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RESEARCH ARTICLE

VALUE CHAIN ANALYSIS OF POTATO IN TOKHA MUNICIPALITY OF KATHMANDU DISTRICT, NEPAL

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ABSTRACT

The study was carried out in Tokha Municipality of Kathmandu district from April, 2020 to June, 2020 to map the value chain of potatoes and assess the productivity and profitability within the existing value chain. Altogether 50 potato producers were selected along with 5 aggregators, 5 wholesalers, 5 retailers and 10 consumers using the random purposive sampling technique. The primary data were collected through field survey, focus group discussion and key informant interviews and secondary data were obtained from various published documents. The data obtained were analyzed in MS-Excel and SPSS. The average area under potato cultivation was 2.94 ropani with a productivity of 6.96 quintals per ropani, which is slightly lower than national-wise productivity (7.48 quintals per ropani). The cost of production per ropani was NRs. 13397 while cost incurred by traders per quintal (aggregators NRs. 3470, traders NRs. 4250 and wholesalers NRs. 3571). The average gross return was NRs. 28182.28 per ropani. The producers B:C ratio was 2.13 while aggregators (3.80), retailers (3.20) and wholesalers (1.99) with the net margin NRs. 7989.58 per ropani. The producer's share on consumer's price was 72.43% and the marketing margin for aggregators, retailers, and wholesalers was NRs.570.91, NRs.800, and NRs.587.44 respectively. The problems in quality assurance among traders and higher prices among the consumers were found. Thus, potato being an important cash crop, the decision-makers should take up initiatives for strengthening the potato value chain by establishing cold storage facilities in production belts and improving subsidized credit services to value chain actors.

KEYWORDS

Value chain, Potato, Productivity, Marketing margin

1. INTRODUCTION

The very first record of potatoes in Nepal dates back to 1793 AD with an early introduction on high altitude in the Himalayas that remained as a relatively minor crop for the next 180 years. After the implementation of the National Potato Development Program (NPDP) in 1970, the quality of seed potato is improved which helps in the rapid expansion of both cultivated area and production. It increases the production of potatoes from 300000 tons in 1975 to a record of 1.97 million tons in 2006 (PotatoPro, 2019). In Nepal, potato ranks fourth after rice, maize, and wheat (Gairhe et al., 2017). It occupies the first position in terms of productivity (14.03 t/ha), second position in total production (2,805,582 Mt), and fifth position in the area of production in Nepal (Shresthaa and Yadav, 2018). In Kathmandu, potato is cultivated in 2555 ha and total production is 52681 tons with a yield of 20619 kg/ha (MoAD, 2018/19). The importance of potatoes in generating employment, improving the economic condition of farmers and entrepreneurs, and providing national nutritional security to the people is widely acknowledged.

Potato (Solanum tuberosum) is widely grown in Nepal from below 100 masl to 4000 m asl with about 100 cm in height and high starch content (Sapkota et al., 2019). Potato constitutes nearly about half of the global annual output of all root and tuber crops, popularly known as 'King of vegetables', and is a native of South America (Ravibhushana, 2016). It is widely cultivated in more than 150 countries of the world of which China accounts for more than 20% of global potato production (PotatoPro, 2019). The potato is the third most important food crop in the world after rice and wheat in terms of human consumption.

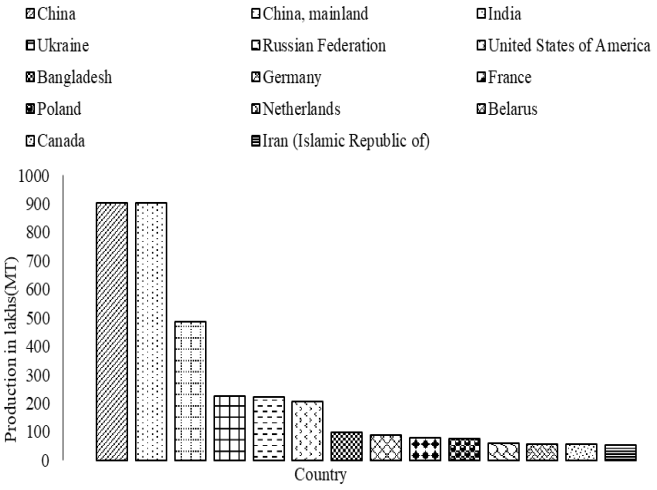

Figure 1: Major producers of potatoes in the world (Source: FAO, 2020)

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Table 1: Area, production and yield of potato in Nepal

Years	Area(ha)	Production (MT)	Yield (MT/ha)
2007	153534	1943246	12.66
2008	156737	2054817	13.11
2009	181900	2424048	13.33
2010	183542	2517696	13.72
2011	182600	2508044	13.74
2012	190250	2584301	13.58
2013	197234	2690421	13.64
2014	205725	2817512	13.70
2015	197037	2586287	13.13
2016	199971	2805582	14.03
2017	194115	2691037	13.86
2018	195268	3088000	15.81

Source: (FAO, 2020)

Table 2: Present status of potato production in Kathmandu

Years	Area (ha)	Production (MT)	Yield (kg/ha)
2011/12	2580	48010	18609
2012/13	2580	48010	18609
2013/14	2580	48010	18609
2014/15	2580	8500	3295
2015/16	910	19550	21484
2016/17	3000	19550	6517
2017/18	2994	55944	18685
2018/19	2555	52681	20619

Source: (MoAD (2011-2018))

Wider adaptability, high yield potential, and growing demand are the crucial factors for the high acceptance of the cultivation of potatoes by many smallholder farmers in Nepal (Shrestha, Adhikari and Yadav, 2018). In the present context, the potato can be considered as a strategic crop that enhances the food security and economic benefits to the country because of its ability to provide a high yield of high-quality product per unit input with a shorter crop cycle than major cereal crops like rice, maize (Tadesse and Bakala, 2018). It is one of the important food crops to address food insecurity in Nepal (Timsina and Sapkota, 2011). Many research centers, cooperatives, and private suppliers are actively engaged in the dissemination of improved varieties of potato in Nepal which is more or less helpful for national nutritional security.

Potato is rich in carbohydrates, comprising 22-24%. Moreover, it contains 2.1-2.7% protein, less than 0.5% of fat and the rest is water (Agriculture Forum, 2015). The starch and protein found in potatoes have high digestibility as compared to cereal crops and it has a high biological value of 98 which is higher than the biological value of rice and wheat (82) (Agriculture Forum, 2015). Potato contains Vit-B6 and Vit-C in an adequate amount along with other vitamins except Vit-A and Vit-E. A single medium-sized potato of 150gm provides nearly half of the daily adult requirements (Ravibhushana, 2016). It also contains minerals (Fe, Ca, P, Mg, and S). Consumption of potatoes is advantageous to the patient of gastritis, blood pressure, and anemia (Agriculture Forum, 2015). Potato has been declared as a "Food Hero" at the 7th world potato congress 2009 held at Christchurch, New Zealand (Ravibhushana, 2016).

Table 3: Consumption statistics of potato (fresh and processed) in Nepal

S.N.	Year	Consumption (Kg/Capita/year)
1	2007	60.39
2	2008	60.79
3	2009	71.65
4	2010	75.48
5	2011	75.14
6	2012	77.01
7	2013	80.56

Source: (PotatoPro, 2019)

1.1 Statement of problems

Within the valley, Bhaktapur is the zone for potato production under the PMAMP project. Besides this, potatoes are also produced in the Kathmandu district as one of the major staple food crops. But the growing demand for potatoes in the valley is not fulfilled by the potato production within the districts (KFVMDB, 2076). Various efforts have been made for improving the production and productivity of potatoes in the district but not much has been achieved. Seed supply problem on required time and amount, knowledge gap on the application of inputs, no adequate storage facility, and lack of potato processing habits are the major problems regarding the potato production and marketing in the study site.

