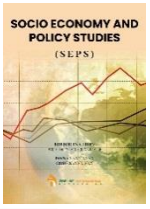
ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2785-8715 (Online)
CODEN: SEPSCJ

Socio Economy and Policy Studies (SEPS)

DOI: http://doi.org/10.26480/seps.02.2021.44.51



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RESEARCH ARTICLE

VALUE CHAIN ANALYSIS OF TOMATO IN PALPA DISTRICT OF NEPAL

Apil Chhetri[a*], Bishnu Prasad Panth[b], Diwas Poudel[c], Bibhor Gauli[d], Dipak Bhattarai[e]

[a]Scholar for Agricultural Extension and Rural Sociology, Agriculture and Forestry University, Rampur, Chitwan, Nepal
[b]Department of Agricultural Extension and Rural sociology, Institute of Agriculture and Animal Sciences, Post-Graduate Campus, Tribhuvan University, Kathmandu, Nepal
[c]Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal
[d]MBA in Agribusiness, King's College, Westcliff University
[e]Senior Agriculture Officer, Prime Minister Agriculture Modernization Project, Project Implementation Unit-Vegetable zone, Palpa
[*]Corresponding Author Email: apilchhetri555@gmail.com

ARTICLE DETAILS

Article History:

Received 01 April 2021
Accepted 03 May 2021
Available online 06 May 2021

ABSTRACT

The study was conducted from January to June 2020. This study aims at carrying out the value chain analysis of tomato subsector in Palpa district. The specific objectives of the study were identifying the actors involved in value chain of tomato, finding out benefit cost ratio, marketing margin, producer share and value share of value chain actors, preparing value chain map of tomatoes and identifying the key strength, weakness, opportunities, and threats at different nodes of tomato value chain. Data were collected from primary and secondary sources. Primary data was collected by household interview, KII and secondary data was collected through published journals, research articles, reports of PMAMP, AKC and other government organizations. Data analysis was done using SPSS, Ms-Excel, and Stata statistical software. Data were analysed using descriptive statistics, benefit cost ratio, Cobb-Douglas production function, correlation analysis and value chain mapping. The opportunities and challenges in tomato value chain was achieved using strength, weakness, opportunities and threats (SWOT) analysis. From the study it was found that economically active population was 60.9% and majority of tomato growers (69.2%) has agriculture as their primary occupation. The average farm size was 0.7 ha and average area for tomato farming was 0.1 ha. The average productivity of tomato of sampled household was 29Mt/ha under open field condition. The average cost of tomato production was NRs. 18.2/kg. The gross margin and net margin per ha were NRs. 394474.4 and NRs. 362014.2 respectively. Benefit cost ratio was 1.67. Market margin was NRs. 25/kg with producer's share 54.55% in the mostly used value chain. Similarly, market margin of local value chain was NRs. 15/kg with producer's share 70% in the local value chain. The result identified that the major actors involved in the value chain were input suppliers, collector/cooperatives, wholesalers, retailers and consumers. The disease/insect infestation was major problem in production while low farm-gate price was major problem in marketing in the study area. The research showed that tomato farming is an important agribusiness in the research area.

KEYWORDS

Tomato, Value chain, SWOT analysis, Benefit cost ratio, Market margin

1. INTRODUCTION

In Nepal, the economy is dominated by agriculture. In Nepal, Agriculture and Forestry sector contributes 31.27 % share in national GDP (MoALD, 2014). Among the total GDP from agriculture, horticultural commodities contribute 14% to the total AGDP and of which vegetable contributes 9.71% AGDP (MoALD, 2014). Annual Growth Rate of GDP by Agriculture and Forestry of 2076/77 (2019/20) is 2.48 (MoALD, 2020).

Nepal is rich in agricultural biodiversity. The variation in temporal, altitudinal, topographical aspects has made agricultural biodiversity (Shrestha, 2007). Palpa district lies in the mid-hill region at an altitude ranging from about 157 meters to 1936 meters above the sea level. It lies at about latitude 27o34'- 27o 57' North and longitude 83o 15'- 840 22', covers an area of 1,366 km^2. This district has climatic variation as it includes tropical areas and sub-tropical areas. The average rainfall over the year in the district is 1903 mm and 80% of the rainfall occurs from jestha to bhadra. The average maximum and minimum temperature of the district is 23oC and 14oC. Major cereals, seasonal vegetables, grain legumes and oilseed crops are cultivated in the district. Similarly fruit crops like citrus, banana, litchi, mango, pomegranate etc are prominently grown. Other than that, spices like ginger, turmeric, onion, garlic, chilli and coriander are also grown. Out of total cultivated land only 37.6% land is irrigated, out of which 32.4% is seasonally irrigated or rainfed and only 5.2% is artificially irrigated all year round (PMAMP, 2019). Majority of farmers in Palpa grow vegetables. PMAMP has started vegetable zone in the district. In the year 2018/19, the area and production of vegetables in Palpa district was recorded to be 2,091 ha and 33,705 Mt, respectively with the yield of 16.12 Mt/ha (MoALD, 2020).

