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Value chain analysis of pea: A case study in Kullu District of Himachal Pradesh

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Abstract
The present study entitled "Value chain analysis of Pea in Kullu District of Himachal Pradesh". Among different commercial vegetables in Kullu district, pea occupied maximum area with 34.38 per cent of total vegetable area. The annual transaction of pea (*Pisum sativum*) was 3146.50 MT from major production pockets of Kullu district. In this study, value chain map highlighted the involvement of diverse actors, who participated directly or indirectly in the value chain. Four channels were identified in the marketing system of Pea in the study area. Out of four channels, channel-C (Producer-Local trader/commission agent-Wholesaler-Retailer-Consumer) was found most preferred channel by the sample vegetable growers since 58.23 per cent of pea was traded through this channel. Degree of value addition in pea varied from 2.20 per cent to 5.85 per cent among different chain actors. There is a potential niche for Himachal Pradesh to develop off-season pea pocket by leveraging the small scale tomato processing units, cooperative societies and self-help groups in the pea growing temperate region-Naggar, Banjar, Lag valley and Manikaran valley of Kullu block.

Keywords: Value chain, mapping of value chain, actors

Introduction
Himachal Pradesh is endowed with versatile agro-climatic conditions that favour the production of almost all types of vegetables, both of temperate and sub-tropical nature (Chauhan, 2004; Chauhan and Mehta, 2002) [6, 7]. Area under vegetable in H.P is 85.76 thousand ha and production is 1743.31 thousand MT during 2016-17 (Anonymous, 2017) [3]. Kullu district forms the eastern part of central Himachal Pradesh micro region and is a centrally located district of the state with its headquarters at Kullu. Out of four agro-climatic zones, part of Kullu district comes under the high hill (wet temperate) zone which lies from 1,801 to 2,200 meters above sea level with humid temperate climate and alpine pastures, while rest comes under mid hill (sub-humid) zone which extends from 651 meters to 1,800 meters above mean sea level. Total area under vegetable in Kullu district is 6046 ha (7.05% of total vegetable area in H.P) and production is 128471 tonnes (7.37% of total vegetable production in H.P) during 2015-16 (Anonymous, 2016) [2]. Out of commercial vegetables of Kullu, the largest area was under pea i.e. 1870 hectare with production 28050 MT during 2015-16 (Anonymous, 2016) [3].

A supply chain or logistics network is the system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer. The conduit that runs from producer to final user, through which the commodity passes, is conventionally referred to as a "marketing and processing chain", a "supply chain", or a "value chain" (FAO, 2005) [8]. In the traditional vegetable supply chains, the post-harvest losses are as high as 35 to 40 per cent (Bhardwaj *et al*., 2011) [5]. This is a serious problem with regard to the traditional vegetable supply chains, as a considerable portion of the total harvest is lost and the cost is ultimately borne by the producer and the consumer. Most of the vegetables are perishable in nature. So, efficient supply chain needed to ensure reduction in post-harvest losses and efficient use of produce in one or the other form. However, value chain analysis is a tool for analysing the nature and source of value within a supply chain and the potential for reducing waste therein, with the focus explicitly on the determinants of value within a manufacturing process rather than the simple measurement of process outputs.

Methodology
Multistage random sampling was adopted in the selection of blocks, villages and the ultimate sample of the respondents who were involved in value chain of vegetables.

Kullu district of Himachal Pradesh was selected purposively because of its wider adaptability for growing vegetables. The important commercial vegetables grown in Kullu district are cauliflower, pea and tomato. At first stage, 3 blocks out of 5 blocks in Kullu district were selected on the basis of area under selected vegetable in all the blocks. At second stage, a list of villages growing vegetable from selected blocks was prepared. 5 villages from each selected block were taken randomly. At third stage, list of the households of the selected 5 villages was prepared and a sample of 30 households from each block was selected on the basis of probability proportion to size method and thus a sample is 90 for the study (Ankita, 2017) [1].

Two markets, namely Bhunter and Kullu were purposively selected to collect the information related to markets and marketing. A sample of 5 local traders/commission agents, 5 wholesalers, 5 retailers and 30 consumers were selected randomly for gathering the data of vegetable marketing in Kullu district.

