



RESEARCH ARTICLE

VEGETABLE SEED PRODUCTION IN RUKUM (WESTERN PART) DISTRICT, NEPAL: AN ECONOMIC AND VALUE CHAIN EVALUATION

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ABSTRACT

Vegetable seed production in Nepal is rapidly growing due to commercialization, seed shortages, and increased value chain participation. The study aimed to comprehensively analyze vegetable seed value chain and economic aspects of the three municipal areas of the Rukum (Western Part) district, namely, Musikot Municipality, Chaurjahari Municipality and Sani Bheri Rural Municipality. A total sample size of 41 was taken using the purposive sampling method. The study identified vegetable seed production center, farmers, seed collectors, co-operatives, seed companies, and vegetable growers as major actors. The cost of seed production per ropani was highest in onion (Rs 16887.93), followed by radish (Rs 14187.85) and the lowest in cauliflower (Rs 12083.28). The onion, radish and cauliflower yield per ropani was found to be 24.5 kg, 93.69 kg, and 47.3 kg respectively. The B/C ratio was highest in cauliflower (2.02), radish (1.45) and onion having the lowest (0.71). A comparison of farm gate prices and B/C ratio with the past results showed consistency in radish and cauliflower. The farm gate price for onions has become highly volatile, and due to a combination of price drops and a high incidence of diseases, current prices are no longer sufficient to cover production costs, a sheer contrast to the past. The producer's share was very low in all three vegetable seeds, radish, onion and cauliflower at 10.9%, 3.38%, and 4.91%, respectively. This was due to high packaging costs and high margins set by traders. The most followed marketing channel was producer-collector-wholesalers-retailer-consumer. SWOT analysis revealed a favorable climate and national recognition as key strengths. The study recommended that the government and non-governmental organizations should focus on regular field inspections and setting and implementing minimum support prices to improve the vegetable seed production sector in the Rukum (Western Part) district.

KEYWORDS

Benefit-cost ratio, Economic analysis, Marketing margin, Value chain, Vegetable seed production

1. INTRODUCTION

Nepal's diverse range of climatic conditions with abundant natural resources makes it favorable for vegetable seed production. The most important driver of agricultural output potential is seed, on which the efficacy of other agricultural inputs are dependent (MoAD, 2013). Vegetable seed is a high-value commodity with significant production and marketing possibilities in both domestic and export markets. One of the promising sub-sectors for increasing agricultural production, reducing poverty, and improving food security in Nepal is good-quality vegetable seed (MoAD, 2013; Timsina et al., 2015). Seeds are produced in two ways, through formal system or through informal systems. It is the informal channel which meets more than four-fifths of the total seed demand where the producers grow and preserve their seeds and take part in a farmer-to-farmer exchange to utilize in the forthcoming season's planting (Neupane et al., 2023). In 2019/2020, the total available formal source of seed was about 642 tonnes and approximately 64% of seed demand was managed from the farmer-managed seed system informally (Karki et al., 2021; Neupane et al., 2023).

The mid and high hills of Nepal are the primary regions for producing

vegetable seeds (Timsina and Shivakoti, 2018). One of the major areas of vegetable seed production is the former demarcated Rapti zone i.e., Rukum, Rolpa, Dang, Salyan and Pyuthan districts, which contribute 25-30 percent of the total vegetable seed production in the country (VSPC, 2018). In 2016, Rukum (Western Part) produced 9.75% of the nation's total vegetable seed production, placing it number one among Nepal's 77 districts (VSPC, 2016; Shrestha and Dhakal, 2020). Major vegetable seeds produced in the district include Radish, Onion, Cauliflower, Bean, Cowpea, Mustard, Cress, and Pea (Bhandari, 2019). The wide diversity of agro-climates in the district, from warm subtropical to cool temperate, provides enormous opportunities for producing seeds of different vegetables.

Farmers in Rukum (Western Part) have been producing vegetable seeds for a long time. However, productivity is low, and they are not being able to utilize the full potential of the favorable climate. The economic viability of seed production is influenced by input costs, market access, and price fluctuations (Timsina et al., 2015). According to the District Agriculture Development Office, DADO (2023), the market price of local seed is decreasing year by year, and farmers are quitting seed production slowly due to lower income. Some main difficulties in vegetable farming in Nepal are the lack of quality inputs, insufficient modern farm equipment, lack of

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technical knowledge, inconsistency in market prices, and lack of access to market information (Paudel et al., 2019).

