheat	39.20	38.90	38.57
Barley	3.94	2.79	2.46
Other cereals	3.40	2.08	1.30
Pulses	4.48	4.22	2.94
Total foodgrain	90.57	88.32	84.91
Fruits	3.00	4.78	6.45
Vegetables	2.22	2.61	3.60
Oilseeds	2.33	2.35	1.61
Others	1.88	1.94	3.38

Source: Directorate of Land Records, Government of Himachal Pradesh, Shimla.

TABLE 4. TEMPORAL CHANGES IN THE AREA UNDER NON-FOODGRAIN CROPS ACROSS DISTRICTS IN HIMACHAL PRADESH: 1982-83 TO 2004-05

(per cent)

District	1982-83	1992-93	2004-05
(1)	(2)	(3)	(4)
Bilaspur	3.30	3.24	5.16
Chamba	7.49	7.46	9.45
Hamirpur	1.28	1.15	1.24
Kangra	9.34	11.04	10.29
Kinnaur	14.45	25.77	37.66
Kullu	11.90	16.96	20.94
Lahaul-Spiti	46.97	63.73	73.80
Mandi	6.80	7.10	10.42
Shimla	20.76	33.14	50.07
Sirmaur	10.75	12.72	19.70
Solan	8.25	10.19	12.96
Una	7.83	8.83	9.20
Himachal Pradesh	9.38	11.65	15.09

Source: Directorate of Land Records, Government of Himachal Pradesh, Shimla.

TABLE 5. TRENDS IN AREA, PRODUCTION AND YIELD OF FRUITS IN HIMACHAL PRADESH: 1980-81 TO 2005-06

Triennium ending	Area (000 ha)			Production (lakh tonnes)			Yield (t/ha)		
	Apple	Others	Total	Apple	Others	Total	Apple	Others	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1980-81	41.96	44.26	86.23	1.25	0.21	1.46	2.98	0.46	1.69
1990-91	60.09	96.27	156.36	3.01	0.47	3.48	4.96	0.49	2.21
2000-01	90.34	126.88	217.22	3.77	0.51	4.28	4.17	0.40	1.97
2005-06	86.20	100.70	186.90	2.68	1.00	3.68	3.11	0.99	1.97

Source: Horticultural Department in Himachal Pradesh: Facts and Figurers at a Glance, Directorate of Horticulture, Government of Himachal Pradesh, Shimla.

TABLE 6. COMPOUND GROWTH RATES IN AREA, PRODUCTION AND YIELD OF FRUITS IN HIMACHAL PRADESH: 1980-81 TO 2005-06

Period	Area			Production			Yield		
	Apple	Others	Total	Apple	Others	Total	Apple	Others	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1980-81 to 1989-90	3.45*	7.69*	5.89*	6.68	6.09	6.51	3.11	1.36	0.57
1990-91 to 1999-2000	3.75*	2.15*	-2.71*	-15.22*	1.82	1.02	-12.25*	-0.44	-9.04
2000-01 to 2005-06	-0.57*	-4.65	-2.88	16.34	18.72	16.67	17.00	24.64	20.12
1980-81 to 2005-06	3.19*	2.78*	2.95*	2.33	4.57*	2.93	-0.75	1.73	-0.02

Source: Horticultural Department in Himachal Pradesh: Facts and Figurers at a Glance, Directorate of Horticulture, Government of Himachal Pradesh, Shimla.

Note: *Denotes significance at 0.05 level of probability.

The area under vegetable crops has also witnessed rapid increase in recent years. For example, Table 7 shows that area under vegetable crops increased from 23.13 thousand hectares in the triennium ending 1992-93 to 55.52 thousand hectares in the triennium ending 2008-09 registering a compound growth rate of around 5.86 per cent per annum. The production during the same period surged from 369 thousand tonnes to around 1040.76 thousand tonnes recording a compound growth rate of around 6.80 per cent. The yield level, however, increased from around 15.95 tonnes/ha to 18.75 tonnes per hectare experiencing a compound growth rate of 0.95 per cent per annum. The process of crop diversification towards horticultural including vegetable crops is also manifested in the rising share of horticulture in the gross value of output originating in agriculture. The data, presented in Table 8 show that while the contribution of crop production declined by ten percentage points, from about 37 per cent in the triennium ending 2000-01 to about 27 per cent in the triennium ending 2006-07, the contribution of horticulture production including vegetable crop increased significantly from about 33 per cent to about 44 per cent. The per cent share of livestock remained nearly unchanged at about 30 per cent. The increasing importance of horticulture in gross value of output originating in agriculture is also evident from a very high growth rate of 13.71 per cent per annum in the value of its output during 1999-2000 and 2006-07.