Vegetables provide nutrients vital for health and maintenance of body. Most vegetables are naturally low in fat and calories. Vegetables are important source of many nutrients, including potassium, dietary fibre, folate (folic acid), vitamin A and vitamin C. Nepal's demand for vegetables is increasing day by day due to population growth, economic progress and urbanization. In Nepal, vegetable production is the primary occupation for

Quick Response Code	Access this article online	
	Website: www.seps.com.my	DOI: 10.26480/seps.02.2021.44.51

Cite The Article: Apil Chhetri, Bishnu Prasad Panth, Diwas Poudel, Bibhor Gauli, Dipak Bhattarai (2021). Value Chain Analysis of Tomato in Palpa District of Nepal. *Socio Economy and Policy Studies, 1(2): 44-51.*

most people who are mostly small holders earning low income. Due to high production of vegetables, it directly helps in the poverty alleviation. Thus, vegetable cultivation can help farm families' raises their income level (EAD, 1991). The areas under the tomato crop and number of farmers growing tomato have been increasing to generate high income as compared to cereal and other annual crops (Bhudhathoki, 2001). Vegetable cultivation makes more effective use of land and labour.

Tomato *(Lycopersicon esculentum)* is the important and widely cultivated vegetables in world. It was originated in the Central and South America (Thompson & Kelly, 1957). The tomato is consumed in diverse ways, raw or cooked, in many dishes, sauces, salads and drinks. Tomatoes are rich in natural vitamins and vitamins. It also has folate, iron, potassium, magnesium, chromium, choline, zinc and phosphorus. It constitutes an important source of antioxidant compounds. Tomato is cultivated mainly as a cash crop. It is believed that there are around 7500 varieties of tomatoes in the world.

Tomato is one of the important vegetables in Nepal. In Nepal, it is cultivated during Autumn-winter in Terai, inner Terai and foot hills. In the mid hills, it can be produced in two season spring and rainy season. Tomato production inside the plastic house during rainy season has become quite profitable to the hill farmers due to less supply from Terai districts (Pandey, Pun, & Upadhyay, 2006). For the commercialization of agriculture sector, the government has formulated many program and policies which have not been implemented effectively. Hence, most of the farmers have been following less profitable, traditional production practices which are characterized by high cost of production, low productivity and low profitability. It is not enough just to produce a vegetable; it must be produced efficiently and marketed successfully (Singh, 2005). In the Mid-hill of Nepal, Planting season of tomato cultivation in open field condition in main season is August – February (Paudel & Adhikari, 2018).

The "value chain" is a refined term after the term "commodity chain" was used in 1977 (Broeder, 2018). Value chain is the full range of activities that includes design, production, marketing and distribution. . It is a sequence of productive processes from the provision of specific inputs for a particular product to primary production, transformation, marketing and distribution, and final consumption (Amatya, 2009). It is simply to bring a product or service from conception to delivery. The complex marketing of tomato is because of perishability and seasonality (Gandhi & Namboodiri, 2004). Agriculture marketing system comprises wide range of activities and mechanism of transferring the products from one hand to another (Ellis, 1996). A well developed and efficient marketing system fosters and provides leverage to the overall growth and development of an economy by facilitating optimal mix and planning and its efficient distribution (Gurung, Subedi, Acharya, G.C., & Gurung, 1996). Different problems related to production like disease, lack of quality inputs, lack of technical knowledge and marketing problems like lack of market information, competition with Indian tomato lowers farmer price (PACT, 2014). Adcock, Halborg, & Ross (2001) states marketing as "The right product, in the right place, at the right time and at the right price".

Agriculture needs diversification and commercialization for sustainable development by identifying high value low volume crops, which have comparative advantage (Gautam, 1995). The government has formulated many program and policies for the commercialization of agriculture sector. Agriculture Development Strategy (ADS) aims to improve food self-sufficiency and reduce poverty through commercialization. The Prime Minister Agriculture Modernization Project (2073) has the vision to increase the production and productivity of agriculture sector through mechanization in agriculture, availability of required technology and production materials and development of essential infrastructure for processing and marketing of agricultural products. But still our Nepalese agricultural growth is constrained by poor infrastructures, weak institutions, and inadequate technical support for commercialization and value chain development. For mitigating such constraints, necessary interventions should be done studying value chain of agricultural commodities.

2. METHODOLOGY

2.1 Study Area

The site of study was Parbhas, Madanpokhara and Bartung area of Tansen municipality which is working area of PMAMP vegetable zone Palpa and involved in production and marketing of tomato. The study area was selected purposively based on level of production, access to road facility, number of tomatoes growing farmer and market distance. Butwal vegetable wholesale market and Tansen vegetable wholesale market was also taken for the study purpose. Different area's agrovets, wholesale and retail vegetable shop of the district were selected by purposively random sampling technique.

