

RESEARCH ARTICLE

VALUE CHAIN ANALYSIS OF POTATO IN SYANGJA DISTRICT, NEPAL

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ABSTRACT

A study was conducted in Galyang Municipality, Putalibazar Municipality, and Phedikhola Rural Municipality in Syangja district to analyze the potato value chain and evaluate its productivity, profitability, and marketing margins. A total of 74 potato producers, 2 aggregators, 2 wholesalers, 4 retailers, and 7 consumers were selected using random purposive sampling for data collection. The data was analyzed using SPSS and Excel software. The cost of production per ropani was NRs. 16789.60 and the productivity was 7.02 quintals per ropani. The B/C ratio obtained was 2.06 with the net margin NRs. 6710.5 per ropani. The producer's share of the consumer's price was NRs. 66.43% for fresh vegetables and 70.91% for tubers. The marketing margin for aggregators, retailers, and wholesalers was NRs. 834, NRs. 1270, and NRs. 946 respectively. The main constraints of potato production were the incidence of diseases and pests such as late blight and red ant, lack of technology and technical manpower, decreasing labor availability, and high production cost. Therefore, it is recommended to establish linkages between the government and different actors in production areas for proper grading and leveling of the product for quality products available in the local area as well as for enhancing export. The government and development agencies should support farmers' organizations for integrated disease management, reduce the cost of production, and develop agricultural marketing infrastructure for easy market access to farmers.

KEYWORDS

Value Chain, Potato, Productivity, Marketing Margin

1. INTRODUCTION

1.1 Background Information

In the Nepalese economy, agriculture is the mainstay, providing livelihood to about 65.6% of the total population in the country and contributing 27.6% of GDP to the national economy (MOALD, 2076/77). However, agriculture is a means of subsistence for a majority and its share of the National Gross Domestic Product (GDP) is minimal, contributing only about one-third to the national GDP. The total area under cultivation in Nepal is 3,091 thousand hectares which represents 21% of total land (MOALD, 2077/78). Agriculture is still the largest economic sector the contribution of the agriculture sector to GDP is decreasing whereas the non-agriculture sector is increasing.

Potato is considered one of the fourth most important crops in the world after wheat, rice, and maize. It is one of the important cash crops to address food insecurity and reduce poverty among smallholder farmers in developing countries like Nepal (Timsina et al., 2011). Worldwide more than 320 million tones of potatoes are being cultivated annually on 20 million hectares of land. This ranks the potato at number four among the world's most important staple food crops. However, the pace of expansion in global potato cultivation production of which has doubled in the past 20 years far exceeds that of higher-ranked crops such as maize and wheat (Cromme et al., 2010). Its cultivation is popular among farmers due to its wider adaptability, high yield potential, and high demand which contributes about 6.57% and 2.17% to AGDP and GDP, respectively (Bajracharya et al., 2017).

The area, production, and productivity of winter Potatoes in Syangja District in the year 2077/78 are 916 ha, 13190 MT, and 14.4 MT/ha respectively. Similarly, the area, production and productivity of summer potatoes in Syangja in the year 2077/78 are 35 ha, 343 MT and 9.8 MT/ha respectively. (AKC, 2077/78).

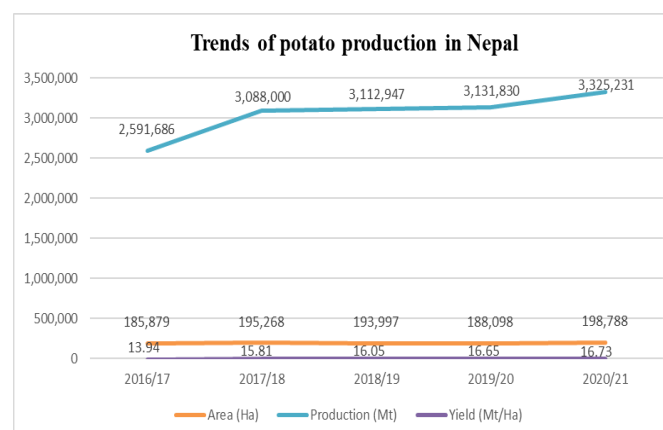


Figure 1: Trends of potato production in Nepal

Source: (MOAD, (Statistical Information on Nepalese Agriculture, 2019/20).

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A value chain is a model that states what activities need to be performed to deliver the value proposition to a customer, client, or end user. (htt1). The concept was created around 1985 by Michael Porter. According to Porter, it consists of primary activities and support activities, all of which add value to the products or services offered by the business. Ideally, the product passes through the activities of the value chain and along the way each activity adds value to the products. The overall goal is to deliver maximum value for the least possible total cost and create a competitive advantage (Lee and Yang, 2000).

Potato is now Nepal's second staple food crop, after rice, and per capita consumption has almost doubled since 1990 to 51 kg a year (Potato Pro, 2018). According to the statistical record of Potato production in Nepal, there was a declination of potato production both in terms of area and productivity on the year 2016/17. Afterward, there is slowly increasing trends of potato production. According to ADS, the production potential is 17Mt/ha so, there is a presence of a productivity gap (Figure 1).

According to the statistical data, there was an increment of potato production in terms of both area and productivity on the year 2018/19. Afterward, there is slowly decreasing trends of potato production in terms of both area and productivity in the year 2020/21 (Figure 2).

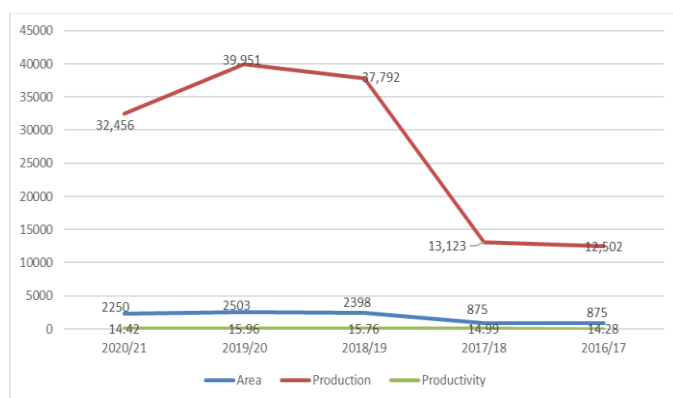


Figure 2: Trend of total potato area, production and productivity in Syangja, Nepal (Source: Statistical information on Nepalese Agriculture, 2020/21)

Potato farming, which is a staple food and cash crop in hilly regions, has the potential to contribute to food security in the area. However, a lack of knowledge about markets, market channels, and value chains, as well as a focus on local markets that offer low prices, is preventing potato production from reaching its full potential (Thakur et al., 1997). Due to the imperfections in market there is so much information and potential things which a farmer can gain are lost. There are other problems in the areas like market information systems and other marketing like place, transportation, storage, processing, promotion, etc. Such problems in value chain linkage create difficulty in achieving potential gains from existing opportunities. Value-adding activities such as grading, packaging and processing are not usually done by the farmers (Shrestha et al., 2018).