TABLE 7. TEMPORAL CHANGES IN AREA, PRODUCTION AND PRODUCTIVITY OF VEGETABLE CROPS IN HIMACHAL PRADESH; 1990-91 TO 2008-09

Year	Area in the triennium ending (000 ha)	Production (000 tonnes)	Yield (t/ha)
(1)	(2)	(3)	(4)
1992-93	23.13	369.00	15.95
1999-2000	28.83	498.33	17.28
2008-09	55.52	1040.76	18.75
Compound growth rate between 1990-91 and 2008-09 (per cent per annum)	5.86*	6.80*	0.95*

Source: Directorate of Agriculture, Government of Himachal Pradesh, Shimla.
Notes: (i) *Significant at 0.05 level of probability.
(ii) The compound growth rates have been computed considering the time series data from 1990-91 to 2008-09.

TABLE 8. SHARE OF CROP PRODUCTION, HORTICULTURE AND LIVESTOCK IN THE GROSS VALUE OF OUTPUT ORIGINATING IN AGRICULTURE: 1999-2000 TO 2006-07

Triennium ending	Crop production	Horticulture	Livestock	Total	Gross value of output originating in agriculture at 1999-2000 prices (Rs. in lakhs)
(1)	(2)	(3)	(4)	(5)	(6)
2001-02 (per cent)	37.05	33.02	29.93	100.00	3,77,503
2006-07 (per cent)	26.80	43.51	29.69	100.00	5,30,210
Compound growth rate between 1999-2000 and 2006-07 (per cent per annum)	1.04	13.71*	6.70*	-	7.18*

Source: Department of Economics and Statistics, Government of Himachal Pradesh, Shimla.
Note: * Significant at 0.05 level of probability.

IV

EVIDENCE FROM SURVEY DATA

As alluded to above, the extent and nature of crop diversification at the household level has been studied by using household survey data collected from 210 randomly selected households from three development blocks, namely, Salooni, Banjar and Kandaghat. To begin with, we discuss some selected agrarian characteristics of different categories of households (Table 9). As may be seen from the table, the average size of operational holdings in different blocks varied from 0.30 hectare to 0.34 hectare on sub-marginal households, from 0.46 hectare to 0.55 hectare on marginal households and from 0.62 hectare to 0.98 hectare in case of small households. The proportion of irrigated area in all the three blocks was higher in respect of sub-marginal households; it varied from around 35 per cent in Salooni to 62.86 per cent in Banjar as compared to marginal and small households. The number of employment days per household accruing from the cultivation of high value crops for different categories of households varied from 80 to 132 man-days in Saolooni, from 90 to 179 man-days in Banjar and from 76 to 108 man-days in Kandaghat.[3] There was, however, no neat pattern in the cropping intensity across blocks; it increased with the increase in the size category of households in Salooni but decreased in the remaining two blocks.

TABLE 9. SELECTED AGRARIAN CHARACTERISTICS OF DIFFERENT CATEGORIES OF HOUSEHOLDS IN SELECTED BLOCKS

	Salooni			Banjar			Kandaghat		
Particulars (1)	Sub-marginal (2)	Marginal (3)	Small (4)	Sub-marginal (5)	Marginal (6)	Small (7)	Sub-marginal (8)	Marginal (9)	Small (10)
Average family size (No.)	6.41	9.14	10.09	6.83	6.60	5.80	6.14	6.11	8.62
Average size of ownership holdings (ha)	0.42	0.80	1.40	0.44	0.86	1.63	0.43	0.81	1.61
Average size of operational holdings (ha)	0.30	0.46	0.67	0.34	0.55	0.98	0.34	0.51	0.62
Proportion of area under irrigation (per cent)	35.48	32.61	31.34	62.86	48.89	61.17	61.76	54.90	54.84
Farm assets (Rs./farm)	1,14,710	1,41,587	1,92,323	1,43,184	1,70,083	2,09,892	1,91,866	2,32,105	3,26,614
Employment from high value crops (days/ household)	80	65	132	90	153	179	108	76	107
Gross cropped area (ha)	0.54	0.80	1.39	0.71	1.13	1.52	0.67	0.95	1.13
Net cropped area (ha)	0.31	0.45	0.67	0.34	0.55	1.03	0.34	0.51	0.62
Cropping intensity (per cent)	174.19	177.78	207.46	208.82	205.45	147.57	197.05	186.27	182.27

Source: Field Survey, 2007-08.