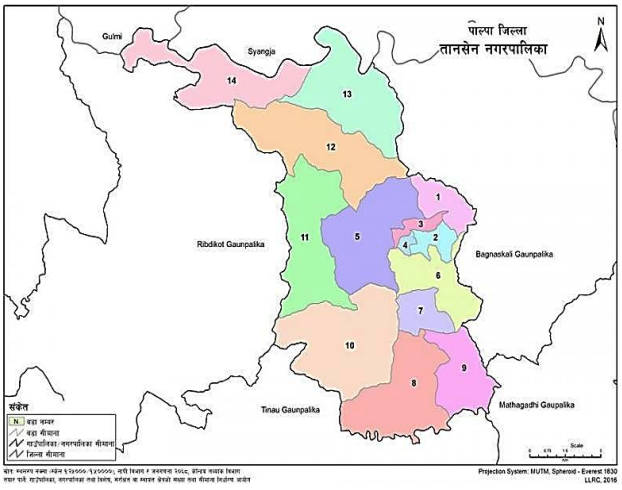

Figure 1: Map of Tansen Municipality of Palpa district showing study sites

2.2 Sampling site and Sampling procedure

The 65 tomato producers of Tansen municipality area were selected as sample for the survey. 10 input suppliers from Tansen municipality,10 Wholesalers, 10 Retailers and 2 Cooperatives were selected in study area for the study of marketing and value chain of tomato. 10 consumers were also interviewed in study area.

2.3 Sources of data

Primary data were obtained from tomato growers, traders, wholesalers, retailers, consumer and input supplier. Secondary data were collected through different publication about tomato production and marketing from different institution and organization like Nepal Agriculture Research Council (NARC), Bureau of Statistics (CBS), Agriculture Knowledge Centre (AKC), various NGOs and INGOs.

2.4 Techniques of data analysis

Primary and Secondary information were coded, tabulated and analysed using Stata and Microsoft Excel.

2.5 Economic analysis

2.5.1 Gross margin analysis

Gross margin is the difference between gross return and total variable cost incurred. In this analysis, gross margin was calculated taking variable cost like seed cost, fertilizer cost, pesticide cost, micronutrient cost, irrigation cost, staking cost, human labour cost and power use cost incurred during tomato production.

Mathematically, GM = GR - VC

Where, GM = gross margin (NRs)

GR = gross revenue (NRs)

VC = variable cost (NRs)

Similarly, net margin was also calculated by subtracting total cost from total revenue. Total cost was a combination of variable cost and fixed cost.

Mathematically, NM= GR-TC

Where, NM= Net Margin (NRs.)

GR= Gross Revenue (NRs.)

TC= Total Cost (NRs.)

2.5.2 Benefit Cost ratio Analysis

Benefit cost ratio is the ratio between gross return and total cost incurred. Cost of production was calculated by summing all the variable cost items and fixed cost items in the production process in open field condition of

one main season. For calculating gross return, income from product sale was accounted. Benefit cost analysis was calculated by using formula.

$$B/C \text{ ratio} = \text{Gross return/total cost}$$

Where,

Gross return = total quantity of tomato sold* average price

Total cost = Seed cost + fertilizer cost + labour cost + staking & mulching cost + irrigation cost + power use cost + plant protection cost + Land Rent

2.5.3 Analysis of factor affecting gross return of tomato production

Gross income may be affected by seed cost, fertilizer cost (Urea, DAP, Potash cum Zinc and Boron), power use cost, labour cost, plant protection cost (pesticide cum PGR cost) and management cost (irrigation cum staking and mulching cost), incurred during production of tomato. Cobb-Douglas type of production function was used to know the factor affecting the gross income of tomato production. The model specified and used was represented by

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}X_6^{b6}e^u$$

Above equation was linearized into logarithmic form, which is expressed as,

$$\text{Log } Y = \text{Log } a + b_1 \text{Log } X_1 + b_2 \text{Log } X_2 + b_3 \text{Log } X_3 + b_4 \text{Log } X_4 + b_5 \text{Log } X_5 + b_6 \text{Log } X_6 + u$$

Where, Y= Gross income from tomato production (NRs.)

a = Constant

X_1 = Seed cost (NRs.)

X_2 = fertilizer cost (NRs.)

X_3 = Power use cost (NRs.)

X_4 = Labour cost (NRs.)

X_5 = Plant protection cost (NRs.)

X_6 = Management cost (NRs.)

E = Base of natural logarithm (NRs.)

u = Error term

b_1, b_2, b_3, b_4, $b_5$and b_6 are the coefficients for seed cost, fertilizer cost, power use cost, labour cost, plant protection cost and management cost, respectively. Gross income was the dependent variable in production function whereas seed cost, Fertilizer cost, Plant protection cost (pesticide cum PGR cost), management cost (irrigation cum staking and mulching cost), human labour cost and power use cost were the independent variables. Labour cost was obtained by adding different costs incurred from cultivation to harvesting of tomato. All the costs were average cost per sampled household and were expressed in rupees (NRs.).

2.5.4 Analysis of Correlation between cost variables and gross income

The correlation of different variable cost for production of tomato i.e. seed cost, nutrient cost (fertilizer cum micronutrient), Plant protection cost, irrigation cum staking & mulching cost, human labour cost power use cross with gross income obtained from tomato production in the study area was also analysed.