Both primary as well as secondary data were collected during the survey investigation. The primary data were collected using pre-tested schedules through personal interview method from the selected households and Traders/Commission agents in the study area and markets. The information regarding value chain aspects like mapping, degree of value addition etc. were collected from other players in the vegetable marketing channel. Secondary data were collected from the Department of Agriculture, Agricultural Produce Market Committee (APMC), traders/commission agents and Wholesalers associations of the selected market.

Analytical framework

Compound growth rate (CGR)

The compound growth rates of area, production and productivity of Pea was computed by fitting the exponential function for seven years from 2010-11 to 2015-16. The ordinary least square method was used to fit the power function of the following form $Y_t = ae^{bt}$.

$$\text{Ln } Y_t = \text{Ln } a + t\, b.$$

Where

Y_t = Area/Production/Productivity in the year 't'.

t = Independent variable (time in years).

Compound growth rates (CGRs) were calculated by using the following formula:

CGR = b*100

Costs of cultivation of different vegetable crops were worked out by using the standard method of cultivation i.e. Commission on Agricultural Costs and Prices (CACP) cost concept.

Value chain analysis

Value chain mapping was conducted in two phases.

1. An initial basic map after the collection of initial data illustrating participants and functions.
2. Adjusted mapping, which was conducted by following additional and follow-up interviews.

Market Analysis

The total cost incurred on marketing by the producer/ seller and of the various intermediaries, involved was computed. Marketing Margins of middlemen were calculated as the difference between the total payments (marketing cost + purchase price) and receipts (sale price) of the middlemen. The difference between the price paid by consumer and price received by the producers is the marketing margin or price spread. Generally the economic efficiency of marketing system is measured in terms of price spread. Smaller the price spread; greater is the efficiency of the marketing system.

Result and Discussion

Area of pea in the Kullu district has increased from 340 hectare in 1995-96 to 1870 hectares in 2015-16 registering a significant compound growth rate of 10.20 per cent per annum (Table 1). Production has gone up from 3400 tonnes in 1995-96 to 28050 tonnes in 2015-16, which is evident from the significant compound growth rate of 12.30 per cent per annum. The growth rate of productivity is also significant at 2.10 per cent per annum.

Table 1: Area, production and yield of Pea in Kullu district, 1995-96 to 2015-16 (Area in ha) (Production in tonnes) (Productivity in tonnes/ha)

Year	Area	Production	Yield
1995-96	340	3400	10
2000-01	420	4000	9.52
2005-06	760	9780	12.87
2010-11	1463	16150	11.04
2015-16	1870	28050	15
CGR (%)	10.20**	12.30**	2.10**
	(0.6)	(0.9)	(0.5)

Note: Figures within parentheses are standard errors; ** Indicates significance at 1% probability level, * indicates significance at 5% probability level.

Source: Directorate of Agriculture, Government of HP, Shimla.

Seasonal calendar of Pea

Pea is 6 month duration crop mostly produced in the hills. Its planting starts during October- November while harvesting starts onward February till March. Most prominently varieties of pea grown by sample farmers were 'AP-I' and 'AP-II'. Input use pattern for pea showed that farmers were using higher doses of Phosphorus and Potassium in comparison to recommended doses. Pea season started during October-November and it ended during February-March in Banjar and Kullu block while in Naggar block, season was from February to July (Fig1).

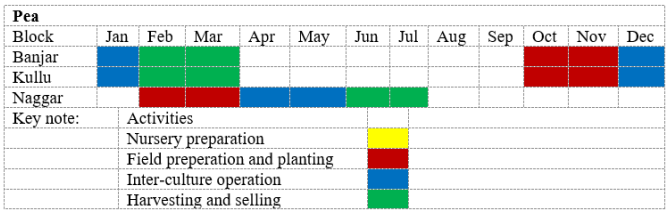

Fig 1: Pictorial representation of seasonal calendar of tomato production in Kullu district

Functionaries/Actors and their role in vegetable value chain

There are direct actors those involved in commercial activities in the chain (input suppliers, producers, traders/commission agents, consumers) while indirect actors are those that provide financial or non-financial support services, such as credit agencies, business service providers, government, NGOs, cooperatives, researchers and extension agents.