Insofar as the extent of crop diversification on different categories of households was concerned, Table 10 shows that households of all three categories devoted a significant proportion of their gross cropped area to the cultivation of high value crops. For example, the sub-marginal households devoted more than 60 per cent of their gross cropped area for the cultivation of these crops in all the three blocks. Likewise, the proportion of area under high value crops in case of marginal households was around 39 per cent in Salooni, 67 per cent in Banjar and 52 per cent in Kandaghat. The respective proportions for small households were 43 per cent in Salooni, 58 per cent in Banjar and 51 per cent in Kandaghat. The table further reveals that tomato, beans, cabbage, cauliflower, peas and garlic were important crops accounting for most of the area under high value crops. The net returns per hectare from the cultivation of these crops, presented in Table 11, on different categories of households were very high. And among crops, these were comparatively higher from garlic, ginger, potato, cauliflower and pea. The crop diversification also made a significant impact on household income. In this context, Table 12 shows that the level of income of all categories of households, including sub-marginal households was fairly high of which around eighty per cent or even more was contributed by

TABLE 10. PER CENT OF GROSS CROPPED AREA UNDER HIGH VALUE CROPS AMONG DIFFERENT CATEGORIES OF HOUSEHOLDS IN SELECTED BLOCKS

	Salooni			Banjar			Kandaghat		
Crops/Area (1)	Sub-marginal (2)	Marginal (3)	Small (4)	Sub-marginal (5)	Marginal (6)	Small (7)	Sub-marginal (8)	Marginal (9)	Small (10)
Tomato	12.09	6.58	4.25	16.87	14.97	9.95	21.74	15.73	16.23
Beans	22.82	12.88	7.00	4.36	8.33	1.83	0.59	1.99	4.23
Capsicum	-	-	-	1.96	-	2.09	6.70	7.97	6.70
Cabbage	4.46	3.28	6.76	3.93	1.06	2.36	0.30	0.31	-
Cauliflower	1.68	1.26	4.89	10.68	5.58	8.12	0.89	0.53	1.06
Peas	1.68	1.39	6.92	10.12	12.05	13.62	8.63	9.11	6.88
Garlic	15.65	3.13	1.37	11.81	19.85	15.47	21.74	14.78	13.04
Potato	2.96	5.65	7.85	-	-	-	-	-	0.35
Others	0.56	4.67	4.17	3.79	5.42	4.72	0.60	1.16	2.31
All veg crops	61.90	38.84	43.21	63.52	67.26	58.16	61.19	51.58	50.80
Cereals	38.10	61.16	56.79	36.48	32.74	41.84	38.81	48.42	49.20
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Field survey, 2007-08.

TABLE 11. NET RETURNS OVER COST D FROM SELECTED HIGH VALUE CROPS FOR DIFFERENT CATEGORIES OF HOUSEHOLDS IN SELECTED BLOCKS

(Rs. /ha)

	Salooni			Banjar			Kandaghat		
Crops/Area (1)	Sub-marginal (2)	Marginal (3)	Small (4)	Sub-marginal (5)	Marginal (6)	Small (7)	Sub-marginal (8)	Marginal (9)	Small (10)
Tomato	30,509	31,588	31,982	25,901	28,935	32,655	57,880	58,925	46468
Beans	57,076	64,118	64,884	47,737	61,606	61,407	40,334	56,296	57,250
Cabbage	16,742	23,717	24,547	40,864	60,173	75,794	36,458	46,890	35,893
Cauliflower	96,064	1,13,652	1,38,812	1,15,483	1,32,269	1,38,124	93,931	1,33,740	1,32,559
Pea	66,111	75,120	71,536	69,164	63,128	77,887	62,989	1,02,128	1,08,502
Garlic	1,89,502	1,94,730	2,05,202	1,43,923	1,21,501	1,78,739	1,94,088	1,93,075	2,00,899
Potato	1,36,205	1,60,347	1,79,172	2,21,691	-	-	1,18,793	-	1,25,217
Ginger	-	3,57,850	-	-	-	-	3,72,558	3,44,714	3,98,667

Source: Field survey, 2007-08.