According to the farmers in the study site, diseases and pests like red ants and late blight are the growing problems in the field. All the above-mentioned factors directly or indirectly reduce the profit margin and thus affect the value chain. It has been general mention that the vegetable growers are fetching reasonable prices. However, on the ground of higher visible prices in retail markets and without considering farm investment on the production process and intermediaries' cost on commodity transfer at various levels, the farmers claim that they are not sharing fairly on consumer's prices. Middlemen within the marketing of potatoes pay low to the farmers and exploiting them is another major problem affecting potato production.

1.2 Justification of the study

Potato is a temperate or cool-season crop that needs low temperature, low humidity, less windy, and bright sunny days. As the Kathmandu district also lies in the hilly region, the climatic condition and geographical situation also favor the production in this area. Since the site of production is very near to the large market i.e. valley, the demand for the potato directly affects the production in the Kathmandu valley. The number of intermediaries involved in the marketing channel and value chain in the valley is generally lower than that of other parts of the country. Moreover, it is a good option to uplift the economic status of farmers and move a step forward to eliminate poverty as per the Sustainable Development Goal of "No Poverty" (Khadka, 2018). This study will fulfill the leftover studies that had been carried out in past and are related to the potato. The study of the value chain helps to analyze the value chain actors, activities to be undertaken, and price addition on each step. It also provides information on the competitive advantage and existing problems and gives better suggestions for policymakers and concerned stakeholders to create a structured and competitive market.

1.3 Objectives

1.3.1 Broad objective

- To carry out the value chain assessment of the potato in Kathmandu valley.

1.3.2 Specific objectives

- To identify the actors of the potato value chain in Tokha municipality and analyze the structure of the value chain map and operational mechanism of the identified actors,
- To analyze the productivity, profitability, and marketing margin of each actor involved in the value chain,
- To identify the prospects and problems associated with potato production and marketing.

1.4 Limitation of the study

The study is based on both primary as well as secondary data. The primary data were collected from the major value chain actors of the study site through the structured questionnaire. The farmers of the study site were predominantly small and medium landholders, and they did not keep any record regarding the production, cost, and benefits, thus have provided information based on their memory. Also, the study was restricted to Tokha Municipality so the generalization of the finding may not be appropriate for the whole district. There were also time and budget limitations due to the outbreak of the Covid-19 pandemic. Thus, considering the above limitations, the results were interpreted.

2. Conceptual Framework

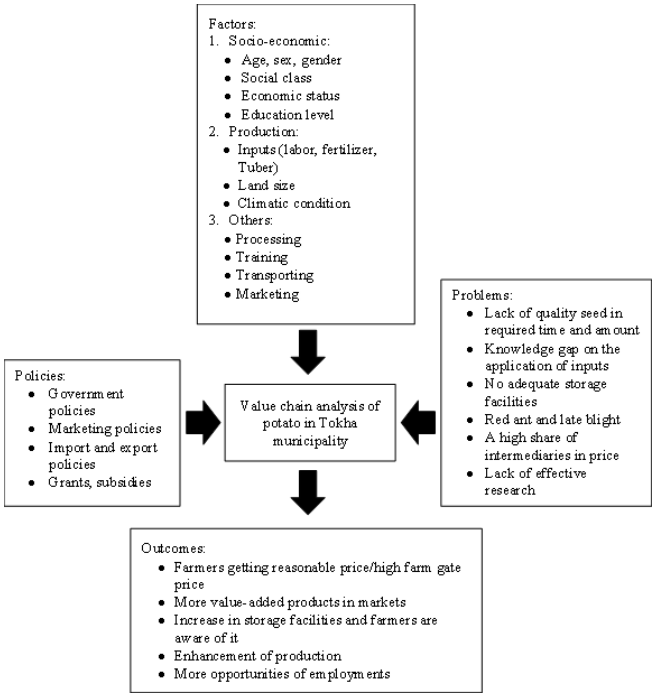

Figure 2: Conceptual framework (Source: Own study (2020)

3. Research Methodology

3.1 Study site

The study was carried out in the Tokha Municipality of Kathmandu district which covers 16.19 sq. km. with 32500 households and an overall 149,000 population (Tokha municipality office, 2019). The study site lies at 27.76 degrees N latitude and 85.33 degrees E longitude.

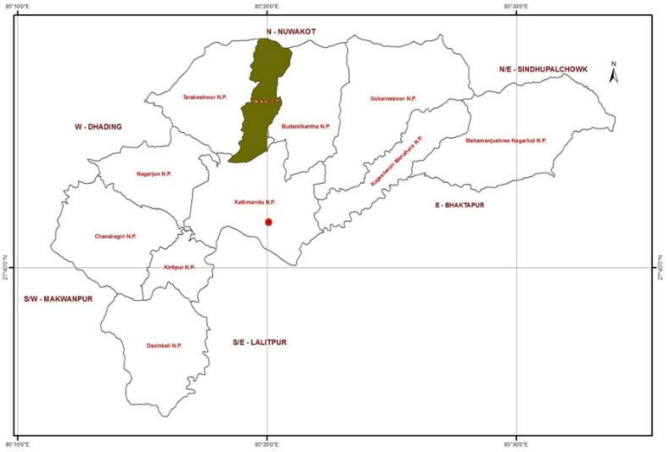

Figure 3: Map showing study site (Tokha municipality) (Source: Google (LGCDP – II)

3.2 Sample and sampling technique

It was impossible to collect the information of all farmers of the municipality since the data should be collected within a limited time with given resource constraints. Thus, all the respondents were selected using the random purposive sampling technique. Careful attention was given to make the list more inclusive (i.e. inclusion from different wealth categories, different ethnic groups, different education levels, etc.). Altogether, 50 producers, 5 aggregators, 5 retailers, 5 wholesalers and 10 consumers were selected.

3.3 Research instruments

Key informant interview (KII), Focus group discussion (FGD), field survey of respondents using the questionnaire, desk survey, stakeholders meeting, market visits, and observation were carried out as cross-sectional research instruments to collect the information.

3.3.1 Preliminary survey

A short preliminary survey was done to gain the knowledge on feasibility of the research through direct observations and informal talk with farmers and traders of the study area.

3.3.2 Pre-testing of questionnaire

Before the actual field survey, a prepared structured questionnaire was pre-tested. To test the pertinence of the questionnaire a pre-testing of the questionnaire was conducted with 4 potato producers and 2 potato traders. After some modifications, the questionnaire for potato producers, traders (aggregators, retailers, and wholesalers) and consumers were finalized.

3.3.3 Questionnaire survey

The questionnaire survey was conducted with selected 50 potato producers, 5 aggregators, 5 retailers, 5 wholesalers and 10 consumers who were selected by using the random purposive sampling technique, and required information was collected.

3.3.4 Key informant interview

Some key informants were interviewed with an unstructured questionnaire and both quantitative and qualitative information were gathered regarding the situation of production and marketing of potato, availability of different facilities, government policies and programs, challenges, and the relationship between the actors.

3.3.5 Focus group discussion

A short focus group discussion was held at the study site with some farmers to understand the problems they had faced in the production and marketing of potatoes.

3.4 Data and Data type

Both primary and secondary data/information was collected during the research study. Primary data were obtained from all the actors of the value chain such as input suppliers (agro vets, NARC, etc.), producers (small and large-scale farmers), traders (local, district, and regional traders), service providers (agricultural officers, JTAs, etc.), wholesalers, retailers, and key informants of related sectors. Primary data were collected by using KII, FGD, survey, market visits, and observation. Secondary data were obtained by desk survey (different articles, reports, journals, websites, internet materials), library study (different books, newspapers), data from MOAD, NPDP, FAOSTAT, Agriculture Knowledge Center (AKC), different I/NGOs, and other similar organization currently working or had worked on similar tasks were consulted.