Many of the farmers of study area do subsistence farming so, they do not keep the records of business. The result of this study is helpful for growers for allocating resources for potato cultivation. Value chain analysis is a tool used to identify and evaluate the various actors, processes, and channels involved in a market. It can help to identify the most profitable market channels and optimize costs and profits for producers. A thorough understanding of the value chain is essential for commercialization. This study aims to analyze the value chain, examining the connections and relationships between farmers, processors, and consumers. (Wang and Li, 2008).

3. RESEARCH METHODOLOGY

3.1 LEE Site and Sub-Sector

The research will be conducted in Syangja District, a part of Gandaki Province, which is one of the seventy-seven districts in Nepal. The district, with Syangja bazaar as its headquarters, covers an area of 1,164 km² and has a population of 289,148. It is located in the hilly region with altitudes ranging from 300 meters along the Kaligandaki river to a couple of thousand meters above sea level. It is situated at approximately 28°4'60 North latitude and 83°52'0 East longitude. Putalibazar Municipality Ward No. 1 and 14, Galyang Municipality Ward No. 11, and Waling Municipality Ward No.1 have been purposely selected due to their major potato growing areas, the presence of cold stores and cooperatives, as well as

being representative of the district and easily accessible for data collection. (Figure 3).

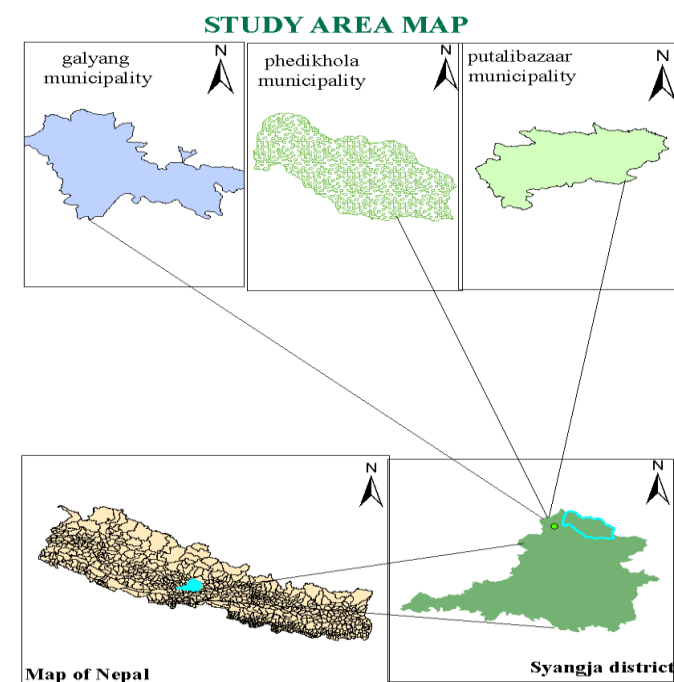


Figure 3: Map of study site

3.2 Preliminary Survey

The preliminary survey was carried out to collect information regarding the socio-cultural, demographic and topographical settings of the site by a conversation with the farmer and by direct observation. The information collected was used in preparing questionnaires and designing a sampling framework.

3.3 Sampling Size and Sampling Technique

It is impossible to collect information from the whole population, so a representative sample of population was taken. The size of sample and the amount of variation, usually affect the quantity and quality of information obtained from survey.

Potato growers of the research site were selected purposively. A total of 74 potato growers, 5 traders, and 7 consumers were selected by simple random sampling techniques to draw a representative sample.

3.4 Sources of Data

Primary data were collected through an interview schedule. Potato growers and traders were the major sources of primary data. These data were supplemented and verified by data collected through Focus Group Discussion (FGD), and Key Informant Survey (KII).

Secondary data were obtained through detailed review of relevant kinds of literature, reports, relevant articles, MoAD publications, NARC journals, Agriculture Knowledge Centre publications, PM-AMP publications, Food and Agriculture Organization (FAO), Central Bureau of Statistics and Statistical information on Nepalese Agriculture.

3.5 Research Instrument

3.5.1 Household Survey

Based on the semi-structured interview schedule, questions were asked face to face with the respondents to gain the aimed information during the household survey. The interview schedule for the data collection from potato growers was pre-tested before administering to actual respondents and necessary adjustments were done for reliability and validity.

3.5.2 Field Observation

Field was observed to verify the data collected from household surveys, FGD and KII.

3.5.3 Focus Group Discussion

A focus group discussion was conducted with 5-6 participants after the

completion of the household survey by the use of an open-ended questionnaire and gathering the information which was left during survey questionnaire.

3.5.4 Key Informant Interview (KII)

Different local leaders, head of cooperatives, progressive farmer, Agriculture Knowledge Center were the key informants of the site. The data from them has been used to supplement the data from household surveys.

3.6 Data Analysis

After collection of quantitative and qualitative data, data were entered and analyzed using simple descriptive statistics, Microsoft Excel and Statistical Packages for Social Science (SPSS). From this data analysis information on socio-demographic and economic variables, gross margins, B/C ratio, marketing margin, producers share, cost of production etc. information are obtained.

3.6.1 Economic Analysis

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 P., 2018)

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

Gross return

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

Gross return = (Total quantity marketed (quintal) $\times$ Price per unit (NRs.))

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)

Benefit-Cost Ratio (B/C Ratio)

A benefit-cost ratio (B/C Ratio) 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 A., 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,

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

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).

Marketing margin

It is the difference between the average sale price and the purchase price (Amgai, Dutta, Regmi, and Dangol, 2015).