TABLE 12. SOURCES OF HOUSEHOLD INCOME AMONG DIFFERENT CATEGORIES OF HOUSEHOLDS IN SELECTED BLOCKS *(per cent)*

	Salooni			Banjar			Kandaghat		
Particulars (1)	Sub-marginal (2)	Marginal (3)	Small (4)	Sub-marginal (5)	Marginal (6)	Small (7)	Sub-marginal (8)	Marginal (9)	Small (10)
Agriculture	96.20	76.80	91.23	78.66	99.47	97.40	98.27	96.43	99.36
Horticulture	-	3.33	-	0.00	0.00	0.00	0.00	0.00	0.00
Dairy	0.07	0.50	0.09	0.45	0.00	0.10	0.02	0.01	0.01
Services	2.75	11.83	7.34	12.50	0.29	1.05	1.25	1.69	0.00
Pension	0.20	1.88	-	0.00	0.00	0.00	0.02	0.11	0.08
Business	0.07	1.08	0.63	0.84	0.15	0.97	0.18	0.80	0.47
Daily paid labour	0.71	4.58	0.72	7.55	0.53	0.48	0.27	0.97	0.08
All	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total Household Income (Rs./ annum)	53,470	57.600	72,840	1,20,650	1,29,600	1,48,120	1,60,270	1,84,400	3,96,284

Source: Field survey, 2007-08.

agriculture alone. Among three blocks, the level of income of all categories of households was substantially higher in Kandaghat where the process of crop diversification started around 20-25 years back followed by Banjar and Salooni blocks where it had started more recently.

V

DRIVERS OF CROP DIVERSIFICATION

A plethora of empirical studies from developing countries have reported that the factors like rapid economic growth accompanied by slowdown of demand for cereals coupled with increasing demand for high value commodities, increasing availability of advanced technologies, declining agricultural prices, changing role of government, expanding role of private sector, improving supply chain management, improving food safety and better quality, emerging trade liberalisation and liberalisation of capital flows are fostering the process of crop diversification. In a similar vein, the market availability and size, price risk, land suitability and land rights, irrigation infrastructure and labour supply are identified to be the major constraints in accelerating the process of crop diversification (Joshi, *et al.*, 2007; Benziger, 1996; Dorjee *et al.,* 2003; Pingali *et al.,* 2005; Pingali and Rosegrant, 1995; Braun, 1995; Pingali, 2006).

It, however, needs to be underlined that the relative importance of different factors in promoting/hindering the process of crop diversification varies from region to region. Before discussing the drivers which facilitated the whole process of crop diversification in the state of Himachal Pradesh, it is imperative to mention that agricultural transformation in a mountainous state like Himachal Pradesh is circumscribed by mountain specificities, namely, inaccessibility, fragility, marginality, niche and human adaptation mechanism created by unique vertical dimensions that distinguish them from plains (Jodha, 1992). While the first three specificities contribute in varying degrees, *inter alia*, to physical isolation, distance and high transportation costs and, therefore, create formidable constraints for agricultural transformation, the latter two suggests the potential scope for growing a variety of micro niche based high value cash crops. The crop diversification experience of the state shows how the adoption of a planning strategy that focused on overcoming the constraints imposed by the inaccessibility, marginality and fragility created enabling/conducive environment for harnessing niche and diversity and, in the ultimate analysis, set into motion the process of agricultural transformation. It is against this background that we analyse the drivers of crop diversification in the state.

First, the adoption of development strategy for overcoming the constraints imposed by the mountain specificities has been the single most important contributory factor in facilitating the whole process of agricultural transformation through crop diversification in the state. For example, thanks to the vision and farsightedness of state political leaders and planners, a very high priority was

accorded to create basic infrastructural facilities like rural roads to break the barriers of inaccessibility, *ab initio*.[4] Table 13 shows that transport and communication, power and social services including education and health, accounted for more than half of the total plan outlay in the first three five year plans. These heavy allocations to basic infrastructure sectors created a reasonably good network of roads, schools and hospitals. The rural roads in the interiors connected both high land and low land with wider markets for high value products in the main towns and cities thus breaking the barriers of inaccessibility and physical isolation. Likewise, the marginality of remote areas in the decision making process was overcome by giving political representation to these areas in the state cabinet. For instance, districts like Shimla, Kullu and Lahaul & Spiti where the process of cultivation of high value crops started in the fifties and the early sixties have most of the times been represented in the state cabinet. The participation of local representative in decision making process helped in focusing on harnessing the regional potential and taking effective measures to overcome the physical and human constraints. The recent developments in the means of communication and widespread expansion of telephone (mobile) facilities in the interiors including tribal areas have further eased the inaccessibility barriers hastening the ongoing process of crop diversification. All these developments enhanced the 'social opportunities' available to the common people and created conditions for promoting inclusive growth, both across regions and sections of society. Further, the adoption of high cash crops cultivation helped the hilly and mountainous regions of the state in two ways. One, it promoted the productive use of abundant marginal land available and; two, it maintained and improved the ecology and environment by promoting soil conservation and soil fertility.