3.5 Data analysis

All the obtained data from the research will be systematically arranged, entered, and analyzed with the help of MS-Excel and Statistical Package for Social Sciences (SPSS).

3.6 Economic analysis

3.6.1 Cost of production

The cost of production includes the cost of all resources that went into making it such as own/lease land, land preparation, seed, irrigation, fertilizers, weeding, earthing-up, pesticides, harvesting, and post-harvesting activities (Khadka, 2018).

Cost of production= $\sum$ cost on all items

3.6.2 Gross return

It is the product of total quantity marketed (quintal) and price per unit of potato (NRs.) (Khadka, 2018).

Gross return= (Total quantity marketed (quintal) × Price per unit (NRs.)

3.6.3 Gross margin

It is the difference between gross return and variable cost of production incurred (Gujrati, 2003) i.e.

Gross margin= (Gross return – Total variable cost)

3.6.4 Benefit-cost (B:C) ratio

A benefit-cost ratio (BCR) is used in cost-benefit analysis which attempts to summarize the overall value for money of a project or proposal. BCR ratio is the ratio of the benefits of a project or proposal, relative to its costs, both expressed in monetary terms (Hayes, 2020). Higher the BCR, the better the investment and to be a profitable business the BCR should be greater than 1.

It is calculated as,

$$\frac{B}{C}\text{ ratio} = \frac{\text{Gross return}}{\text{Total variable cost}}$$

3.6.5 Marketing cost

Marketing cost is the cost which is associated with delivering the goods to the end market. It includes costs incurred in grading, packaging/packing, loading/unloading, transportation, storage (Kohls and Uhl, 1985).

3.6.6 Marketing margin

It is the difference between the average sale price and the purchase price (Amgai et al., 2015).

Marketing margin= (Sale price − purchase price)

3.6.7 Producer's share

Producer's share is the ratio of farm gate price to retail price expressed in percentage (Colman and Young, 1989). The share of other actors of the value chain on retail price was calculated accordingly.

$$\text{Producer's share} = \frac{\text{Price received by Farmers}}{\text{The price paid by Consumers}} \times 100$$

3.6.8 Value share

It is the ratio of value-added to the final price expressed in percentage (Chaudhary, 2010). i.e.

$$\text{Value share} = \frac{\text{Value-added}}{\text{Final price}} \times 100$$

3.6.9 Price spread

It is the difference between the price paid by consumers and the price received by producers (Khadka, 2018). In our study, it exhibits the marketing charges. The formula can be expressed as,

Price spread= (Retail price – farm gate price)

3.6.10 Value chain of potato

The value chain shows the major actors and activities involved from production to trading and consumption in a sequential manner (Kaplinsky and Morris, 2000). Value addition on potato occurs at each step of the chain.

3.6.11 Indexing

Indexing is a technique to analyze respondent's perceptions by using the scaling technique (Subedi et al., 2019). Trader's problems were analyzed using the indexing technique. The index of importance or severity can be expressed as,

$$I = \sum Si \times fi/N$$

Where

I = Indexing of importance/severity

Si = Scaling value at i^{th} severity/importance

fi = Frequency of i^{th} severity given by respondents

N = Total number of respondents

3.7 SWOT Analysis

SWOT (Strength, Weakness, Opportunity, Threats) analysis is a strategic planning technique, which helps to identify strengths, weaknesses, opportunities, and threats related to business competition or project planning (Shrestha et al., 2018). It is intended to identify the internal and external factors that are favorable and unfavorable to the project.

4. Result and Discussion

This section deals with results obtained through the data analysis which were derived from the data acquired throughout the survey period and a discussion on the result obtained.

4.1 Socioeconomic and demographic profile of producers

4.1.1 Age and gender distribution of respondents

Age is one of the demographic factors that are useful to describe respondents' experience and networking. The study revealed that the average age of respondents was 43.14 years with a maximum of 64 years and a minimum of 28 years. Concerning gender, 68 % of the respondents were male and only 32 % of respondents were female. The average age of male respondents was 44.76 years and that of female respondents was 39.69 years (Table 4).

Table 4: Age and gender distribution of respondents

Characteristics	Maximum	Minimum	Mean ± SD
Male (n=34, 68%)	64	30	44.76 ± 8.721
Female (n=16, 32%)	55	28	39.69 ± 7.534
Total (n=50)	64	28	43.14 ± 8.621

Note: SD means standard deviation

Source: Field survey (2020)

4.1.2 Ethnicity and religion of respondents

Concerning ethnicity, the majority of the respondents were Brahmin (70%) followed by Janajati (26%) and Chhetri (6%). Similarly, in the case of religion, the majority of respondents were Hindu (96%) followed by Catholic (4%). The ethnic and religious composition of the sampled households is shown in table 5.

Table 5: Ethnicity and religion of respondents

Categories	Frequency (n=50)	Percent
Ethnicity		
Brahmin	35	70
Chhetri	2	4
Janajati	13	26
Total	50	100
Religion		
Hindu	48	96
Catholic	2	4
Total	50	100

Source: Field survey (2020)

4.1.3 Education qualification of respondents

The education level of the household head can influence how he/she views innovations, techniques, and new ways of doing business (Mahamud, 2016). It also affects the decision-making process. In the study area, the respondents were categorized into five groups based on the level of education received viz. illiterate, primary level (1-5 class), secondary (6-10 class), higher secondary (11-12 class), and bachelor & above. Results showed that the majority of respondents i.e. 34% had received a secondary level of education followed by a higher secondary level (32%). Similarly, 24% of respondents were primary level, 6% were bachelor & above and only 4% were illiterate which is presented in figure 4. The result showed that the people of the study area were well educated, and the literacy ratio is 96%, suggesting that with a good extension and training program they can use modern agricultural equipment and apply science-based management and production practices to improve the quantity and quality of agricultural products and market supply.

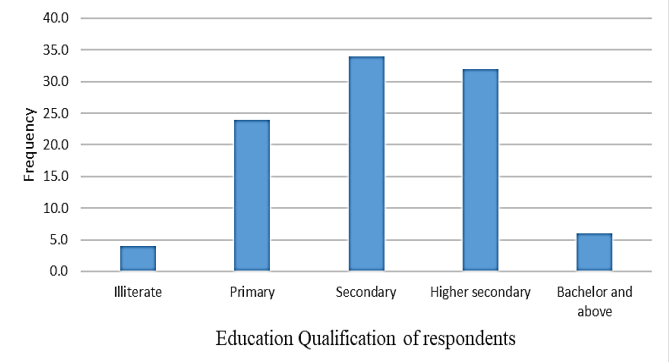

Figure 4: Level of education received by respondent producers

4.1.4 Family size and age distribution of respondents

The family size and age distribution reflect the productivity of the population as it has a bearing on employment pattern, quality of work done, and overall health situation within the community. In developing countries like Nepal, aged members are more prone to diseases and thus are less productive. In the study area, the sampled population was categorized into three categories viz. less than 15 years, 16-59 years (economically active population groups), and above 60 years. The study reveals that 69.53% of the population is economically active followed by 22.58% of the population which is below 15 years and only 7.89% of the population is above 60 years. The calculation showed that the dependency

ratio in the study area is 0.44, it is because most of the respondents had a nucleus family (table 6). The livelihood of farm households mainly depends on agriculture which requires more labor for various activities like land preparation, planting, weeding, harvesting, marketing, and so on. The family size with better age composition is important to carry out the agricultural activities (Mahamud, 2016). The average family size in the study area was 5.58 with a maximum of 11 and a minimum of 3 people.

Table 6: Family size and age distribution of respondents

S.N.	Family size	Mean value	Frequency
1	Male	53.05	148
2	Female	46.95	131
3	Total	100	279
4	Dependent population	30.47	85
5	Active population	69.53	194
6	Dependency ratio	0.44	

Source: Field survey (2020)

4.1.5 Source of income

The study indicated that 62% of respondents had agriculture as their major source of income. Similarly, the study showed that 18% of respondents considered livestock as their major source of income. Service and remittance both covered 8% each as a source of income of the respondents and business only covered 4% as a source of income and is presented in figure 5.