Agricultural inputs primarily seed, fertilizer and agrochemicals have enormous potential to leverage the efforts

of hard-working farmers. Private and government agencies are the main source of input supply in the study area. Private input supplier includes seed dealers, seed companies, small retail shop that sell small quantities of seed, fertilizers and plant protection chemicals to farmers at the village level while government agencies include HIMFED and state Agriculture Department. Different sources of input supply to farmers are presented in the Fig 2.

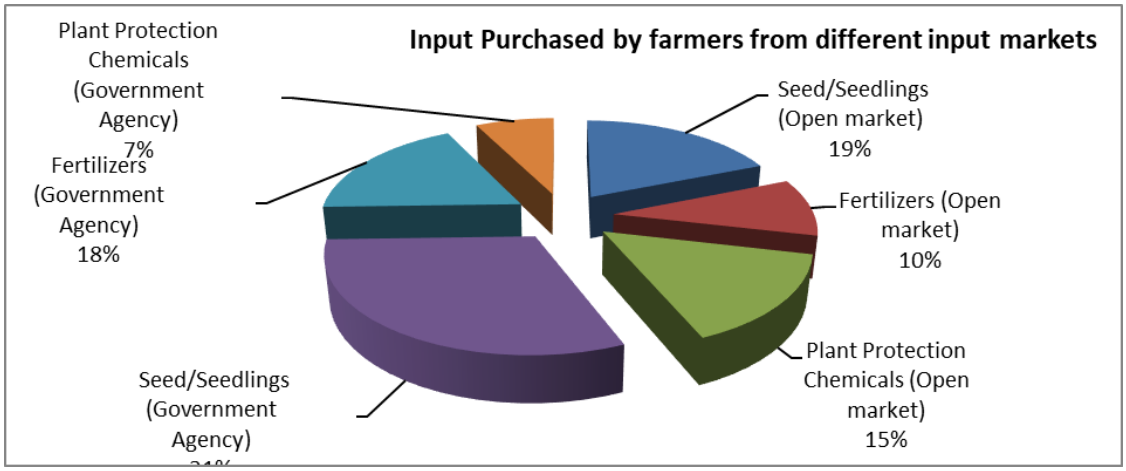

Fig 2: Input delivery system of sample vegetable farmers

Cost and return

The cost of cultivation of pea was computed based on the information collected from the sample households through survey method. The summary of these costs has been given in Table 2. It may be seen in Table, the cost of cultivation (based on cost D) per hectare was observed to be Rs.144518. The cost of cultivation was high primarily due to high labour requirements for preparing various farm operations and practices such as irrigation, collection of stakes, staking, hoeing and weeding operations. Further, substantial cost of seed also contributed to the high cost of cultivation in these crops.

Cost A_1 in pea was highest in medium farms (Rs.78969.06/ha) followed by small farm (Rs.76373.80/ha) and marginal farms (Rs.64716.48/ha). Cost B was estimated to be highest on medium farms i.e. Rs.108320.51 per hectare while cost C and D was highest on marginal farms with a magnitude of Rs.139800.81 and Rs.153780.89 per hectare, respectively (Table 4.17). Thus, study showed that the use of human hired labour was more in medium farm category showing highest cost A_1. Expenditure on plant protection measures was the major contribution in cost A_1.Similar results were shown by Bala *et al*. (2011) [4] in a study conducted in the Kullu district of Himachal Pradesh.

Table 2: Farm management costs of Pea in study area (Rs./hectare)

Farm Management Costs	Marginal	Small	Medium	Overall
Cost A_1	64716.48	76373.80	78969.06	71136.04
Cost B	92414.60	105154.32	108320.51	99488.89
Cost C	139800.81	122916.42	124090.53	131379.74
Cost D	153780.89	135208.06	136499.58	144517.71

Overall gross return from pea was 196772.20 per hectare (Table 3). Net returns over cost A_1, cost B, cost C and cost D in pea was Rs.125636.16, Rs.97283.31, Rs.65392.46 and Rs.52254.54, respectively.