TABLE 13. SECTORAL RESOURCE ALLOCATION IN DIFFERENT FIVE YEAR PLANS

(per cent)

Plan	Transportation and Communication	Social Services	Agriculture
(1)	(2)	(3)	(4)
I (1951-56)	44.66	19.96	17.56
II (1956-61)	31.16	23.16	22.90
III (1961-66)	34.08	22.63	28.43
IV (1969-74)	29.90	16.69	30.76
V (1974-79)	23.04	18.14	22.49
VI (1980-85)	21.91	19.33	22.61
VII (1985-90)	15.67	20.19	25.70
VIII (1992-97)	13.23	29.90	20.72
IX (1997-2002)	10.78	36.95	19.22
X (2002-2007)	13.60	32.28	13.40

Source: Statistical Outlines of Himachal Pradesh, 1971, 1976,1981,1989,1994, 1999 and 2002-03, Directorate of Economics and Statistics, Government of Himachal Pradesh, Shimla.

Second, a network of institutions has been created that facilitated the process of crop diversification. The Himachal Pradesh Horticultural Produce Marketing and Processing Corporation (HPMC) was set up in 1971 with the assistance of World Bank to provide post-harvest infrastructural facilities such as link roads, cold storage,

grading and packing facilities. A network of R & D institutions has been created to evolve new technologies and provide technical know-how and extension back up to the farmers. In addition to an Agricultural University, a separate University of Horticulture and Forestry was established in 1985 to provide technical and extension back up to the growing horticultural sector. The Central Government also established research institutions/centres in the state to strengthen the R & D infrastructure. The most notable among these are Central Potato Research Institute at Shimla, National Institute of Mushroom Research at Solan, IARI Regional Research Station for Vegetable Research at Katrain (Kullu) and Institute of Himalayan Bio-resources Technology at Palampur. These research institutions/centres provided the much needed technical back up to the cultivation of high value cash crops by evolving suitable technologies and advising farmers about varieties suited to the agro-climatic conditions of their respective areas, their agronomic practices and crop protection measures. Thus the readily available technical know-how in these institutions and its transfer to the rural communities through their network of regional research stations and extension network of government line departments like agriculture and horticulture played an important role in accelerating the process of crop diversification.

Third, the support prices for different fruit crops have been introduced to insulate farmers from fluctuations in the market prices. In more recent times, the market intervention scheme has been launched under which the prices of different fruit crops are fixed according to their grade and quality, and if prices happen to fall below these levels, the state government purchases the produce at fixed prices. The implementation of New Policy on Seed Development (NPSD) by the Government of India since October 1988 made the import of good quality seeds much easier and hastened the spread of the cultivation of high value cash crops.

Fourth, rapid spread of the cultivation of high value cash crops has also been on account of very high level of market consciousness among the farmers. A number of factors have contributed towards this development. The farmers in Shimla, Solan and Kullu districts have been traditionally growing cash crops like potato, and have remained in touch with markets outside the state. They have acquired a spirit of innovativeness and are always ready to experiment with new crops/enterprises that promise high economic returns. For instance, when potato ceased to be a cash crop in the fifties and the early sixties due to dwindling yields and falling demand, they switched over to fruit cultivation mainly apple, and subsequently to off-season vegetables. Likewise, in more recent times, when apple production is fluctuating and becoming more uncertain because of erratic weather, farmers in some areas have started switching over to cultivation of cash crops like garlic and off-season vegetables and even to more risky crops like floriculture.

Fifth, the availability of huge market at Delhi and in other cities in the neighbouring states of Punjab and Haryana has been yet another important contributory factor encouraging the cultivation of fruits and off-season vegetables in

the state. Practically from all the far-off parts of the state, the distance to Delhi can be covered in less than twenty-four hours. This puts the state in an advantageous position compared to other mountainous regions including Jammu & Kashmir and northeastern states where lack of nearby markets has been one of the most limiting factors in the cultivation of high value cash crops. As a matter of fact, accessibility of the mountain areas to final markets is a common theme underlying all success stories of crop diversification, especially towards off-season vegetables, in whole of the Hindu Kush Himalayan region (Nagpal, 1999).