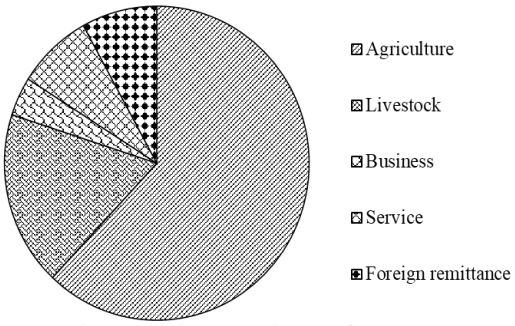

Figure 5: Source of income of respondents

4.1.6 Experience and training in potato cultivation

Training service in agriculture is indispensable which assists the farmers in the improvement of production and productivity (Ahmad et al., 2007). It enables the flow of information and the transfer of knowledge and scientific findings to practice. It also helps in disseminating innovations and ideas which emerge from research findings and improves the farmer's production and productivity. In the study site, the average year of experience of potato cultivation was 17.70 years with a maximum of 40 years and a minimum of 5 years of experience. It indicated the people of the study area were well experienced and had better knowledge of potatoes cultivation. The study also revealed that only 9 out of 50 respondents got training in the different topics on potato cultivation and storage (figure 6). It showed that only a few respondents were able to receive training from different government and non-government organizations.

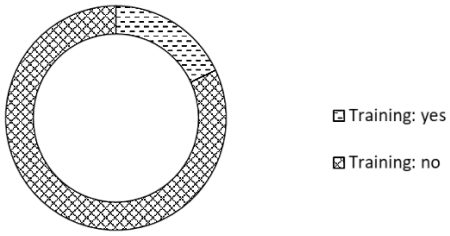

Figure 6: Training on potato cultivation and storage

4.1.7 Source of seed potato

The seed potato is the main input of potato cultivation and good quality seed potato is required for better production both in terms of quantity and quality. It has been reported that most of the farmers were using informal sources of seed that results in lower yields (Ghimire, 2005). Similarly, some researchers reported that the farmer's choice of improved varieties is the major factor that affects crop productivity (Rogers, 2003). The source of potato used by respondents are categorized into five groups i.e. own stock, neighboring farmers, seed selling center/agro-vets, NARC, and others. Most of the respondent used own stock seed potato (68%) followed by seed potato from seed selling center/agro-vets (24%). As a source of seed potato both neighboring farmer and other, both covered 4% each. None of the respondents mentioned NARC as their source of seed potato. The result is presented in figure 7 which indicated that farmers were using local own stock seed for many years and were unaware of the high yielding and disease/pest resistance potato variety. Farmers can increase their production by some level simply by using NARC-recommended high yielding and disease/pest resistance varieties in the study area.

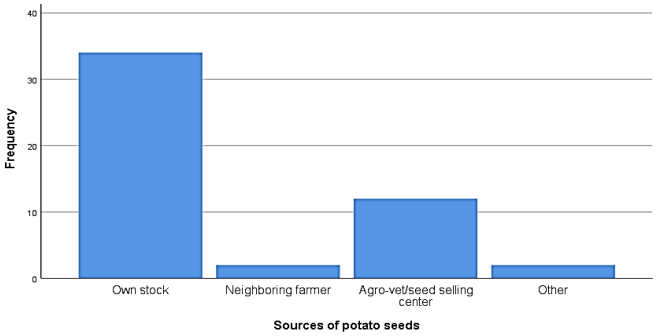

Figure 7: Sources of seed potato (Source: Field survey 2020)

4.1.7 Organic farming

Organic potato production is of interest to many farmers as it is in demand for many consumers, can be more profitable than non-organic and farmers are more aware of nutritional quality. In the study area, the majority of farmers were involved in non-organic production (92%) and only 8% of farmers were involved in organic production (figure 8). The per Kg price for organic potato fetches a higher price than non-organic potato but due to the insect and pest attack, the productivity is relatively lower than non-organic potato.

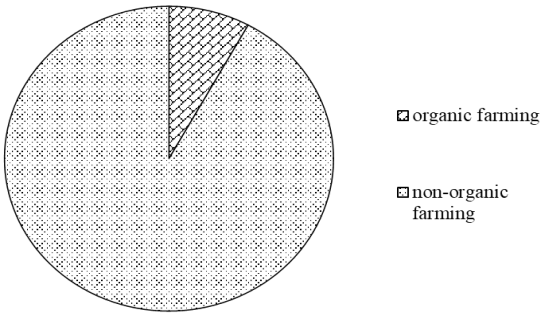

Figure 8: Status of organic farming (Source: Field survey (2020)

4.2 Demographic characteristics of traders

In this study, the traders were the aggregators, retailers, and wholesalers of the study site. The aggregators collected the produce from the smallholder producers at farm gate and delivered to wholesalers and retailer at different levels. They were the first actor that links producers to other participating traders. The retailers were those who buy produce either from producers or aggregators or wholesalers but in small amounts and sell directly to the consumers. The wholesalers were those participants of the trading system who bought the products on the farm field in a large volume than other actors.

4.2.1 General information of traders

The general information about the different traders which was found during the period of the survey is given in the following table. The age of traders indicated the traders' experience and status of networking. The average age of aggregators, retailers, and wholesalers was 41.60, 36.40, and 43.60 years respectively. Concerning gender, unfortunately, all respondent wholesalers were male, and in the case of aggregators 4 were male and only one was female. Similarly, in the case of retailers, 3 were female and 2 were male respondents. The trade type describes the capital investment and stability of the business. In the study area, all of the retailers, 4 of the wholesalers, and 3 of the aggregators handled the business without partnership. Only 2 aggregators and 1 wholesaler did the business in partnership. The study also revealed that in partnership the amount of capital investment, linkage with other traders, and stability of business were higher as compared to singly trading business. The result thus obtained is presented in table 7.

Table 7: General information of traders

Type of business	Age			Gender		Trade type	
	Max.	Min.	Mean ± SD	Male	Female	Single	Partnership
Aggregators	50	28	41.60±8.562	4 (80)	1 (20)	3 (60)	2 (40)
Retailers	50	24	36.40±9.940	2 (40)	3 (60)	5 (100)	0 (0)
Wholesalers	54	29	43.60±9.290	5 100)	0 (0)	4 (80)	1 (20)

Figures in parentheses indicate percent.

Source: Field survey (2020)

4.2.2 Business status of traders

Table 8: Business status of traders

Type of business	People employed		Period of trading			Year of trading
	Family members	Outsiders	Year-round	When purchased price become low	During high supply	
Aggregators	1	1.40	4 (80)	0	1 (20)	4.8
Retailers	1.80	0	5 100)	0	0	4.6
Wholesalers	1.80	1.60	4 (80)	0	1 (20)	12.2

Figures in parentheses indicate percent.

Source: Field survey (2020)

Table 8 showed that the average family member employed in business was 1, 1.80, and 1.80 for aggregators, retailers, and wholesalers respectively. Similarly, the average outsiders employed in business were 1.40, 0, and 1.60 for aggregators, retailers, and wholesalers respectively. The study also revealed that about 80% of aggregators, 100% of retailers, and 80% of wholesalers trade the potato all over the year. Only 20% of aggregators and wholesalers each trade the potato only during the high supply. The average year of trading of aggregators, retailers, and wholesalers were 4.8, 4.6, and 12.2 years respectively.