2.5.5 Value chain analysis

This section includes value chain mapping, analysis of marketing channel, marketing margin, producer's share, value share of each value chain actors, problems in tomato production & marketing and SWOT analysis of tomato production and marketing in the study area.

2.6 Value chain mapping

Value chain mapping is defined as the relationship and interaction among the value chain actors (FIAS, 2007). To make a value chain map, the function such as input supply, production, collection, trading etc were also described.

2.7 Marketing margin and Producer's share

The difference between the farm-gate price and retailer's price is marketing margin which was calculated as below:

Marketing margin = Retailer's price – Farm-gate price

Producer' s share is the price received by farmer expressed as the percentage of retail price that is price paid by consumer. It can be calculated by using following formula:

Producer's share = (Producer's price/ Retailer's price)*10

2.8 Index of production and marketing problem

Indexing is a tool to analyse respondent's perception by using scaling technique. Farmer's perception on production and marketing problem of tomato can be analysed by using five scale value of 1, 0.8, 0.6, 0.4 and 0.2 comprising most serious, serious, moderate, little bit and the least serious problem.

The index of severity/importance was calculated using the following formula;

$$I = \Sigma(S_i f_i/N)$$

Where,

I = index of severity/importance

Σ = summation

S_i = scale value of i^{th} severity/importance

f_i= frequency of severity/importance

N = total number of respondents

2.9 SWOT Analysis

The strength, weakness, opportunities and threat related to tomato subsector were analysed from the group discussion, interview and key informants. SWOT analysis was done at production and marketing level of tomato. Information thus obtained from different actors in value chain was used in SWOT analysis.

3. Results and Discussion

3.1 Socio-economic characteristics of respondents

Out of the total respondents, 70.8% were male. This shows that the households in the study area was male dominated where male runs the farm activities. Female have less knowledge regarding financial and management aspects of the farm. Majority (64.6%) of the respondents belonged to age group 36-54. The total population of 65 sampled households was found 348 with 49.4% male and 50.6% female which was also higher than national (48.50%) and Palpa district (44.4%) average (CBS, 2018). The average family size of the study area was 5.4, which was higher than that of national (4.88) and Palpa (4.41) average family size in 2011 (CBS, 2011). In the study area, majority of respondents were Brahmin/Chhetri (63.1%) followed by Janajatis (26.2) and Dalits (10.8%). The majority (48.36%) of the farmers had over 10 years of experience in tomato farming followed by 43.15% had 5-10 years of experience and 8.49% had less than 5 years' experience. From the study, the average land holding of the household was found to be 0.7 ha. It was also found that average area under tomato cultivation was 0.1 ha. According to the respondent, the varieties of tomato grown were Srijana, Allrounder, Manisha, Amita, Ansari, Himsona and Ruchi. Some of the farmers grew more than one varieties but the most grown varieties was Srijana (40%) in the study area. Abinash, Allrounder, Trishul, Srijana, Shamjhana, Dhanalaxmi Indira, Roma, Pusa Ruby, NBL-1, and others are common varieties of tomato grown in Nepal (Bhandari, Bhattarai, & Aryal, 2016).

3.2 Economics of tomato production

This section includes cost of production, gross return, gross margin, marketing margin, benefit cost ratio, factors affecting gross revenue and correlation of production cost variables with gross revenue of tomato production.

The study revealed that the average cost of tomato production was NRs. 534998.3 per ha under open field condition. Per hectare total variable and fixed cost incurred was NRs. 502538.1 and NRs. 32460.2 respectively under open field condition. The average production of the tomato was 28,750.4kg/ha. The highest cost in average variable cost was staking which contribute about 39.5 percentage of the total production and followed by human labour (22.4%). The cost of the production per kg of tomato produced was Rs.18.2.

Table 1: Average cost of tomato production per hectare in the study area

Description	Average cost of production (Rs. /ha)	Contribution of total average cost (%)
Variable Cost		
Human Labour	119663.6	22.4
Power use	20128.9	3.8
Seed	23376.1	4.4
Urea	1999.9	0.4
DAP	6364.9	1.2
Potash	1886.4	0.3
Manure	62107.1	11.6
Micronutrients (Zinc & Boron)	2246.7	0.4
Staking	211432.4	39.5
Mulching	9761.9	1.8
Irrigation	6046.1	1.1
Pesticides & PGR	37524.1	7.01
Total Variable cost	502538.1	93.9
Fixed cost		
Land Rent	32460.2	6.1
Total Fixed cost	32460.2	6.1
Total cost (Rs)	534998.3	100
Average production (kg/ha)	28,750.4	
Cost of production (Rs/kg)	18.2	

The average gross revenue was NRs. 897012.5 per hectare. The results showed that total cost of production per ha was NRs. 534998.3 where the total variable cost per ha was NRs. 502538.1. The average gross margin and net income were NRs. 394474.4 and NRs. 362014.2 respectively. The benefit cost ratio analysis showed that the tomato cultivation was profitable with the B/C ratio greater than 1, i.e. 1.67.