Sixth, the emergence of relatively efficient marketing system is also an important factor that has contributed towards the adoption and popularisation of high value cash crops. Different marketing systems are in vogue in different regions. For example, in areas where the cultivation of off-season vegetables is 20-25 years old, the local youths have formed some sort of informal groups to market their produce. In some other areas, a different marketing system has got evolved under which the growers sell their produce to traders on their fields. More importantly, however, the farmers while selling their crops to the traders are fully aware of the prices prevailing in the nearby markets. And if the traders offer much lower price than the prevailing price they refuse to sell. The formation of informal groups by the local youth has also started taking place in these areas. The state marketing board also played an important role in facilitating the marketing of high value cash crops. It has opened marketing yards and established regulated markets where small and marginal growers can sell their produce. There are around 45 regulated markets including marketing yards in the state, and more than thirty are located in the off-season vegetable producing districts.

Seventh, the emergence of self-help institutions like fruit growers' associations/co-operatives in some of the producing regions is yet another factor that has played an important role in promoting the cultivation of high value cash crops. These institutions help farmers, particularly the small and marginal ones, in different ways like procuring inputs and also in marketing their produce. The Lahaul Potato Growers Co-operative Society and the Fruit Growers' Associations in Kullu and Shimla districts are notable examples of such co-operative endeavours by the farmers.[5]

The results of the analysis of household data, discussed above, show the profitability of different high value cash crops in comparison to traditional cereal crops in all the three study areas. Nevertheless, given the profitability of these crops, there are a number of factors at the household level like size of landholdings, availability of family labour, income from non-farm sources, the availability of irrigation facilities, farm assets, etc. that influence the farmers' decision to bring their crop land under these crops. Therefore, it is hypothesised that factors like the size of landholdings, availability of irrigation facilities and family labour encourage the farmers to bring in higher proportion of their crop land under these crops. Likewise, the higher income from non-farm sources is expected to have discouraging effect.

The effect of these factors on the per cent of total cropped area under high value cash crops has been studied using multiple regression analysis separately for three study areas. The results of regression analysis, given below, were not uniform across three different blocks. For example, the results for Salooni show that the size of landholdings and age of the head of the family did not have significant effect on the proportion of gross cropped area under non-foodgrain crops. However, other factors - like family labour, availability of irrigated area, family size and education of the head of the family had positive and statistically significant effect on the proportion of gross cropped area under non-foodgrain crops. The effect of non-farm income was, however, negative and statistically significant as well suggesting that higher non-farm income will cause decrease in the proportion of gross cropped area under these crops. In the case of Banjar, only two factors, namely, size of landholdings and size of family had a positive and statistically significant effect on the proportion of gross cropped area under non-foodgrain crops. The effect of other variables like family labour, area under irrigation, non-farm income and age of the head of the family was statistically insignificant though all the regression coefficients have had expected signs. Finally, in respect of Kandaghat, the size of the landholding had statistically significant negative effect while family size had statistically significant positive effect on the proportion of gross cropped area under non-foodgrain crops. The variables like family labour, non-farm income and education of the head of the family neither had expected signs nor were statistically significant. Thus, the hypotheses proposed above are empirically supported for some blocks while for others these are not. It is not unexpected inasmuch there are huge variations in the socio-economic-geographic-micro climatic conditions among the three selected blocks.

Kandaghat

$$Y = 56.50 - 0.58^{*} X_1 - 0.12 X_2 + 0.05X4 + 0.26^{**} X_5 + 0.01X_7$$
$$\quad\quad (-4.52) \quad (0.39) \quad (0.69) \quad (1.99) \quad (0.95)$$
$$R^{-2} = 0.23; \quad F=4.45 \quad N= 70$$

Salooni

$$Y = 39.54 - 0.77 X_1 + 0.09^{*} X_2 + 7.34^{*} X_3 - 0.05^{*} X_4 + 0.43^{***} X_5 + 0.02 X_6 + 1.23^{***} X_7$$
$$\quad\quad (0.12) \quad (5.22) \quad (3.09) \quad (-2.56) \quad (1.59) \quad (0.24) \quad (1.85)$$
$$R^{-2} = 0.49 \quad F= 6.67 \quad N= 70$$