Marketing margin = (Sale price – purchase price)

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.

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

Value share

It is the ratio of value-added to the final price expressed in percentage

(Chaudhary, 2010). i.e.

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

Price spread

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

Price spread = (Retail price – farm gate price)

3.6.2 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 & Morris, 2000). Value addition on potato occurs at each step of the chain.

3.6.3 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, Adhikari, & Yadav, 2018). It is intended to identify the internal and external factors that are favorable and unfavorable to the project.

Ten point scale

For reason of potato cultivation, each reasons were given a point from 1-10. Farmers were free to give points out of 10 according to majority. So, the full marks for each reason was 740(74*10). Finally, all the points were sum up and reasons were ranked according to highest point obtained.

Relative Important Index

Relative Importance Index = $\sum w/A*N$

$$= 5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1 / 5N$$

equation 1

Where w is the respondent's weighting of each factor, which can range from 1 to 5, for instance,

n1 represents the number of respondents for Not Important, n2 represents the number of respondents for Less Important, n3 represents the number of respondents for Moderately Important, n4 represents the number of respondents for Important, and n5 represents the number of respondents for Very Important. Thus, the highest weight (in this case, 5) is A, and the total number of people labeled as N. The Relative Importance Index ranges from 0 to 1.

4. RESULTS AND DISCUSSIONS

4.1 Socioeconomic and Demographic Profile of Producers

4.1.1 Gender of the Respondents

Out of 74 respondents, 74.32% were male and 25.68% were female. This signifies the patriarchal system of family. Male is the dominant member of majority of the household (Figure 4).

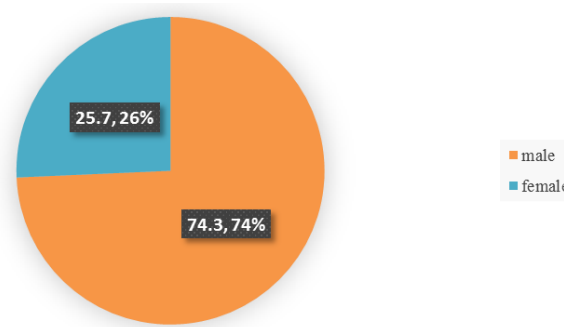


Figure 4: Gender of potato growers in Syangja district, 2022 (Source: Field survey, 2022)

4.1.2 Ethnicity of the Respondents

Concerning ethnicity, the majority of the respondents were Brahmin (70%) followed by Chhetri (21.62%), 13.51% of respondents belongs to Janajati and remaining 9.46% were from Dalit community.

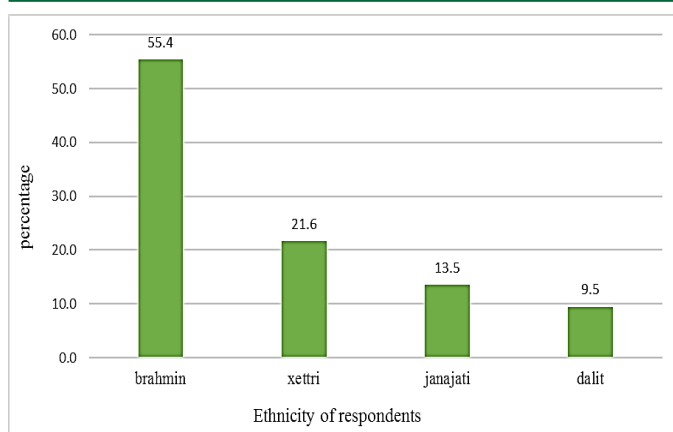


Figure 5: Ethnicity of respondents in the survey area, 2022 (Source: Field survey, 2022)

Table 1: Family Size and Age Distribution of Respondents Source: Field Survey, 2022			
Description	Economically active member	Economically inactive member	Family size member
Mean	3.88	2.24	6.11
Std. Deviation	1.452	1.451	2.123
Minimum	2	0	3
Maximum	8	6	11
Sum	287	166	453

4.1.3 Family Size and Age Distribution of Respondents

The family size and age distribution is presented in Table 1. The family size and age distribution reflect the productivity of the population as it has a bearing on economic activities, quality of work done, and overall health situation within the community. In developing countries like Nepal, age members are more prone to diseases and 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 average of 3.88 were economically active age member with maximum 8 and minimum 2 members. The economically inactive age members are average of 2.24 with maximum 6 and minimum 0 member. The calculation showed that the dependency ratio in the study area is 0.57.

The livelihood of farm households mainly depends on agriculture, which requires more labor for various activities like planting, land preparation, weeding, harvesting and so on. (Mahamud, 2016) The average family size in the study area was 6.11 with maximum of 11 and minimum of 3 people.

4.1.4 Education Qualification of Respondents

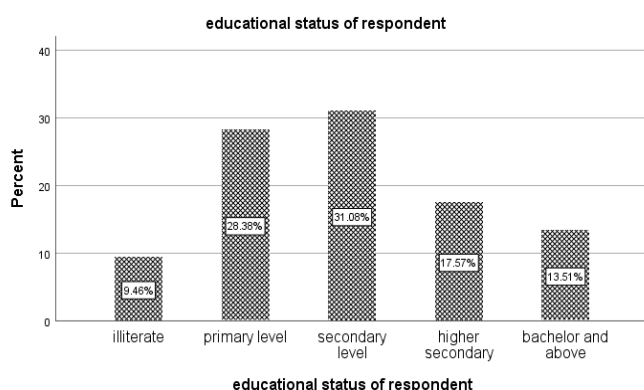


Figure 6: Level of education received by respondent

The level of education of the person in charge of the household can have an impact on their perspective towards new ideas, methods, and business practices. (Mahamud, 2016). It also affects the decision-making process. In the study area, the respondents were categorized into five groups based on level of education received viz. illiterate, primary level, secondary level, higher secondary level and bachelor & above. Results showed that

majority of respondents i.e. 31.08% had received a secondary level of education followed by primary level 28.38%. Similarly, 17.57% of respondents were higher secondary level, 13.51% were bachelor and above and only 9.46 % were illiterate which is presented in Figure 6.

The result showed that the people of the study area were well educated and the literacy rate is 90.54%, suggesting that with a good extension and training program they can use modern agricultural equipment and good production practices to improve the quantity and quality of agricultural products and their supply.