4.2.3 Linkage with other traders

Table 9: Linkage with other traders

Type of business	Linkage with						
	Producers	Retailers	Wholesalers	Aggregators	Consumers	Others	Total
Aggregators	2(14.3)	5(35.7)	4(28.6)	0(0)	3(21.4)	0(0)	14(100)
Retailers	4(21.1)	0(0)	5(26.3)	5(26.3)	5(26.3)	0(0)	19(100)
Wholesalers	5(21.7)	5(21.7)	3(13.0)	5(21.7)	2(8.7)	3(13.0)	23(100)

Figures in parentheses indicate percent.

Source: Field survey (2020)

Table 9 revealed that among the 5 aggregators, only 2 had linkage with producers, all 5 had linkage with retailers, 4 had linkage with wholesalers and 3 had linkage with consumers. Similarly, in the case of retailers, 4 had linkage with producers, all 5 had relations with wholesalers, aggregators, and consumers. Likewise, all 5 wholesalers had linkage with producers, retailers, and aggregators. 3 wholesalers had linkage with other wholesalers and others (cold storage, import agencies, industrialist, etc.). Only 2 had directly supplied some potatoes to consumers along with other value chain actors.

4.3 Demographic characteristics of consumers

Table 10: Demographic characteristics of consumers

Type of consumers	Frequency	Family size	Monthly income	Source of income			
				Business	Services	Pension	Foreign remittance
Household	7	5.43	28571	2	2	2	1
Restaurant	3	5.67	21667	3	0	0	0

Source: Field survey (2020)

In the study site, 7 households and 3 restaurants were selected as consumers. The average family size for the household was 5.43 and for the restaurant was 5.67. The average monthly income for the household was NRs.28571 and for the restaurant was NRs.21667. Among the 7 household respondents 2 of them mentioned business as the major source of income, another 2 of them mentioned service as the main source of income. Similarly, 2 of them mentioned pension as a source of income, and 1 of them mentioned remittance as a source of income. In the case of the restaurant, all of them mentioned business as the major source of income and is presented in table 10.

4.4 Economic analysis

This section deals with the economic analysis of all value chain actors of this study. Cost of production, marketing cost, gross margin, benefit-cost ratio were estimated for each actor. Similarly, marketing margin, producer's share, value share, price spread was also estimated.

4.4.1 Cost of production

The study revealed that the total cost of production per ropani was NRs. 13397 and is argued with "Economics of potato (*Solanum tuberosum L.*) production in Taplejung district of Nepal" by (Timilsina et al., 2011). The cost of land and cost of land preparation was the major cost of production as the price of land/rent of land and labor shortage were increasing day by day. The cost of land and cost of land preparation covered 29.63% and 21.13% of the total cost of production. Similarly, the cost of seed contributed 11.66%, cost of fertilizer contributed 14.97%, cost of weeding contributed 10.84%, cost of pesticides contributed 2.11%, cost of irrigation contributed 0.28%, cost of harvesting contributed 9.034% and miscellaneous cost contributed 0.35% to the total cost of production (Table 11).

The total variable cost was NRs. 13397 in the study site which corroborates with the finding of Economics of potato (*Solanum tuberosum*

L.) production in the terai region of Nepal, which was NRs. 12469.69 (Subedi et al., 2019). The finding of study site was also in line with the finding of Value chain analysis of potato in Ilam district, Nepal (Shresthaa and Yadav, 2018). They had reported that the average total cost of production per ropani was NRs. 13711.

Table 11: Details of the cost of production per ropani

S.N.	Particulars	Mean
1	Cost of land	5640.70
2	Cost of land preparation	4022
3	Cost of seed	2221
4	Cost of irrigation	53
5	Cost of fertilizers	2851
6	Cost of earthing-up and weeding	2064
7	Cost of pesticides	403
8	Cost of harvesting	1720
9	Miscellaneous cost	63
Total variable cost		13397
Total production cost (NRs.)		13397

Source: Field survey (2020)

4.4.2 Production and selling statistics

Table 12: Production and selling statistics

Particulars	Minimum	Maximum	Mean
Area under potato cultivation (in ropani)	.50	10.00	2.9400
Total production in quintals	4.50	100.00	20.4700
Quantity sold to consumer in quintal	1.50	19.00	7.8187
Quantity sold to aggregator in quintal	2.50	20.00	14.5833
Quantity sold to retailer in quintal	3.00	27.00	9.1031
Quantity sold to the wholesaler in quintal	16.00	95.00	33.3889
Home consumption + seed stock (in quintal)	.30	5.00	1.9000
Price per quintal to consumer	3400.00	6000.00	4462.5000
Price per quintal to aggregator	3400.00	3800.00	3516.6667
Price per quintal to retailer	3500.00	5200.00	4050.0000
Price per quintal to wholesaler	3200.00	3700.00	3422.2222
Price per quintal for home use	4300.00	6000.00	4954.0000
Total selling price	19000.00	338500.00	82167.8000

Source: Field survey (2020)

In table 12, as the mean area under potato cultivation is 2.94 ropani and mean production is 20.47 quintal, we could conclude that the productivity in the study area was 6.96 quintals per ropani, which is lower than national wise productivity (7.48 quintal per ropani) (MoAD, 2018/19). It is also lower than the finding of in their article "Technical efficiency of potato production in mid-western Terai region of Nepal", which is 8.24 quintal per ropani (Lamichhane et al., 2019). Since the total production cost per ropani was NRs. 19037.37, the total production cost for 1 quintal was found NRs.2735.30. The average farmer's selling price to the traders was NRs3662.89/quintal.

The study revealed that about half of the production (49.98%) was sold to wholesalers followed by 21.83% sold to aggregators. Similarly, 13.62% was sold to retailers, 11.70% was directly sold to consumers and 2.87% was used for home consumption as well as a source of potato seed for the next generation. The price per quintal for the consumer is relatively higher than others, it is because of the home delivery facility provided by farmers themselves. The price per quintal for aggregators, retailers, and wholesalers was NRs. 3516.67, NRs. 4050, and NRs. 3422.22. The price for aggregators and wholesalers is lower because they went to the farm to take the produce.

The study revealed that the correlation between area under potato cultivation and total quantity produced was strongly correlated with correlation coefficient 0.96 as well as total quantity produced and total cost per ropani were found moderately correlated with correlation coefficient 0.45. The study also showed that the area under potato cultivation and total cost per ropani were negatively correlated with a correlation coefficient of -0.41(Table 13). It indicates that with the increase in area under potato production, the total cost per ropani decreases and vice-versa.

Table 13: Correlations of area, production, and cost

Correlations		Area under potato cultivation	Total production in quintals	Total cost per ropani
Area under potato cultivation	Pearson Correlation	1	.960**	-.041
	Sig. (2-tailed)		.000	.776
	N	50	50	50
Total production in quintals	Pearson Correlation	.960**	1	.045
	Sig. (2-tailed)	.000		.754
	N	50	50	50
Total cost per ropani	Pearson Correlation	-.041	.045	1
	Sig. (2-tailed)	.776	.754	
	N	50	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Field survey (2020)

4.4.3 Marketing cost of farmers

As the majority of the farmer sold the produce in the retail market (outside the farms), calculation of marketing cost incurred to farmers was necessary. Post-harvest handling costs and transportation costs were basic marketing costs incurred to the farmers in the study area. The details of marketing costs to the farmer are presented in table 14.

Table 14: Marketing cost of farmers (per ropani)

S.N.	Particulars	Mean (NRs.)
1.	Post-harvest handling cost	864
2.	Transportation cost	291
	Total marketing cost	NRs. 1155

Source: Field survey (2020)

The result showed that post-harvest handling cost per ropani was NRs.864 which covers 74.80% of the total marketing cost per ropani. The transportation cost per ropani was NRs.291 and covers the remaining 25.20% of the total marketing cost per ropani. According to the finding of Economics of potato (*Solanum tuberosum L.*) production in Taplejung district of Nepal the transportation cost per kg of potato to district headquarter was NRs. 2.3, which was quite higher than finding of study site which was NRs. 0.42 (Timilsina et al., 2011). It was because the study site was too much near to the district headquarter.