Table 2: Economic indicator of tomato production growing under open field condition

Measuring criteria	**Average value**
Total variable cost(Rs/ha)	502538.1
Total Fixed cost(Rs./ha)	32460.2
Total cost (Rs./ha)	534998.3
Production (kg/ha)	28,750.4
Average price (Rs./kg)	31.2
Gross revenue (Rs./ha)	897012.5
Gross margin(Rs./ha)	394474.4
Net income (Rs./ha)	362014.2
Benefit-cost ratio	1.67

3.3 Factor affecting gross income of farmer

A Cobb-Douglas production function was run based on the cross-sectional data to find out the effects of different factors on gross income of tomato farming in the study area. The explanatory variables included in the models were seed cost, Fertilizer cost, Plant protection cost (pesticide cum PGR cost), management cost (irrigation cum staking and mulching cost), human labour cost and power use cost incurred during tomato production.

Coefficient of multiple determination (R^2) is a summary measure which tells how well the sample regression line fits the data. The explanatory power of the model showed that the model was best fit as the R^2 value obtained was 0.865. It means 86.5% variation is explained by the variable present in the model. The value of adjusted R^2 was 0.851 indicating that after considering the degree of freedom (df) 85.1% of the variation in the dependent variable explained by the explanatory variables included in the model. The measures of the overall significance of the estimated regression F value was 62.25 which was significant at 1% level, so that we can say the model was best fit. The estimated coefficient for fertilizer cost showed no significant effect on the gross income from tomato production.

The seed cost and management cost showed high significant effect at 1% level of significance whereas plant protection cost showed significance effect at 5% level of significance on gross income of household from tomato production. The regression coefficient for seed cost and management cost were 0.258 and 0.457 which had depicted that with 100% increase in seed and management, gross income could be increased by 25.8% and 45.7% respectively. Likewise, other inputs used in tomato production namely plant protection cost could increase the gross return by about 20.4% with the increase in their use by 100%.

The regression output obtained for gross income from tomato production is presented in Table 3.

Table 3: Regression estimates for factors affecting gross income of tomato growers

Variables	Estimated Coefficients	Standard Error	t-value	P-value
Constant	1.771***	0.560	3.16	0.003
Seed cost (NRs.)	0.258***	0.069	3.73	0.000
Fertilizer cost (NRs.)	-0.036	0.081	-0.44	0.661
Power use cost (NRs.)	0.076	0.105	0.72	0.473
Labour cost (NRs.)	0.113	0.167	0.68	0.500
Plant protection cost (NRs.)	0.204*	0.113	1.80	0.077
Management cost (NRs.)	0.457***	0.139	3.28	0.002
F value	62.25***			0.000
R^2	0.865			
Adjusted R^2	0.851			
Return to scale	0.536			

Note: ***, ** and * refers to significant at 0.01, 0.05 and 0.10 level of significance respectively.

3.4 Correlation between variable cost and gross income

The result showed that, seed cost, fertilizer cost, power use cost, labour cost, plant protection cost and management cost were highly correlated with gross income obtained from tomato production in the study area as shown in Table 4.

Table 4: Correlation results between cost variables and gross income from tomato production

Variables	Gross income
Seed cost (NRs.)	0.817
Fertilizer cost (NRs.)	0.759
Power use cost (NRs.)	0.861
Labor cost (NRs.)	0.907
Plant protection cost (NRs.)	0.772
Management cost (NRs.)	0.896

3.5 Value chain analysis

This section deals with value chain mapping, analysis of marketing channel, marketing margin, producer share, value share of each value chain actors, problems in production and marketing and SWOT analysis of tomato production and marketing in the study area. Hence, value chain analysis is needed to understand the dynamics of how demand was changing at both domestic and international markets, and the implications for value chain organization and performance (Anandajayasekaram & Gebremedhin, 2009).

3.6 Value addition

Value adding activities were not found in the survey area. Very few farmers processed fresh tomato as pickles and dried tomato locally for domestic consumption during peak production season. Bigger processing units were not still emerged in the area.

3.7 Value chain mapping

Value chain involved the three components, namely functions, actors and enabling environment. The function includes the process with which the products delivered from its origin to the end users. Actors are those who were involved in the transfer of products and enabling environment indicates the rules and regulations, infrastructure and regulatory bodies which were in the favour of business enabling. The map was sketched to illustrate the function involved in the production and marketing of tomato well as the relationship among all actors in the value chain which is presented in Figure 2.