4.1.5 Source of Income

Agriculture is the mainstream profession for respondent. Out of 74 respondents, 63.5% are pursuing agriculture as their primary source of income. 23% of respondent are pursuing service as their primary source of income while 6.8% are engaged in business, 4.1% depends upon remittance, 1.4% depends upon pension and 1.4% are engaged in other activities such as carpenter, muscle labor etc.

Table 2: Source of Income of Respondents		
Profession	Frequency	Percent
Agriculture	47	63.5
Service	17	23.0
Business	5	6.8
Others	1	1.4
Remittance	3	4.1
Pension	1	1.4
Total	74	100.0

Source: Field survey, 2022

4.1.6 Experience and Training in Potato Cultivation

Agricultural training is essential in helping farmers enhance their production and efficiency. (Ahmad et al., 2007). Training helps in disseminating innovation, ideas, knowledge and flow of information which emerge from research findings which helps in improving farmer's production practices, productivity. In the study site, the average year of experience of potato cultivation was 15.09 years with a maximum of 40 years and a minimum of 4 years of experience. It indicated the people of study area were well experienced and had a good knowledge of potato cultivation. The study also revealed that 41.89% respondents got training. Among them most of the respondents got training on IPM program by different government organization like AKC, PMAMP and few of them got training on seed production by SQCC.

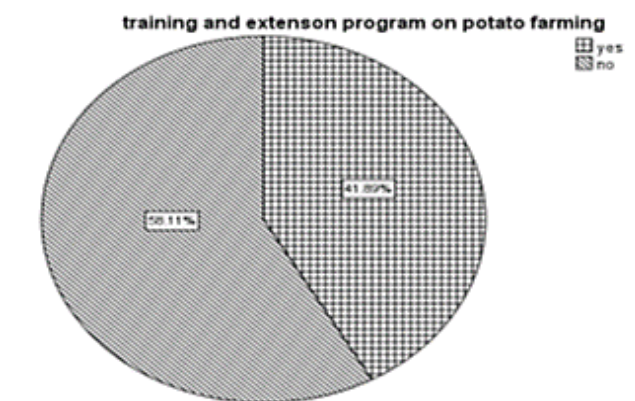


Figure 7: Training on IPM

4.1.7 Sources of Seed Potato

The seed is the primary component of cultivation, and high-quality seed is necessary for improved production in terms of both quantity and quality. It is reported that the farmer's choice of improved varieties is the major factor that affects crop productivity. The source of potato used by respondents are categorized into own stock, agro-vet, cooperatives, AKC, PMAMP, own and cooperative (Rogers, 2003). Most of the respondents used own plus cooperative and from agro-vets (25.7%) followed by seed potato from cooperatives only. 14.9% of respondents used from own stock and 9.5% used given by government organization or buy from there (Table

3). The PBS seed provided from cooperatives are from National Potato Development Center, Khumaltar, Lalitpur. In some study site farmers are using NARC recommended high yielding varieties like Janakdev, Khumal

Rato, Khumal Ujwal, MS-43, TPS, PBS etc. This shows farmer of that study site are somewhat progressive and involves in seed production like first generation, second generation and third generation.

Table 3: Sources of seed potato in survey area

Sources	Frequencies	Percent
Own	11	14.9
Agro- vet	19	25.7
cooperatives	18	24.3
AKC, PMAMP	7	9.5
Own and cooperative	19	25.7
Total	74	100.0

Source: Field survey, 2022

4.1.8 Sources of Fertilizer and Pesticide

Table 4: Sources of Fertilizer and Pesticide in Survey Area

Sources	Frequencies	Percent
Agro- vet	65	87.8
NGO/INGOs	1	1.4
AKC, PMAMP	3	4.1
cooperative	5	6.8
Total	74	100.0

Fertilizers and pesticides are very important input materials which are required for proper development of plant and to protect plant from diseases and insect pests. Majority of respondents (87.8%) relied on input materials provided by agro-vet while 6.8% in cooperative. Only 4.1% relied on Government Organization and 1.4% on NGO/INGOs.

4.1.9 Land use status of respondents

The average land holding of the survey area was 11.20 ropani with

maximum of 65 ropani and minimum of 1 ropani. The area under cultivation was 8.40 ropani with maximum of 50 ropani and minimum of 1 ropani. From 11.20 ropani of total land in survey area, 3.43 ropani of land had the occupancy of potato making it 30.68% of total owned land, 75.03% occupied by cereals, 7.72% by grasses and 11.58% occupied by other crops such as pulses, fruits and other vegetables. People in the survey area have potato cultivation in 3.43 per household (Table 5).

Table 5: Land Holding Pattern and Pattern of Production Commodities

Land holding pattern (Ropani)	Minimum	Maximum	Mean	Std. Deviation
Total owned area	1.00	65.00	11.2027	11.12166
Total cultivated area	1.00	50.00	8.4054	7.45887
Potato area	.50	40.00	3.4378	4.84368
Cereal area	.00	50.00	6.8851	6.82188
Grass area	.00	9.00	.8649	1.55338

Source: Field survey, 2022

4.2 Level of Perception of Potato Growers on Different Statement

The mentioned statements are related with the perception of potato growers. Based on the perception made by the respondents, results from Table 6 showed that all the statements related to potato grower perception were positively evaluated. Availability of input is easier (4.23), Support from GO/INGOs is satisfactory (3.74), Production amount is at satisfactory level (3.86), Marketing is much easier (4.08) and received price from potato is at satisfactory level (3.65).

Table 6: Level of perception of potato growers

Statements	Mean	Std. Deviation
Availability of the input is easier	4.23	0.987
Support from GO/INGOs is satisfactory	3.74	0.812
Production amount is at satisfactory level	3.86	0.865
Marketing is much easier	4.08	0.918
Received price from potato is at satisfactory level	3.65	1.013

Source: Field survey, 2022

4.3 Demographic Characteristics of Traders

In this study, the traders were the collectors, wholesalers, retailers and consumers in the study site. The aggregators are those who collect the produce from the smallholder producers at farm gate and delivered to wholesalers and retailers. The retailers are those who buy produce either from producers or aggregators or wholesalers but in small amounts and sell directly to the consumers. The wholesalers are those who bought the products on the farm field in a large volume than other actors.