Banjar

$$Y = 50.15 + 3.47^{**} X_1 + 0.20X_2 + 0.14X_3 - 0.12 X_4 + 0.45^{*} X_5 + 0.07X_7$$
$$\quad\quad (1.82) \quad (1.40) \quad (1.18) \quad (1.08) \quad (3.28) \quad (0.60)$$
$$R^{-2} = 0.20 \quad F= 3.11 \quad N= 70$$

Where Y = the per cent of total cropped are under high value crops; X_1 = the size of landholdings; X_2 = the family labour; X_3 =takes value 1 if a household has area under irrigation, 0 otherwise; X_4 = Non-farm income and X_5 = family size; X_6 = age of the head of the family; X_7 = education of the head of the family

Note; (i.) The figures in parentheses are 't' values.
(ii.) *, ** and *** denote significance at 0.01, 0.05 and 0.10 level of probability, respectively.

VI

EMERGING CHALLENGES

All is, however, not well with the ongoing process of crop diversification in the state. The so-called 'second generation problems' have started looming large, more ostensibly in regions where the process of crop diversification has reached advanced stages. Some of the impending challenges that endanger the economic viability and ecological sustainability of the cultivation of cash crops are discussed below.

First, the cultivation of high value crops, especially horticultural crops, has started showing increasing symptoms of unsustainability due to, among other things, falling soil fertility, erratic weather conditions and the emergence of numerous insects, pests and diseases. The adoption of same cropping sequence year after year has caused the loss of micronutrients leading to deterioration in the overall soil health. The problem has been compounded due to the availability of spurious inputs, especially agro-chemicals, in the post liberalisation regime. There is as yet no regulatory mechanism to control the supply of spurious inputs. The high incidence of diseases has led to an excessive use of agro-chemicals that has given rise to a vicious cycle of falling productivity-more use of chemicals–further fall in productivity, and so on. This has not only escalated the production cost but has also affected environment and bio-diversity adversely.

Second, new outward looking open trade linked strategy and the launching of WTO has posed competition from cheaper imports. This has affected the production of crops and enterprises like hops, sericulture, honey and rabbit wool adversely. This problem is likely to become more serious in times to come.[6]

Third, the shifting/erosion of micro niches/comparative advantages hitherto enjoyed by the state due to fast technological developments outside the producing regions has posed a new problem. There are instances to show that some areas in the state have lost their comparative advantage in the production of crops like mushrooms, herbs, off-season vegetables and seed potato due to technological changes outside. These crops are being grown on a large scale in the plains using polyhouse technologies and seed plot techniques. The process is likely to get accentuated with the intensification of the process of globalisation, which is bound to bring in new technologies and infrastructural and support systems (Jodha, 2000).

Fourth, slow but perceptible change in weather and climate conditions has posed yet another serious threat to the cultivation of some of the high value crops. For example, during the last fifteen to twenty years, the cultivation of apple has shifted along the altitude, primarily because of inadequate precipitation in the form of snow and rains leading to non-fulfillment of the chilling requirement of the crop. This has resulted into year to year wild fluctuations in apple output inflicting huge losses on apple growers.

Fifth, the infrastructural facilities are increasingly proving to be inadequate to cope with the mounting pressure. The markets yards do not have adequate space to

house the produce brought for sale and also lack modern facilities like internet. Not only that, some remote areas, with a potential to grow high value crops, still remain inaccessible.

Sixth, low and stagnant productivity levels coupled with high cost of production are other important aspects to worry. In case of apple, nearly one-fifth of the crop bearing plantations are over-aged which pull down the overall productivity. These need to be replaced by new dwarf, spur bearing and high yielding plantations.

VI

SUMMING UP

In sum, the foregoing analysis shows that agriculture including animal husbandry in the state has recorded a growth rate of around three per cent per annum during the past two and half decades since 1980-81. A reasonably better performance of agricultural sector became possible because of booming horticultural sector including fruit and vegetable crops. The ongoing process of crop diversification in the state becomes evident from rising proportion of gross cropped area under fruit and vegetable crops. This is also manifested in increasing the contribution of these crops towards gross value of output originating in agriculture. The household survey data from three different blocks of the state further show that even the sub-marginal households, owning up to half a hectare of land, have devoted nearly three-fifths of their gross cropped area for the cultivation of these crops. The cultivation of high value crops yields very high net returns and has made a significant impact on the income and employment levels of all the categories of cultivating households.