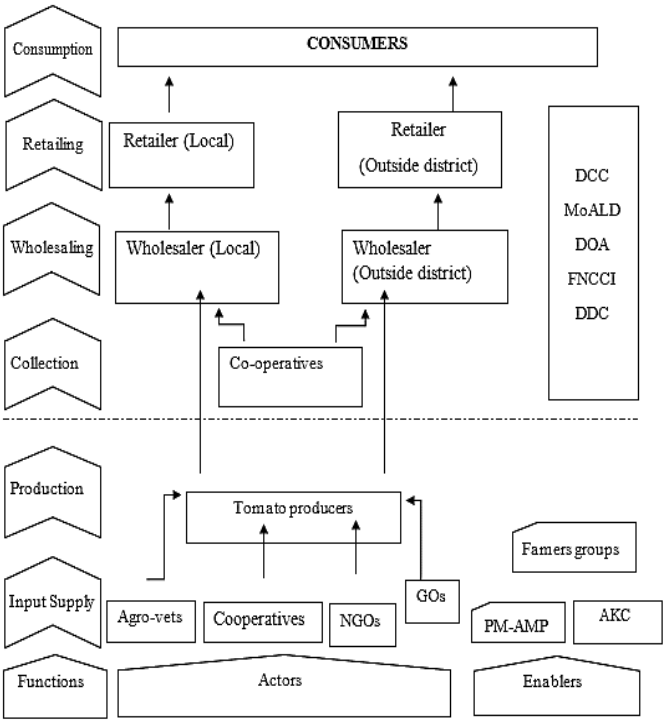

Figure 2: Linkage and flow of tomato value chain in study area

3.8 Function

The main function of the value chain analysis was the input supply for the tomato production. The input supply may be seeds, fertilizers, pesticides etc. that was provided by the nearby agro-vets, GOs, AKC, PMAMP. Collection is the function after production which was done by local collectors and traders in study area Co-operative also plays role in collection and trading. The function like cleaning, processing was not effectively done in local markets. Market chain includes all levels of the market (assembly, wholesale and retail) and actors that have a role in the distribution and transformation of a commodity (Vorst, Silva, & JH, 2007).

3.9 Actors involved in value chain

Actors are those who are directly involved in the dealing of the product. In Palpa, the input supplier, producers, wholesalers, retailer and consumers are the actors involved in value chain. Value chain actors, supporters and influencers has identified as three important levels of value chain (Bammann, 2007).

3.9.1 Input suppliers

Input suppliers play important role in production of tomato. The quality of seed, fertilizer dose, plant protection measures and their cost and staking decide the fate of tomato production. The major input suppliers of tomato production in the area were agrovets. Tomato growers obtained input supplies and valuable information regarding cultivation from agrovets. Other input suppliers were AKC, PMAMP, GOs and other non-government organizations in the area. These organizations supplied inputs on various schemes of subsidies and technical assistance. Majority of Farmer used hybrid seeds Srijana.

3.9.2 Producers

Producers are the farmers who grow tomato for the purpose of income and household consumption in the study area.They obtained the necessary input from the input supplier. The produced tomatoes are sold to the local traders (wholesalers and retailers) or directly to the consumers. Most of the producers cultivate tomato with local input. Most farmers used homemade manure only.

3.9.3 Cooperatives

Co-operative also acts as collector for trading of tomato further. Cooperatives are centre of collection of produce which played only facilitating role in input supply and marketing of produce.

3.9.4 Wholesalers

The wholesalers were found active in the peak period in Butwal and Galyang market carrying tomato from Madanpokhara to Butwal. They were involved in buying of tomato from district level wholesalers or directly from producer's cooperatives and farmer's group of the district and selling to retailers, hotels, and institutional users within the district. The market price was fixed by wholesalers.

3.9.5 Retailers

Retailers are those actors who collect the product from the wholesaler and sold to the consumer. The retailers are directly connected with the consumer, so it is important to know about the market demand and consumer preference. Retailers were the major traders of the area. The retailers of the area were thus focused on selling Local vegetables rather than importing it from the plains.

3.9.6 Consumers

Consumers are the ultimate price bearers. The consumers of the area were found to be paying higher price for the tomato due to the high market margin at farm-gate as well as retailers' level. The major portion of the production was reached to the consumer of Tansen, Parbhas, Bartung and little outside the district namely Butwal. They are individual households and large consumers like restaurants, hotels. They bought tomato for their household consumption.

3.10 Enablers and Facilitators

Enablers and facilitators are those parties who support the activities in the value chain one way or the another. The support may be technical help regarding production, innovative technologies dissemination or marketing aids. The main enablers and facilitators were:

3.11 Agriculture Knowledge Centre, Palpa

AKC, Palpa was found to be providing various support services to the farmers. Major activities of DADO included technical assistance during tomato production, distribution of high yielding seeds, support on agricultural machineries and providing trainings and visits. AKC also had been promoting farmers' group formation and cooperative farming.

3.12 PMAMP, PIU, Vegetable Zone, Palpa

The vegetables zone which is a PIU of PMAMP was found effective in helping the farmers. It provides farmers with vegetable cultivation training, inputs like seed, fertilizers, and machineries at subsidies. It works specifically on vegetables sector and provides technical help to farmers at field level.

3.13 Marketing channel, Marketing margin and Producer's share

Marketing margin indicates the efficiency of marketing cost (Acharya & Agrawal, 1999). Marketing margin is defined as the difference between the price paid by consumers and that obtained by consumers (Tomek & Robinson, 1981). The tomatoes from study area were found to be reaching Butwal through the cooperatives and wholesalers at the peak season. 55 percent and 30 percent of the tomato were sold to wholesalers and retailers respectively while 7 percent and 8 percent were sold to cooperatives and consumers respectively. There are four types of marketing channel to deliver tomato from farm to consumer. The market channel involved is shown in figure 3.