4.3.1 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 trader indicated the traders' experience and status of networking. The average age of traders was 37.80, 39.30 and 46 for retailers, wholesalers and aggregators respectively. Concerning gender, 50% were male and 50% were female for retailers, 100% were male in case of wholesalers and aggregators. The trade type describes the capital investment and stability of the business. In the study area, 7 of the traders handled the business without partnership. Only 1 trader did the business in partnership. The average year of trading of aggregators, retailers, and wholesalers were 6, 10, and 7 years respectively.

Table 7: General information of traders

Types of business	Gender		Trade type		Age	Experience years in potato trade
	Male	Female	Single	Partnership	Mean $\pm$ SD	Mean $\pm$ SD
Retailers	2 (50)	2 (50)	4 (100)	0	37.80 $\pm$ 9.25	10 $\pm$ 2.42
Wholesalers	2 (100)	0	1 (50)	1 (50)	39.30 $\pm$ 4.74	7 $\pm$ 2.91
Aggregators	2 (100)	0	2 (100)	0	46 $\pm$ 10.31	6 $\pm$ 1.92

Source: Field survey, 2022

4.4 Demographic Characteristics of Consumers

In the study site, 3 households and 4 hotels were selected as consumers. The average family size for the household was 5.67 and for the hotel was 5.42. The average monthly income for the household was NRs. 28500 and

for the hotel was NRs. 65567. Among the 3 household respondents 1 of them mentioned business as the major source of income, another 2 mentioned service as the major source of income. Similarly, in case of hotel all 4 of them mentioned business as the major source of income.

Table 8: Demographic characteristics of consumers

Type of consumers	Frequency	Family size	Monthly income	Source of income	
				Business	Service
Household	3	5.67	28500	1	2
Hotel	4	5.42	65567	4	0

Source: Field survey, 2022

4.5 Marketing Aspect Analysis of Study Site

i. Marketing channels

In the study area, there were 5 different marketing channels through which the product was reached to the end consumers. Among the channels, 29.7% of producers follow channel 5, similarly 24.3% of producers follow channel 4, 20.3% of producers follow channel 1, 16.2% of producers follow channel 3 and 9.5% of producers follow channel 2. The overall status of the marketing channel followed by producers can be presented in Table 9.

Table 9: Marketing channels followed by producer

S.N.	Marketing Channels	Frequencies	Percent
1	Producers - Consumers	15	20.3
2	Producers - Collectors - Wholesalers - Retailers - Consumer	12	16.21
3	Producers - Retailers - Consumers	17	22.97
4	Producers - Cooperatives - Traders - Consumers	30	40.54
	Total	74	100.0

Source: Field survey, 2022

ii. Major player determining price in study site

In the study area, there were 5 different major player determining price in study site. The players were producer himself, local trader, retailers, cooperative and local government. The most important role in determining price of potato is played by cooperatives (28.4%), after that local trader (25.7%), producer himself (21.6%), both retailer and local government (12.2%), which is shown in Table 10.

Table 10: Major player determining price in study site

Actors	Frequencies	Percent
Producer himself	16	21.6
local trader	19	25.7
retailers	9	12.2
cooperative	21	28.4
local government	9	12.2
Total	74	100.0

Source: Field survey, 2022

iii. Actor playing important role to facilitate the marketing of potato

In the study site, three major actors were playing important role to facilitate the marketing of potato. The actors were Government Organizations (AKC, PMAMP, Local Government), cooperatives/groups and local trader. Among them most important role was played by cooperatives/groups (63.5%), after that local trader (23%) and GOs (13.5%).

Table 11: Actors playing important role to facilitate marketing of potato

Actors	Frequency	Percentage
GO	10	13.5
Cooperative/groups	47	63.5
Local trader	17	23.0

Source: field survey, 2022

iv. Mode of Selling and Storage

In the study area, 6 different types of mode of selling was found. They are categorized as local trader, retailer, cooperatives, contractual, contract plus cooperative and local trader plus cooperative. Only 2.7% of respondents did the contractual agreement with traders and most of the selling is done through cooperatives (29.73%), local trader (21.62%), retailer (18.92%), contract plus cooperative (10.81%) and local trader plus cooperative (6.22%).

In case of storage, it was not problem to most of the farmer due to its availability and respondent store for longer period to sell during off season to get more profit. It is revealed that a major portion (58.1%) of the respondent stored for 7 months, 17.6% stored for 8 months, 12.2% do not kept in storage, 10.8% store for 6 months and only 1.4% stored for 3 months (Table 12).

Table 12: Durations of storage of potato

Durations of storage(months)	Frequencies	Percent
0	9	12.2
3	1	1.4
6	8	10.8
7	43	58.1
8	13	17.6
Total	74	100.0

Source: Field survey, 2022

4.5.1 Value Addition Activities Analysis

In the study site, 6 different types of value addition practices were found which are categorized as grading, packaging, sorting, transporting, storing and weighing. According to the study, it was found that 87.81% of respondent carry out grading activities, 51.4% do the packaging, 63.5% do the sorting, 56.8% do the transporting, 85.1% do the storing and 83.8% do the weighing activities. This type of activities is very important in increasing the value of our product and helps to increase the profit to the farmers and traders.

Table 13: Value Addition Practices

Value addition practices	Yes	No
Grading	65 (87.81%)	9 (12.2%)
Packaging	38 (51.4%)	36 (48.6 %)
Sorting	47 (63.5%)	27 (36.5%)
Transporting	42 (56.8%)	32 (43.2%)
Storing	63 (85.1%)	11(14.9%)
Weighing	62 (83.8%)	12 (16.2%)

Source: field survey, 2022

4.5.2 Forms of selling

In the study area, 2 forms of selling of potato was found that is, as fresh vegetables and as seed. According to the study, most of the farmer (39.2%) sell the potato as fresh vegetables, 21.6% as seed and 39.2% as both fresh vegetables and seed.