Table 3: Net returns from Pea in study area (Rs./hectare)

Gross Returns	Net Returns			
	Cost A_1	Cost B	Cost C	Cost D
196772.20	125636.16	97283.31	65392.46	52254.54

Table 4 revealed overall net farm income earned was Rs.52249.15 per hectare and maximum was in medium farm category i.e. Rs.65250.86 per hectare. Maximum farm business income and family labour income was earned in marginal category i.e. Rs.128234.46 and Rs.100536.34 per hectare respectively while farm investment income was more in medium category which was Rs.107014.09 per hectare. Overall break-even point was achieved at Rs.82589.66 per hectare and break-even output was achieved at 30.96 quintal per hectare. Overall output-input ratio was 1.36 and it was noted to increase as the farm size increases.

Table 4: Average return from pea (Rs./ hectare)

Sr. No.	Particulars	Marginal	Small	Medium	overall
1	Net Farm Income	39170.05	61346.31	65250.86	52249.15
2	Farm business Income	128234.46	120180.57	122784.11	125631.30
3	Family Labour Income	100536.34	91400.05	93432.65	97278.46
4	Farm investment Income	80848.25	102418.48	107014.09	93740.46
5	Break-even point	90550.75	77040.71	79071.55	82589.66
6	Break even output (qtl.)	33.80	28.95	29.74	30.96
7	Output-input ratio	1.25	1.45	1.48	1.36

Based on total cost, the cost of production per quintal of selected vegetable was estimated to be Rs.1881.15 per quintal (Table 5). The cost of production per quintal on cost A_1 (without family labour) amounted to be Rs.976.79 for pea.

Table 5: Cost of production of Pea in the study area (Rs./quintal)

S. No	Cost of Production	
1	Based on Cost A1(without family labour)	976.79
2	Variable Cost (with family labour)	1407.76
3	Total Cost (Variable and fixed)	1881.15

Marketing of Pea

Marketing functions

Various marketing functions are performed by the vegetable farmers for the marketing of produce. The product has to be prepared for the market which involves picking, grading, packing, transportation and loading/unloading etc. All these factors are important determinants of prices which vegetables fetch in the market, and great care has to be ensured at every step.

Marketing Channels

Due to the existence of various agencies working between producer and consumer, there are different marketing channels for the same commodity. The agencies involved in the marketing of Pea in the study area are local Trader/Commission agents, wholesalers and retailers.

It can be observed from the results of Table 6 that channel-C (Producer-Local Trader/Commission agent -W-R-C) was found most preferred channel by the sample vegetable growers since 58.23 per cent of pea was traded through this channel. The second important channel followed by the growers was Producer-W-R-C. Further channel-A (producer acting retailer himself) was also patronized on a limited scale as this took more time for the sale of Pea in spite of its high efficiency.

Table 6: Quantity of Pea marketed through various channels

Marketing Channels	Marketing intermediaries	No. of farmers	% Share in total quantity
Channel-A	Producer-Consumer	23	4.43
Channel-B	Producer-W-R-C	41	21.37
Channel-C	Producer-Local Trader/Commission agent -W-R-C	60	58.23
Channel-D	Producer-R-C	35	15.98

Price spread in marketing of pea

The results of the analysis of the price spread of the pea among different channels are presented in Table 7. It was observed that producer's price varied from Rs.2573.49 to Rs.2948.38 among different channels. The price spread was maximum in channel C (34.30%) followed by channel B (31.67%), D (19.67%) and A (1.57%). Marketing margins varied between 7.50 to 9.19 per cent. Marketing cost varied between 1.57 to 25.11 per cent.

Table 7: Price spread and marketing efficiency of pea among the different marketing channels

Particulars	A	B	C	D
Producer price (Rs.)	2948.38	2661.87	2573.49	2676.51
Consumer's price (Rs.)	2995.36	3895.84	3917.10	3332.07
Gross marketing margin(GMM) (Rs)	46.98	1233.97	1343.61	655.56
Marketing cost (Rs.)	46.98	883.97	983.61	405.56
Marketing margin (Rs.)	-	350.00	360.00	250.00
Gross marketing margin (TGMM) (%)	1.57	31.67	34.30	19.67
Marketing cost (%)	1.57	22.69	25.11	12.17
Marketing margin (%)	-	8.98	9.19	7.50
Producer's Share (%)	98.43	68.33	65.70	80.33
Marketing efficiency	62.76	2.16	1.92	4.08