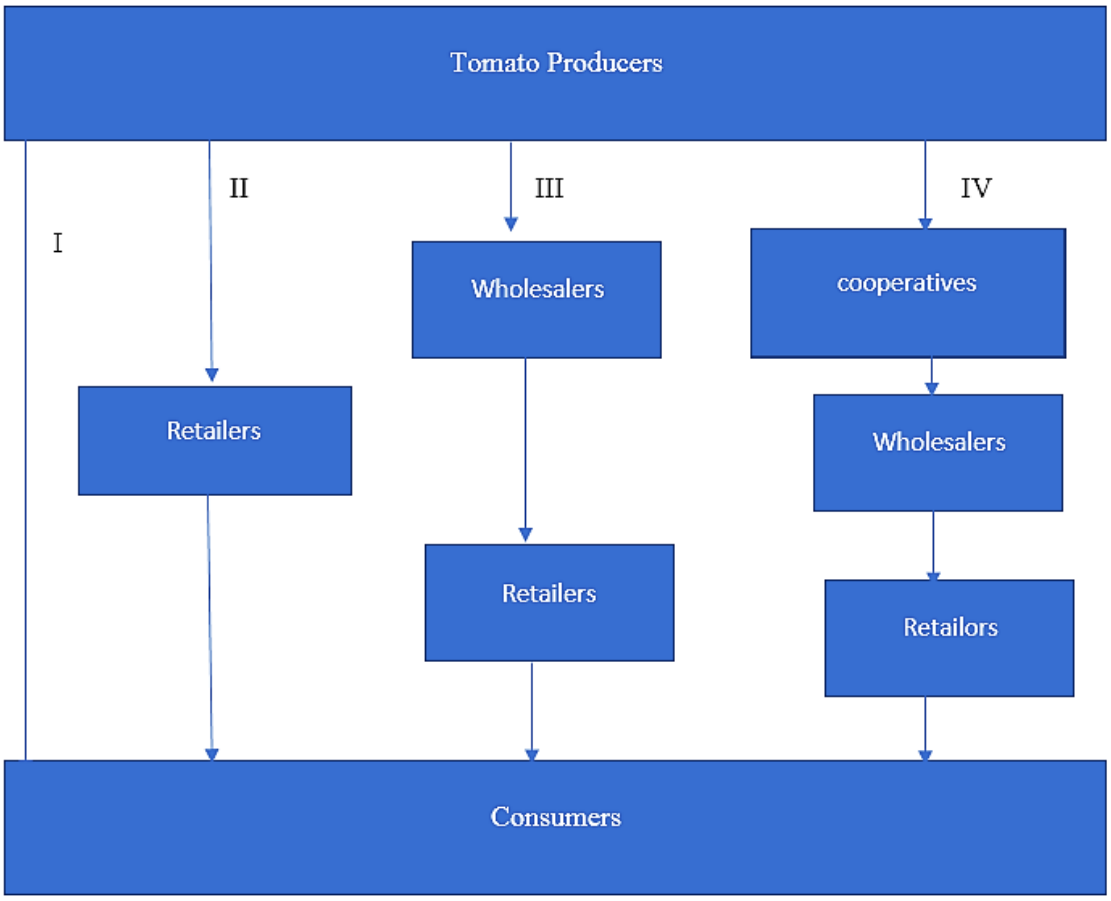

Figure 3: Marketing channels of tomato in the study area

Cooperatives were centre of collection of produce which played only facilitating role in input supply and marketing of produce and accounted the net margin of NRs. 0.25/kg.In the marketing channel III, which was the mostly used value chain, producers' share for tomato was thus calculated to be 54.55 percent and market margin was calculated to be NRs 25/kg. The higher market margin indicates towards higher demand and lesser supply of tomato in the study area. The major portion of the consumers' price goes on pocket of retailers due to higher margin (Subedi, Sharma, & Bista, 1993). Similarly, in the marketing channel II (local value chain), producer's share was 70 percent and market margin was NRs. 15/kg. In the marketing channel I, producer's share was 100 percent as there was no middle man. The efficiency of marketing is crucial in determining the profits from the products (Hugar & Hiremoth, 1984). The inefficient marketing system may hamper the producer in getting remunerative return (Abbas, Mahmood, & Saadullah, 2007). According to modern concept, marketing system is system which includes producers, traders, transporters, wholesalers, retailers and consumers as the main actors for carrying out different activities (Sindhu, 2001).

3.14 Production problems

The most common problems of tomato production were identified through direct field observation and KIS. The problems were disease/insect infestation, lack of irrigation, lack of quality inputs, natural hazards, and input/labour shortage. The result obtained from indexing showed that diseases/insect infestation is the most severe problem in tomato production. The most prevalent diseases were virus disease, late and early blight, damping off and root rot, similarly insect pests such as hairy caterpillar, leaf minor, borer and fruit fly of tomato. The second ranked problem was found to be lack of quality inputs. The quality seeds, fertilizers and pesticides were not distributed to the farmers. Similarly, the third major problem was lack of irrigation whereas occurrence of natural hazards like heavy rain, hailstones, landslide was seen to be the fourth major problem followed by fifth major problem shortage of input and labour. Farmer ranked low farm gate price of tomato as their most important problem (Issahaku, 2012).