Table 14: Forms of selling of potato

Forms of selling	Frequencies	Percent
Fresh vegetable	29	39.2
Seed	16	21.6
Both	29	39.2
Total	74	100.0

Source: field survey, 2022

4.6 Economic analysis

4.6.1 Cost of Production

The study revealed that the total cost of production per ropani was NRs. 16789.60. The cost of seed and labor was the major cost of production as the price of quality seed and labor shortage were increasing day by day. The cost of seed and labor covered 27.92% and 14.64% of the total cost of production. Similarly, the cost of machinery contributed 13.83%, cost of land contributed 3.38%, cost of storage contributed 11.13%, cost of FYM contributed 5.10%, cost of fertilizer contributed 3.80%, cost of plant protection measure contributed 1.26%, cost of irrigation contributed 2.53%, cost of harvesting contributed 8.14% and cost of intercultural activities contributed 8.20% to the total cost of production (Table 15).

4.6.2 Cost Incurred to Traders

Table 16: Cost incurred to traders per quintal

Variable	Aggregators (mean± SD)	Wholesalers (mean± SD)	Retailers (mean± SD)
Total marketing cost	216.8±41.37	250.5±12.67	196.8±56.02
Loss in transportation and storage	5±3.12	30±5.52	90±19.12
Purchase price	2866±205.9	3300±240.4	4000±598.6
Total cost incurred to trader	3087.8±250.39	3580±258.62	4286±673.74

Source: Field survey, 2022

The study revealed that marketing cost incurred to traders like aggregators, wholesalers and retailers are NRs. 216, NRs. 250.5, NRs. 196.8 respectively. The cost incurred in the loss in transportation and storage per quintal was NRs. 5, NRs. 30, and NRs. 90 for aggregators, retailers, and wholesalers respectively. The purchase price/quintal was NRs. 2866, NRs. 4000, and NRs. 3300 as well as the total cost incurred/quintal was NRs. 3087, NRs. 4286, and NRs. 3580 for aggregators, retailers, and wholesalers respectively (Table 16). Here, the total cost incurred/quintal was the summation of total marketing cost/quintal, loss in transportation and storage/quintal, and purchase price/quintal.

4.6.3 Purchase and Selling Status Per Month of Traders

The purchase and selling status of potato per month of traders is presented in Table 17. The aggregators purchase 18.5 quintals of potato from farmers, wholesalers purchase 100.5 quintals of potato from aggregators and farmers and retailers purchase 7.8 quintals of potato from wholesalers. The purchase price per quintal was NRs. 2866, NRs. 3300, NRs. 4000 and selling price per quintal was NRs. 3700, NRs. 4246, NRs. 5270 for aggregators, wholesalers and retailers, respectively (Table 17).

Table 17: Purchase and selling status of trader per month

Particulars	Aggregators	Wholesalers	Retailers
Quantity purchased in one month (quintal)	18.5±2.563	100.5±3.049	7.8±2.243
Quantity sold in one month (quintal)	18.5±2.56	95.6±1.89	7.6±2.25
Purchase price per quintal (NRs.)	2866±205.9	3300±240.4	4000±598.6
Selling price per quintal (NRs.)	3700±350.54	4246±395.75	5270±736.70

Source: Field survey, 2022

4.6.4 Marketing margin and value share of traders

The marketing margin was higher for retailers (NRs. 1270) compared to

Table 15: Details of the cost of production per ropani

Particulars	Mean		Std. Deviation
	Statistic	Std. Error	Statistic
Machinery cost	2323.50	381.50	3281.81
Land cost	568.69	175.54	1510.06
Storage cost	1870.05	168.00	1445.24
Seed cost	4688.54	404.02	3475.53
Labor cost	2459.23	156.46	1345.98
FYM cost	857.34	197.54	1699.36
Fertilizer cost	638.88	72.97	627.75
Plant protection	212.24	20.24	174.17
Irrigation cost	426.42	90.68	780.10
Harvesting cost	1367.06	102.63	882.92
Intercultural cost	1377.59	250.47	2154.63
Total cost per ropani	16789.60	867.32	7461.02

Source: field survey, 2022

wholesalers (NRs. 946) and aggregators (NRs. 834). The value share of retailers was 24.09% and that of wholesalers and aggregators was 17.95%, 15.82%, respectively. The net marketing margin was NRs. 659.5, NRs. 617.2 and NRs. 1074 for wholesalers, aggregators and retailers respectively, which shows all the trading business, are profitable (Table 18).

Table 18: Marketing margin and value share of traders

Particular	Wholesaler	Aggregator	Retailers
Marketing margin (SP-PP)	946	834	1270
Net marketing margin (MM-MC)	659.5	617.2	1074
Value share% (SP-PP)/retail price*100	17.95%	15.82%	24.09%

Source: field survey, 2022

4.6.5 Gross Return and Benefit Cost Ratio

The table revealed that the gross return was NRs. 33422.29/ropani and the gross margin was NRs. 16632.69/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 2.06 which means with an investment of NRs. 1 the farmers can earn NRs. 2.06. It is the same as the finding of and higher than the finding of which stated the B:C ratio of only 1.73 (Shrestha and Yadav, 2018; Subedi, Ghimire et al., 2019). The total cost of production was NRs. 16789.60 and the Net margin found was NRs. 6710.5/ropani (Table 19).

Table 19: Gross return and B:C ratio calculation per ropani

Particulars	Amounts (NRs/Ropani)
Total variable cost per ropani	16220.91
Gross return per ropani	33422.29
B:C Ratio	2.06
Gross margin per ropani	16632.69

Source: field survey, 2022

4.6.6 Producer's share, market margin and price spread

As the farm gate price (price received by farmers) and the retail price paid by consumers were NRs. 3875/quintal and NRs. 5833/quintal respectively for fresh vegetables, the producer's share of consumer's price was 66.43%. The farm gate price and retail price paid by consumers were NRs. 6500/quintal and NRs. 9166/quintal respectively for seed vegetables, the producer's share of consumer's price was 70.91%. 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 improved farming practices, short distance to market, availability of storage structure for off season marketing. The price spread between the producers and consumers was 33.56%.

The market margin between the producers and consumers for fresh vegetables was NRs. 1958/quintal and for seed was NRs. 2666/quintal.