Value chain map

Value chain mapping enables to visualize the flow of the product from conception to end consumer through various actors. It also helps to identify the different actors involved in the vegetable value chain, and to understand their roles and linkages. Consequently, the current value chain map of different vegetables in Kullu district is depicted in Figure 3

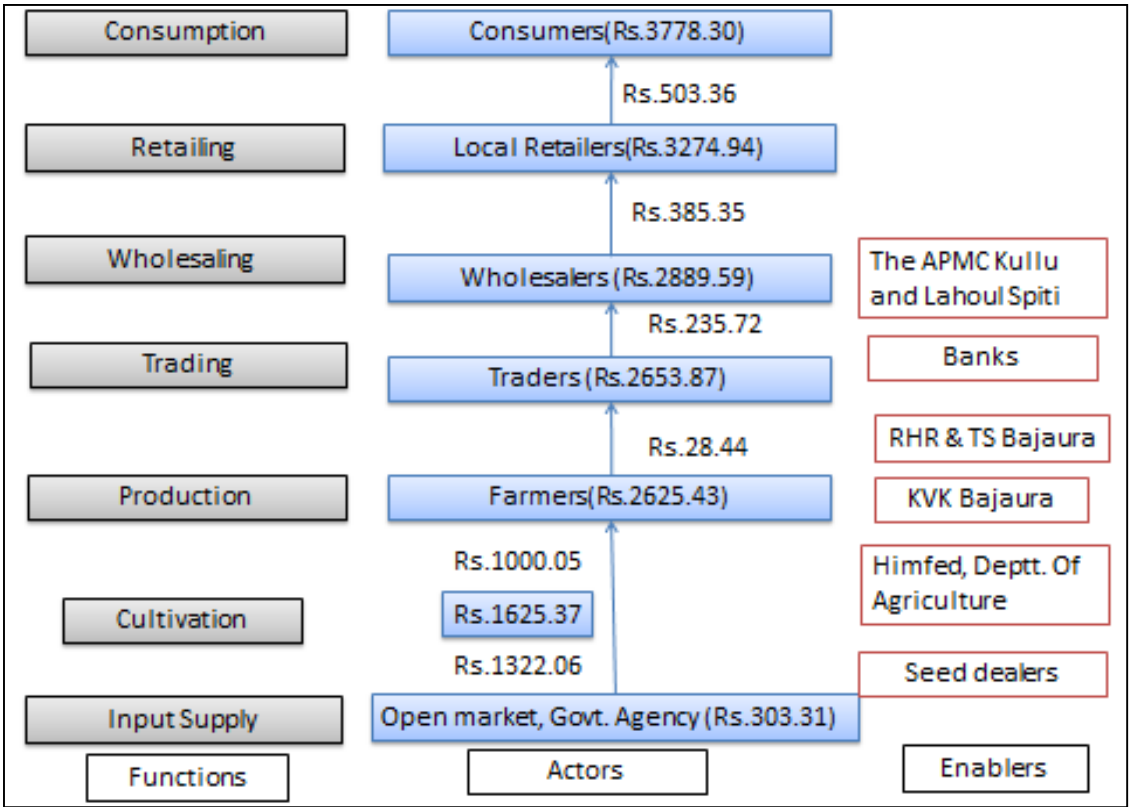

Fig 3: Value chain map of pea

Degree of value addition

As the vegetables move along the chain and change the actors' hands, the value gets altered and this process is value addition. The extent or the percentage increase in the value of product is the degree of value addition on that product. It was observed that degree of value addition in Pea at the trader's stage was varied 2.20 per cent as they performed the grading and transportation activities due to which the value gets added up. The wholesalers add 3.88 per cent of value and the retailer creates value to the tune of 5.85 per cent by performing the functions like transportation and retailing (Table 8).

Table 8: Degree of value addition at each stage of Pea value chain (Rs/quintal)

Particular	Farmer	Trader/Commission agent	Wholesaler	Retailer	Consumer
Sale price	2721.41	2925.97	3370.38	3814.56	-
Purchase price	-	2721.41	2925.97	3370.38	3778.3
Price difference	-	204.56	444.41	444.18	-
Cost	95.99	212.1	367.37	331.26	-
Margin	-	60	113.42	197.07	-
Degree of value addition (%)	-	2.2	3.88	5.85	-

Constraints and opportunities within value chain

The constraints were classified into two categories, *viz*., constraints related to production and related to marketing. The production problems prevail in the study area were related to skilled labour, farm inputs, other problems and non-availability of suitable planting material, limited availability of FYM, lack of irrigation facility and diseases were faced by the farmers at the time of production. Marketing problems encountered in the study area were problems related to transportation, market intelligence and malpractices like harassment by middleman and not taking the consent of farmers while selling.