A value chain represents a vertical connection or network that connects multiple business entities and can involve processing, packaging, storage, transport and distribution (FAO, 2005). In the vegetable seed sector of Rukum (Western Part), many actors and functions are out of sync with one another. The linkage between growers, traders and end users needs to be stronger (Malla, 2021). The actors engaged in marketing and production have different areas of interest. Market actors are interested in quality assurance and market-led price fixation, while producers are primarily interested in access to technical input and market assurance of both price and quantity (Shrestha et al., 2021). Middlemen exploit the limited market knowledge of local farmers to their advantage, manipulating prices in their favor, and often offering lower compensation to farmers for their produce. Additionally, these middlemen frequently delay payments to farmers, causing financial hardship and disrupting the overall value chain.

To maximize the region's ability to produce vegetable seed, it is necessary to overcome the difficulties that farmers in Rukum (Western Part) face. Similarly, to find bottlenecks and inefficiencies, especially the exploitation of middlemen, and to suggest options for enhancing the whole system, it is crucial to comprehend the dynamics of the value chain and proper economic analysis. The objectives of our study are to map the value chain, access cost and return, estimate profitability and marketing margin and to conduct SWOT analysis within the vegetable seed value chain. Study's results can be utilized to guide decisions concerning policies and interventions aimed at increasing the productivity, profitability, and sustainability of vegetable seed production in Rukum (Western Part) district, ultimately assisting in the reduction of poverty and increasing food security in the area and all over the nation.

2. MATERIALS AND METHODS

2.1 Study Area

The research was conducted in the Rukum (Western Part) district of Nepal. Two municipalities, Musikot and Chaurjahari, and one rural municipality, Sani Bheri were selected purposively because they are the major vegetable seed growing domains and have a major contribution to the total production of vegetable seeds in the district (DADO, 2015). The study site is depicted in Figure 1.

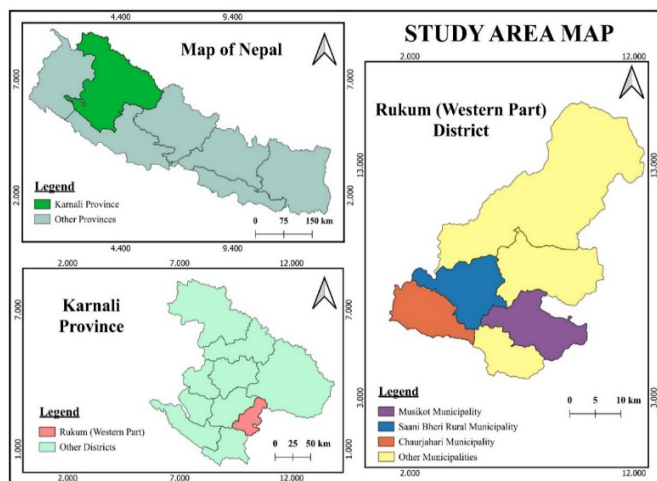


Figure 1: Map of Study Area

2.2 Sampling Technique and Data Collection

The sampling frame included commercial vegetable seed producers and cooperatives from the district and collectors, wholesalers, retailers, and consumers of Rukum (Western Part) and Kathmandu Valley. The purposive sampling method was used to select the value chain actors, and a total of 41 respondents were selected, including 21 producers, 5 collectors/cooperatives, 5 wholesalers, and 5 retailers along with 5 enablers. The primary sources of data were collected using structured questionnaires. Similarly, an unstructured questionnaire was used to interview a few key informants and a short focus group discussion with several farmers was held at the study site. Various published and unpublished materials, including journal and proceeding articles, websites of different organizations, and annual reports of the related governmental organizations such as, Vegetable Seed Production Center Rukum (Western Part), Ministry of Agriculture and Livestock Development, Nepal Agricultural Research Council were reviewed to collect secondary data.