4.6.7 Value chain mapping

Figure 8 illustrate the value chain map of Syangja 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 the agricultural service providers located in Syangja district, including AKC- Syangja and Potato Super Zone Kavre, were providing the necessary inputs and technologies for potato farmers. The small, medium, and large-scale farmers in the area were heavily engaged in potato production and were the key players in the potato value chain. Agriculture officers, JTAs, private companies, and cooperatives were instrumental in supplying inputs and promoting production. Local and district traders, along with potato producers and cooperatives, were involved in the collection, grading, packaging, and storage processes. In Syangja and the surrounding region, wholesalers were responsible for wholesale potato marketing, while retailers and department stores handled retail marketing. FNCCI, AKC-Syangja provided an enabling environment for the trading of potatoes. Lastly, consumers were the end-users of the value chain, governing the consumption function of potatoes.

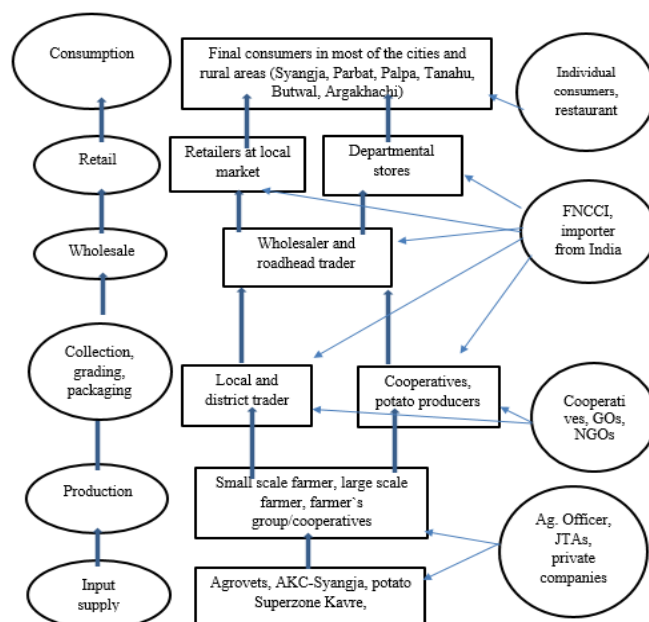


Figure 8: Value chain map of potato in Syangja district

4.7 Correlations of Area, Production and Cost

The study revealed that the correlation between area under potato cultivation and total quantity produced was strongly correlated with correlation coefficient 0.99 as well as total quantity produced and total cost per ropani were found moderately correlated with correlation coefficient 0.62. The study also showed that the area under potato cultivation and total cost per ropani were negatively correlated with correlation coefficient of -0.51. It indicates that with the increase in area under potato production, the total cost per ropani decreases and vice-versa (Table 20).

Table 20: Correlations of area, production and cost				
Correlations		Potato Production Area (rop)	Cost/ rop	Productions in quintals
Potato production area (rop)	Pearson Correlation	1	.051	.998**
	Sig. (2-tailed)		.663	.000
	N	74	74	74
Cost/ rop	Pearson Correlation	.051	1	.062
	Sig. (2-tailed)	.663		.597
	N	74	74	74
Productions in quintals	Pearson Correlation	.998**	.062	1
	Sig. (2-tailed)	.000	.597	
	N	74	74	74

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

Source: Field survey, 2022

4.8 Consumption Amount per Month and Price per Kg of Potato

From table 21, it is clear that at household 66.67% of the total amount of potato was consumed as vegetable and 33.33% was consumed in other forms than vegetable like in chatpat, chatni, pakauda etc. In the case of the hotel, the major part (75%) was consumed as fried potato, potato stick, aaluchap, aalu parautha, samosa etc. and only 25% was consumed as a

vegetable. The price/kg for both types of consumers was somewhat similar. The average price/kg of potato was NRs. 52.5, which means consumers had to pay NRs. 5250/quintal of potato. In the above table, the highest and lowest prices are of the previous year.

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

Table 21: Consumption amount per month and price per kg of potato						
Type of consumers	Amount consumed (kg/month)			Price (NRs. /kg)		
	Vegetable	Other	Total	Recent	Highest	Lowest
Household	7.33 (66.67%)	3.66 (33.33%)	11	55	80	32.28
Hotel	38.12 (25%)	114.37 (75%)	152.5	50	80	30

Source: Field survey, 2022

4.9 Indexing of problems

4.9.1 Indexing of Production Problems

Five problems were identified by survey, FGDs and KII and the identified problems were asked to rank from P1-P5 where P1 means least prioritized

and P5 means highly prioritized. Among 5 problems incidence of pest and disease held highest priority along with lack of technology and technical men power. Similarly, shortage of labor had also been prioritized problem. Unavailability and high price of quality seed, lack of irrigation held 4th and 5th position.

Table 22: Production Problems in the Survey Area, 2022

SN	Problems	Frequencies					Index	Rank
		P1	P2	P3	P4	P5		
1.	Unavailability and high price of quality seed	16	24	19	11	4	0.5	IV
2.	Lack of irrigation	15	30	19	8	2	0.470	V
3.	Shortage of human labor	8	12	16	21	17	0.672	III
4.	Lack of technology and technical men power	4	6	18	34	12	0.708	II
5.	Incidence of pest and disease	1	1	26	40	6	0.732	I

Source: Field survey, 2022

4.9.2 Marketing and Value Chain Problems

Six problems from survey, KII and FGDs were identified and respondents were asked to rank those problems from P1 to P6 where P1 means least prioritized and P6 means highly prioritized. Among 6 problems, weak forward and backward linkage held the highest priority which had limited the immense scope of product diversification of potato producers and

collateral value addition. Similarly, monopoly of middleman also held high priority signifying the low producers share in valuation of price of commodity. Inappropriate market price was hampering the economics of growers which was the result of unscientific pricing strategy. Similarly, lack of marketing knowledge was also significant problem of the survey area. The poor market intelligence among farmers caused the lack of market dynamics for better market price. Lack of transportation and shortage of storage held lowest priority.