4.4.4 Cost incurred to traders

The average packaging/packing cost per quintal was NRs.26, NRs.96, and NRs.46 for aggregators, retailers, and wholesalers respectively. The packaging/packing cost was higher for retailers as they have to use many polythene bags to sell the produce. The average loading/unloading cost per quintal was NRs.20, NRs.4, and NRs.16 and the transportation cost per quintal was NRs.66, NRs.14, and NRs.42 for aggregators, retailers, and wholesalers respectively. The loading/unloading and transportation cost for retailers were too less since most of the aggregators and wholesalers delivered the product to the retailer's shop by themselves. The aggregators didn't bear any storage cost and sorting cost as they sold the potato within a short time. The storage cost and sorting cost per quintal for wholesalers were NRs.100 and NRs.20 respectively and the sorting cost per quintal for retailers was NRs.25. The total marketing cost per quintal for aggregators, retailers, and wholesalers was NRs.122, NRs.142, and NRs.228 respectively. The cost incurred in the loss in transportation and storage per quintal was NRs.28, NRs.108, and NRs.66 for aggregators, retailers, and wholesalers respectively. The loss in transportation and storage was higher for retailers as consumers didn't accept the damaged and rotten potatoes. The overall cost incurred to traders is presented in table 15.

Table 15: Cost incurred to the traders

S. No	Particulars (NRs. /qt.)	Aggregators	Retailers	Wholesalers
1	Packaging/ packing cost	26	96	46
2	Loading/ unloading cost	20	4	16
3	Transportation cost	66	14	42
4	Storage cost	0	0	100
5	Sorting cost	0	25	20
6	Personal expenses	10	0	4
7	Other cost	0	3	0
i	Total marketing cost	122	142	228
ii	Loss in transportation and storage	28	108	66
iii	Purchase price	3320	4000	3277
iv	Total cost incurred (NRs. /qt.)	3470	4250	3571

Source: Field survey (2020)

The purchase price/quintal was NRs.3320, NRs.4000, and NRs.3277 as well as the total cost incurred/quintal was NRs.3470, NRs.4250, and NRs.3571 for aggregators, retailers, and wholesalers respectively (Table 15). Here, the total cost incurred/quintal was the summation of total marketing cost/quintal, loss in transportation and storage/quintal, and purchase price/quintal.

4.4.5 Purchase and selling status of traders

4.4.5.1 Purchase and selling status per month of aggregators

Table 16: Purchase and selling status per month of aggregators

Value chain actors	Quantity purchased (quintal)	Purchased price/quintal	Total purchase price	Quantity sold (quintal)	Selling price/ quintal	Total selling price
Farmers	60	3300	198000	×	×	×
Wholesalers	167.50	3325	575750	47.50	3550	168000
Aggregators	0	0	0	0	0	0
Retailers	0	0	0	113.50	3840	439900
Consumers	×	×	×	19.17	4166.67	80000
Institutional consumers	×	×	×	10	4000	40000
Total	146	3320	500200	146	3890.91	563100

Source: Field survey (2020)

The study conducted on aggregators revealed that the aggregators purchased about 60 quintals of potato per month from farmers on an average of NRs.3300/quintal in potato production seasons (table 16). Similarly, they bought about 167.50 quintals/month on an average NRs.3325/quintal from wholesalers. The overall average purchased quantity was 146 quintals on an average of NRs.3320/quintal. The study also showed that the major share of the quantity purchased was sold to the retailers (59.68%) with selling price NRs.3840/quintal, followed by quantity sold to wholesalers (24.97%) with selling price NRs. 3550/quintal. 10% of the total quantity was sold to consumers on an average of NRs.4166.67/quintal and the remaining 5.35% of the total quantity was sold to institutional consumers on an average of NRs.4000/quintal.

4.4.5.2 Purchase and selling status per month of retailers

The purchase and selling status per month of retailers is illustrated in table 17. It revealed that 5.5 quintals and 5 quintals per month were purchased from farmers and aggregators by the respondent retailers with purchase prices NRs.4075 and NRs.3850 per quintal respectively. The respondent retailers then sold the majority of the quantity to consumers (88.35%) @ NRs.4860/quintal and only 11.65% was sold to institutional consumers @ NRs.4500/quintal.

Table 17: Purchase and selling status per month of retailers

Value chain actors	Quantity purchased (quintal)	Purchased price/quintal	Total purchase price	Quantity sold (quintal)	Selling price/quintal	Total selling price
Farmers	5.5	4075	22050	×	×	×
Wholesalers	0	0	0	×	×	×
Aggregators	5	3850	19100	0	0	0
Retailers	0	0	0	0	0	0
Consumers	×	×	×	6.0680	4860	29158
Institutional consumers	×	×	×	0.80	4500	3600
Total	6.4	4000	25280	6.228	4800	29878

Source: Field survey (2020)

4.4.5.3 Purchase and selling status per month of wholesalers

Table 18: Purchase and selling status per month of wholesalers

Value chain actors	Quantity purchased (quintal)	Purchased price/quintal	Total purchase price	Quantity sold (quintal)	Selling price/quintal	Total selling price
Farmers	606.75	3250	1951600	×	×	×
Wholesalers	0	0	0	48.50	3700	179450
Aggregators	55	3400	184500	0	0	0
Retailers	0	0	0	491.48	3880	1831824
Consumers	×	×	×	3.833	4200	16333.34
Institutional consumers	×	×	×	2.25	4200	9450
Total	507.40	3277	1635080	504.38	3864.444	1881414

Source: Field survey (2020)

Table 18 illustrated the purchase and selling status of wholesalers per month. The wholesalers purchase 606.75 quintals and 55 quintals from farmers and aggregators respectively. The mean quantity purchased was 507.40 quintals per month as a whole. The purchase price from farmers and aggregators were NRs.3250 and NRs.3400 respectively, so it was clear that the overall average purchase price was NRs.3277/quintal. The study illustrated major part of the quantity was sold to retailers (491.48 quintals) with selling price NRs.3880/quintal. The wholesalers sold 48.50 quintals to other wholesalers @ NRs.3700/quintal along with 3.833 quintals to consumers and 2.25 quintals to institutional consumers @ NRs.4200/quintal.

4.4.6 Consumption amount per month and price per kg of potato

From table 19, it is clear that at household 91.02% of the total amount of potato was consumed as a vegetable and only 8.98% was consumed in other forms than a vegetable like in *chatpat, chatni*, etc. In the case of the restaurant, the major part (73.53%) was consumed as fried potato, *aalu stick, aaluchap, aalu parauttha, pakauda, samosa,* etc. and only 26.47% was consumed as a vegetable. The price/kg for both types of consumers was somewhat similar. The average price/kg of potato was NRs.50.57, which means consumers had to pay NRs.5057/quintal of potato. The finding was quite higher than the finding of Economics of potato (*Solanum tuberosum L.*) production in the terai region of Nepal (Subedi et al., 2019). It was solely due to high cost of land rent and high cost of labor in study site. In the above table, the highest and lowest prices are of the previous year.

The amount of potato consumed per month and price/kg in the study area can be presented as follow.

Table 19: Consumption amount per month and price per kg of potato

Type of consumers	Amount consumed (kg)/month			Price (NRs.)/kg		
	As vegetable	Other	Total	Recent	Highest	Lowest
Household	7.928 (91.02)	0.782 (8.98)	8.71	51.14	65.71	32.28
Restaurant	30 (26.47)	83.34 (73.53)	113.34	50	70	30

Figures in parentheses indicate percent.
Source: Field survey (2020)

4.4.7 Profitability analysis

The details of profitability analysis can be presented as follow:

4.4.7.1 Gross return and B:C ratio calculation per ropani

In the above table 20 presented, GR1, GR2, GR3, GR4, and GR5 represents gross return obtained when farmer sold the product to the consumer, gross return obtained when farmer sold the product to the aggregators, gross return obtained when farmer sold the product to the retailer, gross return obtained when farmer sold the product to the wholesaler and gross return obtained when farmer store the potato for seed and home consumption purpose respectively. Amongst them GR5 was higher than other, it is because the higher quantity was sold to wholesaler than other value chain actors.