Table 10 manifested the opportunities which are required to eliminate the constraints faced by farmers and other actors in value chain.

Table 10: Opportunities to eliminate constraints within the value chain

Sr. No.	Constraints	OPPORTUNITIES
	Input suppliers	
1.	• Most input providers are located at district head-quarter only. • Difficulty to build trust in business.	• Demand for the input is increasing. So need of more input providers in the study area. • Need of different distributor companies in the study area.
	Producers	
1.	• Shortage of skilled labour and non-availability at peak operation time. • High incidence of diseases and pests. • Price and yield risk.	• Higher returns per unit area. • Short duration crops. • Provide employment.

	• Non-availability of quality seed and planting material.	
2.	• Higher prices of inputs.	• Existence of subsidies for inputs by regulatory bodies.
3.	• Market malpractices.	• Strengthening of producers' groups, marketing cooperatives for proper management and organization within value chain.
4.	• High transportation charges.	• Extension and improvement in the road network.
5.	• Poor access to post-harvest handling technology at farmers. • Poor access to processing industry/units.	• Establishment of processing industries in the area. • Product diversification (pickles, tomato ketchup, green peas, dried vegetables).
	Traders/Commission Agents/Wholesalers	
1.	• Poor and unhygienic condition of market yards. • Insufficient knowledge about entrepreneurship among Trader/Commission agent s. • High variations in the prices lead to unhealthy competition.	• Establishment of collection centres in different production pockets. • Upgrading of existed infrastructure. • Need of metalled roads near market area.
	Retailers	
1.	• Limited operating capital. • Intrinsic complexity of retailing – rapid price changes, constant threat of product obsolescence.	• Need of modernized sale shops.
	Consumers	
1.	• Unavailability of the items as per consumers' demand. • High prices of produce.	• Improvement in the chain to provide fresh vegetables.

Conclusion and Policy Implication

Studying value chain system is very important for improving market efficiency and increasing producer as well as consumer surplus. In this paper, the value chain for pea has been carried out with a focus on estimating costs and returns in its cultivation, marketing costs and share of different actors in the movement of produce. The majority of the sample farmers were dependent on government agencies for seed and fertilizers, whereas plant protection chemicals were being purchased from the open market because of their superior quality. Tomato production being a labour-intensive activity can provide gainful employment to the rural population. Tomato growers needed to diversify their market portfolio to realize better prices. It highlights the need to enhance efficiency of the market channel-B (Producer-W-R-C) and channel-C (Producer-Local Trader/Commission agent -W-R-C) through competition by organized marketing chains and modernizing the vegetable market system in the district, which is largely traditional and lacks modern facilities such as efficient transportation of produce and grading & standardization facilities.

The diverse agro-climatic conditions of Kullu have provided nearly unlimited scope for growing vegetable crops like pea. Thus, exploring market niches and with proper promotion activities, Kullu district can produce potential benefit provided appropriate technology and adequate infrastructure, legal and policy environment for market oriented tomato production. Short term training programmes on pest, diseases management and scientific methods of value addition and grading should be organized in the vegetable producing areas in order to enhance the skill of producers to maximize the net profit and reduce wastage of produce. There is need of producers' groups, marketing cooperatives for proper management and organization within value chain. For better disposal of vegetables, the producer-industry linkages need to be developed as pea has potential for processing.

Qualitative assessment highlighted some of the challenges faced in the value chain and explored the possibility of conservation-based activities. While adding another conservation-focused brand is potential challenging at a large scale given the relatively low-cost production technologies seems potentially viable and accessible for a range of stakeholders, particularly small producers. At the sector level, tomato requires improved institutional support through producer associations or better contractual linkages between buyers and producers with leadership and vision in the tomato value chain to integrate sustainability principles and strengthen the actors in the value chain.

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