3.15 Marketing problems

The most common problems of tomato marketing were identified through KIS. The problems of the sample farmer in the study area were low farm-gate price, lack of processing facility, lack of storage facility, poor transportation, and lack of market knowledge. The most severe problem in the marketing was found to be the low farm-gate price. Local trader who are dominant and have principal role in price fixation. Lack of processing unit was the second major problem in the marketing. Farmers were deprived from value addition of tomato. Similarly, lack of storage facility, poor transportation and lack of market knowledge were ranked third, fourth and fifth respectively.

Table 5: Production problems of tomato producers in the study area

Production problem	Level of problems					Total	Weightage	Index	Rank
	1	0.8	0.6	0.4	0.2				
Disease/insect/pest problem	44	21	0	0	0	65	61.1	0.94	I
Lack of quality inputs	21	42	2	0	0	65	55.9	0.85	II
Lack of irrigation	0	2	43	16	4	65	34.45	0.53	III
Natural hazards (flood, hailstone)	0	0	20	33	12	65	27.3	0.42	IV
Inputs and labor shortage	0	0	0	16	49	65	16.25	0.25	V

Table 6: Marketing problems of tomato producers in the study area

Marketing problem	Level of problems					Total	Weightage	Index	Rank
	1	0.8	0.6	0.4	0.2				
Low farm-price	33	25	7	0	0	65	57.2	0.88	I
Lack of Processing units	23	26	9	2	5	65	50.7	0.78	II
Low storage facilities	0	10	34	14	7	65	35.1	0.54	III
Poor transportation	7	3	12	31	12	65	31.2	0.48	IV
Lack of market knowledge	2	1	4	19	39	65	20.8	0.32	V

3.16 SWOT analysis

Tomato production and marketing sector in the study site has following strength, weakness, opportunity and threats.

Table 7: SWOT analysis of tomato farming in Palpa district

Strength

Production

- Suitable Climate.
- Major sources of income to small farmers
- Comparative advantage over cereals and other vegetables
- Quality inputs easily available

Marketing

- Farmers establishing strong linkage with retailers
- Farmers aware about grading in two category and proper packaging.
- Nearby local market.

Weakness

Production

- Lack of technical knowledge
- Inadequate technology in production
- High cost of input like fertilizers, pesticide
- Lack of improved variety

Marketing

- Lack of market information
- No storage facility
- No processing facility
- Transportation problems on rainy season.
- Unsystematic price fixation

Opportunities

Production

- Favorable agricultural policies
- Employment opportunity
- Different subsidies from government and non-government sector
- Establishment of vegetable zone by PMAMP in the district

Marketing

- Higher market demand of tomato
- Higher price and market margin in tomato due to time arrangement of tomato production based on market information
- Increasing awareness towards the consumption of the tomato
- Road access to all the farmers

Threats

Production

- Severe risk of diseases like Early blight, late blight
- Severe risk of insects like *Tutaabsoluta*
- Hailstones and heavy rain are serious threats.

Marketing

- Lack of coordination between production and marketing sector
- Inflow of low priced tomato from India
- Inadequate information on marketing
- Highly fluctuation of price.

CONCLUSIONS

Vegetable farming is an important agribusiness in Nepal which is one of the important sources of income and nutrients. The demand of vegetable is increasing day by day due to urbanization, industrialization, and population growth. The linkage among main actors should be clear and strong. All the study rea (Madanpokhara, Parbhas, Bartung) were found to be the potential production area for tomato cultivation. From the calculation of gross revenue, gross margin, net margin and B/C ratio, tomato cultivation was found to be profitable.

The study revealed that most of farmers sold their tomato to retailers and wholesalers. Various input suppliers, cooperatives/ collectors, wholesalers, retailers, and consumer were actors of value chain. Agrovets were the major input suppliers and AKC, PMAMP and other Government and Non-government organizations were the facilitators in the value chain.

Majority of farmer cultivated tomato in the small scale so there was need of high input cost, due to which the benefit cost ratio wasn't highly satisfactory. Since the tomato is highly perishable vegetable and farmer were forced to sell their product at the price fixed by the wholesalers and retailers. Farmers were only the price taker not the price maker. Wholesalers and retailers were being dominant in price fixation of tomato due to poor coordination among producers, market actors and government agencies regarding market information and price control mechanism.

The study identified various problems related to tomato cultivation. The major problem in production were disease/insect infestation followed by lack of quality inputs, poor irrigation, natural hazards, and input/labour shortage. These production problems should be solved by providing the training about improved cultivation practice, quality inputs and provision of irrigation facility. Similarly, the major problem in marketing were low farm-gate price followed by lack of processing facility, lack of storage facility, poor transportation, and lack of market knowledge. These marketing problems should be solved by grading of tomato, stabilization price of tomato and establishment of storage and processing units and proper coordination among producers, market actors and government agencies.

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