Our analysis further shows that explicit consideration of mountain specificities, namely, inaccessibility, marginality, fragility, niche and human adaptation mechanism in formulating and implementing developmental strategies was the single most important factor that set into motion the whole process of agricultural transformation through crop diversification. The focus on overcoming mountain specificities, in particular inaccessibility, resulted in the creation of basic infrastructural facilities which linked the high low lands in the interior with markets in towns and cities. In addition, government support in terms of creating R&D institutions and offering support prices, availability of huge market in the neighbouring states, high level of market consciousness among farmers and the emergence of self-help institutions were some of the other important drivers of the ongoing process of crop diversification. These factors created enabling environment for the process of crop diversification to get under way even in the remote tribal districts like Lahaul & Spiti and Kinnaur. The analysis of household data further reveals that the importance of different factors in influencing the farmers' decision to bring more area under these crops varies from one development block to other because of variations in socio-economic-geographic-climatic factors. Nonetheless, on a more general plane, factors like the size of landholdings, availability of irrigation

facilities, availability of family labour, family size, non-farm income and education of the head of the family were important determinants of the process of crop diversification at the household level. All is, however, not well. The emerging challenges like rapid depletion of soil fertility, changing weather and climatic conditions, increasing erosion of comparative advantages, increasing competition from cheaper imports, inadequate infrastructural facilities and old age of crop bearing apple plantations pose a serious threat to the economic viability and ecological sustainability of the process of crop diversification.

On the whole, the Himachal model of agricultural transformation throws up two important messages. First, the incorporation of regional specificities in development strategy coupled with committed state intervention is *sine qua non* for creating favourable conditions for triggering the process of agricultural transformation through crop diversification. Second, harnessing of regional diversities and local micro climate niches through diversified cropping systems promotes inter-ecosystems and inter-regional resource flows causing a variety of favourable impacts through a host of forward and backward linkages. These resource flows and linkages not only impart economic and ecological resilience to the process of agricultural transformation but also create huge employment and income opportunities for people at different levels. At the regional level, agricultural transformation in the state has developed two way mutually beneficial relationships with the neighbouring states. For example, while the neighbouring states contributes towards sustaining the process of crop diversification in the state by providing ever expanding demand for fruits and vegetables, the state in turn is a huge source of demand for products produced in the non-farm sector of the neighbouring states.

Revision March 2010. *Revision accepted March 2011.*

NOTES

1. For a comparative analysis of the performance of Himachal Pradesh in terms of a number of socio-economic indicators vis-à-vis other states, see Dreze and Sen, 2002, pp.101-110; 177-184 and Appendix Table 3.

2. For details on methodology see, Sharma *et al.*, 2010.

3. The cultivation of high value crops has also generated employment opportunities in activities like trade and commerce, transport and communication, construction etc. through a host of backward and forward linkages. A recent study found the proportion of area under non-foodgrain crops as a significant factor influencing growth of rural non-farm employment across districts. For details, see Sharma, 2009.

4. The political leaders like Dr. Y.S. Parmar and Dr. Partap Singh Karion played a very important role in initiating the process of crop diversification towards fruit and vegetable in the state during the fifties and the early sixties. A visit to villages in Kullu district which was a part of erstwhile Punjab and interaction with the farmers clearly bring out the important role played by the then political leadership in persuading farmers to plant apple orchards. The farmers fondly remember how Late Partap Singh Karion, the then chief minister of Punjab, exhorted them to plant apple orchards by saying that 'you give me apple I will give you wheat'. As a matter of fact, the difference between the levels of agricultural transformation in Himachal Pradesh and hilly regions of erstwhile Uttar Pradesh, now Uttarakhand, can largely be explained in terms of the active role played by the state politicians like late Dr. Y.S. Parmar by exclusively focusing on the development of the state as compared to their counterparts from Uttarakhand region who mostly remained pre-occupied at the

national level. For details on the processes of agricultural transformation in the state and the role of political leadership, see Sharma, 1996.

5. Dreze and Sen have attributed the rapid economic and social transformation of Himachal Pradesh to three important enabling factors: (i) well directed public intervention in support of social opportunities; (ii) active agency of women (iii) local democracy and social cooperation. For details see, Dreze and Sen 2002, pp.105-110 and 179-184.

6. A recently concluded study showed how lowering of tariff rates in the aftermath of the implementation of WTO accord practically destroyed the hops crop in Lahaul valley of Lahaul and Spiti district of Himachal Pradesh. For details, see Sharma *et al.*, 2010.

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