The table revealed that the overall gross return was NRs.28182.2786/ropani and the gross margin was NRs.14785.2786/ropani. It is supported by the finding of in which it is stated that the gross margin per ropani in Taplejung district was NRs.15504 (Timilsina et al., 2011). The BC ratio was 2.1342 which means with an investment of NRs. 1 the farmers can earn NRs.2.1342. It is the same as the finding of and higher than the finding of which stated the B:C ratio of only 1.73 (Subedi et al., 2019; Shrestha and Yadav, 2018). The total cost of production was NRs.19037.70 and the marketing cost incurred for farmers was NRs.1155/ropani as they did post-harvest handling activities and delivered the produce to other value chain actors by themselves. So, the Net margin found was NRs.7989.5786/ropani.

Table 20: Gross return and B:C ratio calculation per ropani		
S.N.	**Particulars**	**Mean**
1.	GR1	14661.9043
2.	GR2	12042.6587
3.	GR3	15884.5313
4.	GR4	17863.7566
5.	GR5	3803.6952
7.	Overall Gross return/ropani (GR)	28182.2786
8.	Total variable cost/ropani	13397
9.	Gross margin/ropani (7-8)	14785.2786
10.	B:C ratio (7/8)	2.1342

Source: Field survey (2020)

4.4.7.2 Producer's share and price spread

As the farm gate price (price received by farmers) and the retail price paid by consumers were NRs.3662.89/quintal and NRs.5057/quintal respectively, the producer's share of consumer's price was 72.43%. This provided evidence that producers have the highest share of gain in the value chain of potatoes in the study area. The producer's share was higher because of increasing organic farming practices, which fetches the higher price than non-organic farming along with prevailing short value chain, short distance to market, and off-season production. The finding was comparatively higher as compared to the producer's share in Karnataka of India, where the author reported only 61.79% producer's share of consumer's price (Bhajantri, 2016). The price spread between the producers and consumers was NRs.1394.11/quintal in the study site whereas it was only NRs. 584.4/quintal in Karnataka, India (Bhajantri, 2016).

4.4.7.3 Marketing margin, value share, and B:C ratio of traders

The above table 21 illustrated that the marketing margin was higher for retailers (NRs.800) as compared to aggregators (NRs.570.91) and wholesalers (NRs.587.44). The value share of aggregators was 14.67% and that of retailers and wholesalers was 16.67% and 15.20% respectively. All the trading businesses are profitable businesses since the B:C ratio for all is greater than 1 (3.80, 3.20, and 1.99 for aggregators, retailers, and wholesalers respectively).

The marketing margin, value share, and B:C ratio of all three traders are presented as follow:

Table 21: Marketing margin, value share, and B:C ratio of traders per quintal			
	Aggregators	**Retailers**	**Wholesalers**
Marketing margin (NRs.)	570.91	800	587.44
Value share (%)	14.67	16.67	15.20
B:C ratio	3.80	3.20	1.99

Source: Field survey (2020)

4.4.8 Marketing aspect analysis

4.4.8.1 Marketing aspect analysis of producers

4.4.8.1.1 Buying and selling strategy

The selling places where the producers sold their product and the deciding factor which was considered by producers to sell are presented in the following table 22 and figure 11.

Table 22: Buying and selling strategy						
	Selling place			**Decision factor to sell**		
	Own farm	**Outside the farm**	**Self-selling in retail market**	**Transport availability**	**Price**	**Closeness in distance**
Frequency	15	15	20	18	17	15
Percent	30	30	40	36	34	30

Source: Field survey (2020)

Out of interviewed farmers, 40% of the farmers sold the product in the retail market by themselves, and 30% of the farmers sold at their farm, and the remaining 30% sold outside the farm. The study also revealed that 36% of farmers considered transport availability to sell followed by 34% who considered the price to sell the product. The remaining 30% considered closeness in distance to sell the product (Table 22).

4.4.8.1.2 Price setting and transportation strategy

The survey result indicated amongst the respondents 2% of the respondents set the selling price for themselves. The majority of respondents (64%) mentioned that the selling price was set by demand and supply and the remaining 34% of respondents mentioned that it was set by negotiation. Out of 100%, the majority of respondents (48%) used bus/truck as a means of transport for transportation to market. Similarly, 34% of respondents used bike/cycle as a means of transport followed by 16% of respondents who used delivery van/jeep as a means of transport. Only the remaining 2% of respondents used porter as a means of transport to sell the product in the market.

4.4.8.1.3 Contractual agreement and storage

In the study area, only 26% of respondents did the contractual agreement with traders and the remaining 74% of respondents produced and sold the product without any contractual agreement with any traders. The storage was a problem for 64% of the respondent as they have to store for a longer period in the production season to fetch a good price. The average loss percent of the produce (of both seasons) was 6.16%. Table 23 revealed that a major portion (26%) of the respondent farmers have to store 0-20 days before selling the potato and thus storage was one of the major problems of the study site.

Table 23: Storage days before selling		
Days	**Frequency**	**Percent**
0-5 days	10	20.0
0-10 days	7	14.0
0-15 days	10	20.0
0-20 days	13	26.0
0-25 days	2	4.0
0-30 days	7	14.0
More than 30 days	1	2.0
Total	50	100.0

Source: Field survey (2020)

4.4.8.2 Marketing aspect analysis of the study site

4.4.8.2.1 Marketing channel and quantity flow in channel

In the study area, there were 4 different marketing channels through which the product was reached to the end consumers. The 4 different marketing channels were:

- Channel 1 = farmers --- aggregators ---wholesalers/retailers --- consumers
- Channel 2 = farmers --- wholesalers --- retailers --- consumers
- Channel 3 = farmers --- retailers --- consumers
- Channel 4 = farmers --- consumers

Among the above-mentioned channels, 36.36% of producers follow channel 3, similarly, the next 36.36% follow channel 4 to sell the product. The overall status of the marketing channel followed by producers can be presented in the following table 24:

Table 24: Marketing channel followed by respondents

S.N.	Channels	Frequency	Percent
1	Channel 1	15	17.05
2	Channel 2	9	10.23
3	Channel 3	32	36.36
4	Channel 4	32	36.36
5	Total	88	100

Source: Field survey (2020)

The quantity flow of the product (in percentage) among the different value chain actors in the study site can be represented in figure 9:

The below quantity flow chart (figure 9) illustrated that the quantity flow from the farmer is highest for the wholesalers which comprise 51.46% of the total volume sold by farmers. The quantity flow from farmers to retailers, aggregators, and consumers was 14.02%, 22.47%, and 12.05% of the total quantity. Similarly, aggregators sold about 24.98% and 59.68% of the quantity to wholesalers and retailers respectively. Aggregators also sold 10.08% and 5.26% of the total quantity to consumers and institutional consumers respectively. The study also revealed that retailers sold the product to consumers and institutional consumers in the ratio of 7.58:1 i.e. 88.35% to consumers and 11.65% to institutional consumers. In the case of wholesalers, 90% of the quantity was sold to retailers, and the remaining 10% was distributed among aggregators, consumers, and institutional consumers with 8.88%, 0.70%, and 0.42% respectively.