Table 23: Marketing and Value Chain Problems

SN	Marketing problems	Frequencies						Index	Rank
		P1	P2	P3	P4	P5	P6		
1	Lack of marketing knowledge	6	16	24	13	6	7	0.527	IV
2	Monopoly of middleman	2	2	4	7	50	9	0.765	II
3	Weak forward and backward linkage	0	0	3	5	57	9	0.828	I
4	Inappropriate market price	6	5	14	35	10	4	0.612	III
5	Shortage of storage	52	17	5	0	0	0	0.227	VI
6	Lack of transportation	18	30	13	10	2	1	0.389	V

Source: Field survey, 2022

4.9.3 Marketing Problems for Traders

Eight problems were found during the study. Each problem was given a point from 1-10. Farmers were free to give points out of 10 according to

severity. So, the full mark for each problem was 50. The most important problem was found to be quality problem of commodity (43 points) and variation of demand (40 points). The other problems were lack of marketing knowledge and supply shortage (39 points), inappropriate market price (35 points), capital shortage (29 points), lack of storage structure and transportation (15 points).

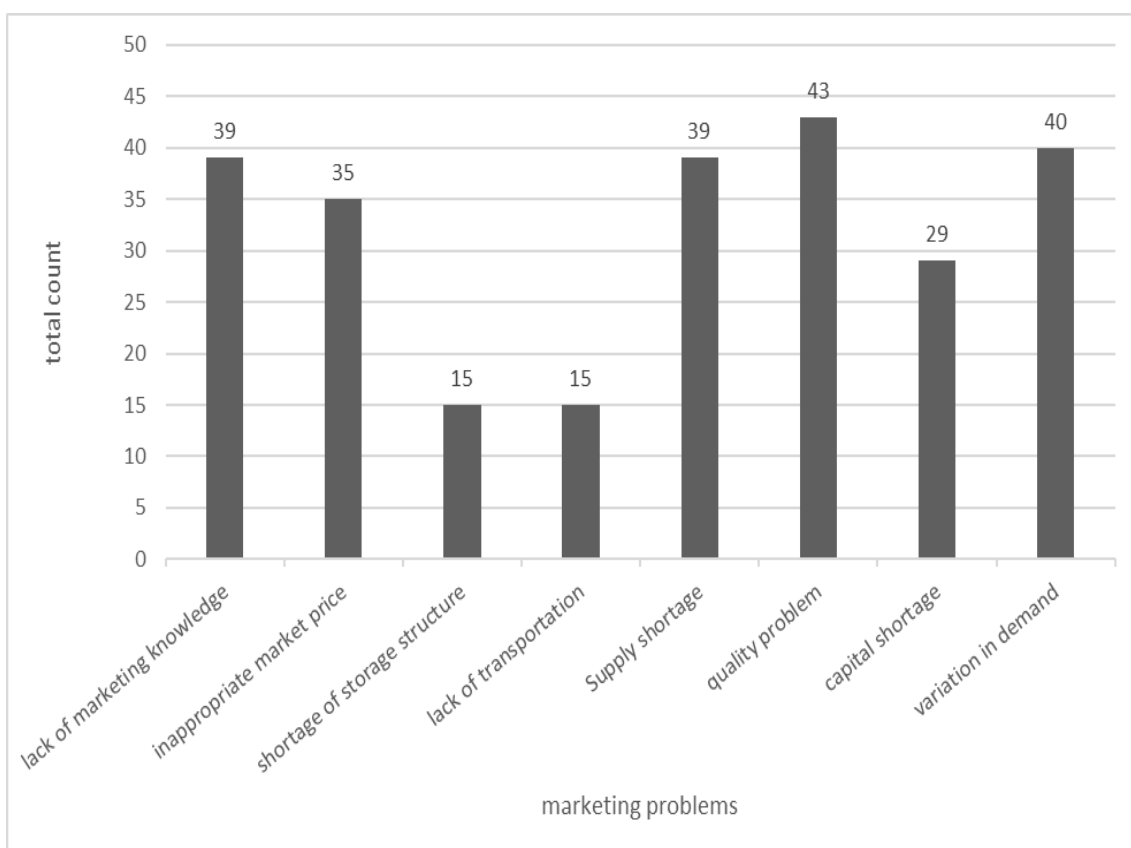


Figure 9: Marketing problems for traders (Source: Field survey, 2022)

5. SWOT ANALYSIS AT PRODUCER'S LEVEL

Table 24: SWOT analysis at potato producer's level

Strengths	Weaknesses
- Favorable climate for potato production - Farmers have reasonable access to technical services from the municipality and AKC. - Higher returns than cereal crops - Availability of more or less market information - Good shelf life - High demand in the local and regional market - Well- developed road network	- Lack of processing technology - Price fluctuation - Severe attack from blight and red ant - Sprouting and black scurf of potato during storage - Farmers not fully aware of quality inputs and modern techniques - Lack of technical knowledge - Inadequate government support
Opportunities	Threats
- Scope for value-added products - Scope for establishing potato processing industries - Increase in the establishment of cold storage - Potential to increase productivity - Scope for import substitution - Better access to market namely Pokhara, Butwal, Bhairahawa, Palpa	- Threat of fungal disease like late blight, black scurf - Serious threat of red ant - Decreasing trends of farm labor availability and high cost of production - Bad weather like heavy rainfall, hailstorm, and hailstones. - Lack of organized and assured market - Incidence of the pandemic situation causing poor marketing.

Source: Field survey, 2022

6. 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 soil suitability of the Syangja district provides an abundant opportunity for the farmers to grow potatoes. Input suppliers, farmers, wholesalers, retailers, cooperatives and consumers are major VC actors of Syangja for potato. Although farmers have enabled themselves to increase potato production, they still have lower level of economy due to middleman and retailers buying potato produced in other districts like Butwal and Bhairahawa than local produced. The seed potato is sold in this market as well as in distant markets like Pokhara, Palpa, Tanahu, Parbat, Butwal etc. The contract type of transaction of potato produces, actual valuation has been rarely done, which has created barriers for farmers to obtain the real value of their produces. Due to the lack of processing unit in district, farmers are not involved in product diversification. The only forms of selling of potato are as fresh vegetables and as seed potato so, there is scope of establishing processing industries. Cooperatives of Syangja district has played major role in marketing of potato due to the establishment of storage structures, collection and selling of potato from farmers. Farmers are also growing improved varieties like Janakdev, Khumal Rato, Khumal Ujwal, MS-43, TPS, PBS, cardinal etc. It shows GOs like AKC, PMAMP, Local government has done good job in awareness of improved varieties and more than half of the respondents from study area has got the training related to IPM.

CONFLICT OF INTEREST

The author here declares that there is no conflict of interest regarding the publication of this article.

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