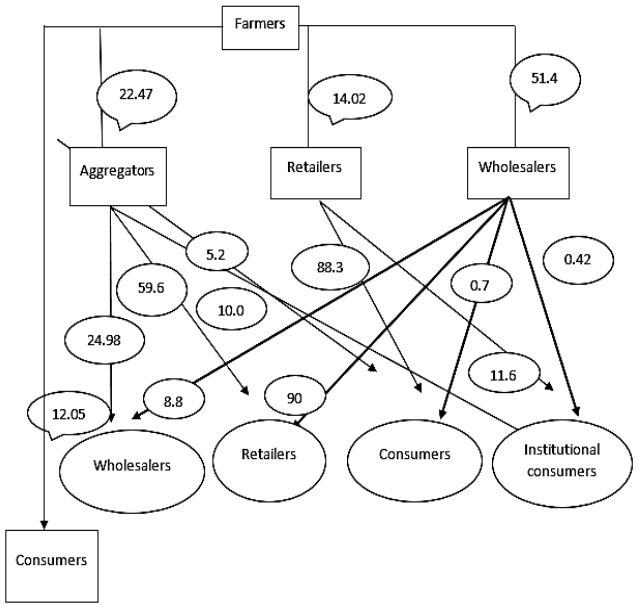

Figure 9: Quantity flow chart among value chain actors

4.5 Value chain mapping

Figure 10 illustrated the value chain map of Tokha Municipality of Kathmandu district. It shows the various actors involved in the value chain and their relationship. On the left of the figure, the corresponding functions of the actors are mentioned. Similarly, on the right, the support institutions and enabling environment for the value chain are mentioned. All agro-vets which are established in and near Tokha municipality, AKC – Lalitpur and NARC, Khumaltar were supplying the necessary inputs and needed technology for the potato producers of Tokha municipality. All the small, medium, and large-scale farmers are engaged in potato production and were the major actor of the value chain in the study area. The enablers for input supply and production were agriculture officers, JTAs, private companies, and cooperatives. The local and district traders along with large companies/potato processors were engaged in the collection, grading, packaging, and processing functions. The Kathmandu and region-based wholesalers deal with wholesale marketing of potatoes whereas retailers at the local and regional markets as well as departmental stores deal with retail marketing of fresh and processed potato products in the study area. FNCCI - Ktm, AKC – Lalitpur, and custom and revenue office was the enabling environment/institutions for the trading of potatoes. Finally, consumers were the end value chain actor governing the consumption function in the value chain of potatoes.

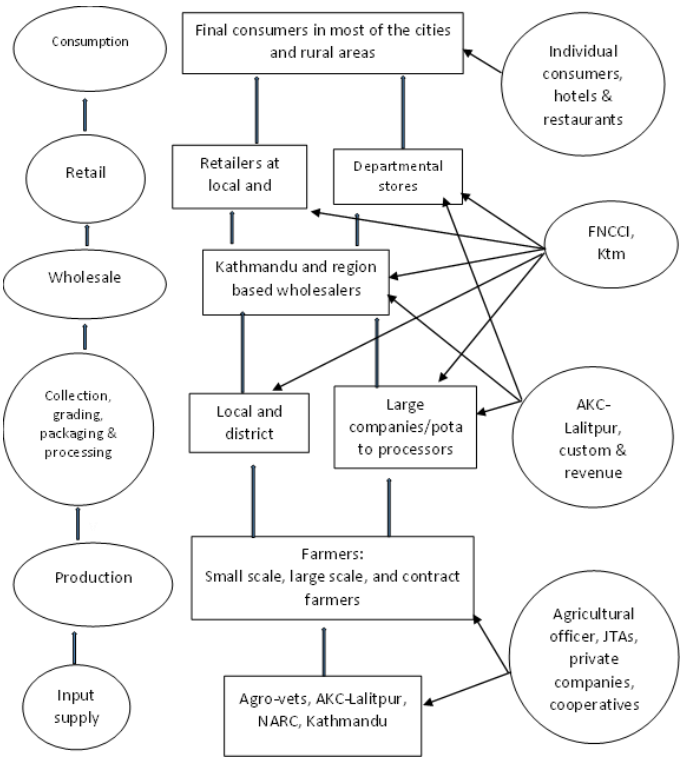

Figure 10: Value chain mapping of potato in Tokha Municipality, Kathmandu

4.6 Indexing of problem

4.6.1 Indexing of trader's problem

The ranking of the major problems of traders in the study site is presented in the following table 25. It was found that quality problems, variation in demand, and capital shortage were the major problem in trading business with rankings I, II, and III respectively with index values 0.816, 0.725, and 0.708. It was followed by other problems like storage problem (0.658), inadequate market information (0.567), and price-setting (0.558). In addition to that, the problem of road access (0.391) and supply shortage (0.208) were the minor problems of traders with ranking VII and VIII respectively.

Table 25: Indexing of trader's problem

Problems	Index value	Priority ranking
Price setting	0.558	VI
Supply shortage	0.208	VIII
Storage problem	0.658	IV
Variation in demand	0.725	II
Quality problems	0.816	I
Inadequate market information	0.567	V
Capital shortage	0.708	III
Problem of road access	0.391	VII

Source: Field survey (2020)

4.6.2 Indexing of consumer's problem

The ranking of the problems of consumers was presented in table 26 as below. In the study area, it was found that higher prices, poor quality, and lack of storage at home were the major problems with index values 0.80, 0.683, and 0.60 with rankings I, II, and III respectively. The other problems

were, unavailability of the items as per consumers' demand, insufficient availability in the local retail market, and income shortage with rankings IV, V, and VI with index values 0.583, 0.433, and 0.40 respectively.

Table 26: Indexing of consumer's problem

Problems	Index value	Priority ranking
Insufficient availability in local retail market	0.43	V
Not availability as per the consumers demand	0.58	IV
Higher price	0.80	I
Income shortage	0.40	VI
Poor quality of product	0.68	II
Lack of storage at home	0.60	III

Source: Field survey (2020)

4.7 SWOT analysis at potato producer's level

Table 27: SWOT analysis at potato producer's level

Strength	Weakness
• Favorable climate for potato production • Well-developed road network • Farmers have reasonable access to technical services from the municipality and AKC • Higher return than cereal crops • Near to the local and regional market • Availability of more or less market information • Higher nutritional and medicinal benefits • Good shelf life • High demand in the local and regional market	• Lack of storage and pre-cooling facilities near the farm • Price fluctuation • Low farm-gate price • Severe attack from blight and red ant • Deterioration of potato tubers • Greening and sprouting of tubers • Farmers not fully aware of quality inputs and modern techniques • Lack of availability of labor at peak planting and harvesting season • Lack of technical knowledge • High labor wage and high cost of inputs • Inadequate government support
Opportunities	Threats
• Scope for value-added products • Scope for establishing potato processing industries • The municipality is working for the establishment of cold storage • Potential to increase productivity • Increasing supports from both state and local government • Scope for import substitution	• A serious threat of diseases like late blight, wart • Emerging threat of Red ant and potato tuber moth (PTM) • The decreasing trend of farm labor availability and high cost of production • Increasing land plotting

5. Conclusion

The potato is a promising and strategic crop that enhances food security and economic benefits to the farmers because of its ability to provide a high yield of high-quality product per unit input used. Wider adaptability, high yield potential, and growing demand are crucial factors for high acceptance for the cultivation of potatoes. The climatic and geographic suitability of the Kathmandu district provides an abundant opportunity for the farmers to grow potatoes. However, the majority of farmers are growing local varieties that are less productive and diseases/pest susceptible. Thus, the productivity of the study area was less than the productivity of Nepal. The area and productivity could be increased by introducing new improved varieties, reducing the cost of production, providing better training and extension services, the implication of organic farming, and management of diseases and pests. The result of the study shows that aggregators are earning more benefits in the value chain. Farmers are not getting premium benefits due to the high cost of production, lack of storage facilities, an infestation of pests and diseases, and high spoilage of potatoes. There is an emerging need for proper coordination between farmers and extension service providers along with a strategic plan from central as well as state governments to tackle these problems.

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