2.3 Methods and Techniques of Economic Analysis

The economic viability of vegetable seeds was assessed by calculating the actor's production cost, marketing cost, gross margin, benefit-cost ratio, marketing margin and producer's share. The collected information was imported, processed and analyzed using R. Analyzed data are displayed using charts, graphs, and tables. The variables included in the economic analysis are as follows:

2.3.1 Cost of production

The total cost of production was calculated by summing every expenditure on variable inputs (Adhikari, 2013). It is given below:

Cost of production = \sum of cost of all variable inputs.

= cost of seed + cost of fertilizer + cost of land preparation and sowing + cost of plant protection measure + cost of intercultural operation + cost of harvesting + cost of post-harvest activities.

2.3.2 Gross Margin

The gross margin is the difference between the total revenue from sales and the total variable costs incurred in production. Variable costs are those that vary with the production level, such as the cost of seeds, fertilizers, and pesticides. Fixed costs, such as the cost of land and machinery, are not factored into the gross margin calculation (Choumbou et al., 2015).

Gross Margin = Gross Return – Total Variable Cost

where,

Gross Return = Price \times Total Quantity Marketed

Total Variable Cost = Cost of all variable items

2.3.3 Benefit-Cost Ratio (B/C Ratio) Analysis

Benefit Cost Ratio (BCR) is considered as a fast and convenient way for assessing the economic performance of any agricultural operation (Dhakal, 2015; Acharya et al., 2021). This analysis provides options and offers the best approach to achieving goals while saving on investment costs (FAO, 2005). The benefit-cost ratio is estimated using the formula:

B/C Ratio = Gross Return/ Total Cost

2.3.4 Marketing Margin

The marketing margin, also known as the retail-farm-gate margin, is the difference between the retail price of a product and the price received by farmers for their vegetable seed product (Colman and Young, 1995). It is calculated as follows:

Marketing Margin = Retailer's Price - Farm Gate Price

2.3.5 Producer's Share

According to a study, the producer's share is the ratio between the farm gate price and the retail price of any good or commodity (Magar and Gauchan, 2016). It is calculated as:

Producer's Share = (Farm Gate Price / Retailer's Price) \times 100

3. RESULTS AND DISCUSSION

The results of the data analysis, which were produced from the data collected over the survey period, are covered in this section, along with a discussion of the findings with the help of charts and tables wherever necessary.

3.1 Demographic Characteristics of Vegetable Seed Producers

The average age of farmer respondents was found to be 44.9 years. 71% of the producers were above 40 years old, highlighting a lack of involvement of youth and noticeable involvement of adults in seed production. Similarly, gender distribution was skewed towards male (Table 1). In the social settings of Rukum (Western Part), males were more willing to participate in surveys than females. The disparity was a result of cultural norms as females do not take part in external communication and might have limited insights to the process of seed production.

It was found that 61.9% of populations are either illiterate or are educated up to primary level and there were no respondents who were educated above intermediate level. This shows a lack of interest among educated youth in seed production. Also, parents prefer their educated children to pursue white-collar jobs, and migration in search for better opportunities remains a major concern. The number of new seed growers was noticed

very low which showed the lack of appeal of seed production. The premium of producing fresh vegetables over seeds due to improved roads could be a major reason.

Table 1: Demographic Characteristics of Vegetable Seed Producers in the study area	
Demographic Characteristics	Statistics
Age Distribution	
20-30 years	9.52%
30-40 years	19.05%
40-50 years	38.10%
50-60 years	23.81%
Above 60 years	9.52%
Gender Distribution	
Male	85.70%
Female	14.30%
Educational Qualification	
Illiterate	33.30%
Primary Level	28.60%
Secondary Level	19%
Intermediate Level	19%
Bachelor and above	0%
Experience in Seed Production	
0-3 years	4.80%
3-6 years	14.30%
6-10 years	9.50%
10-15 years	19%
More than 15 years	52.40%

(Source: Field Survey, 2023).

3.2 Cost of production

The cost of production of radish, onion and cauliflower seeds per ropani was calculated and presented in Table 2. The cost of production includes all resources used, such as land preparation, seed, fertilizers, weeding, irrigation, plant protection measures, harvesting, and post-harvesting measures. The result showed the cost of vegetable seed cultivation was highest for onions and lowest for cauliflower. The cost was high because it takes two years for onion seed production. Onion bulbs were produced in the first year, and seeds were produced from bulbs in the second year, requiring more inputs. Similarly, post-harvest costs were high for onions and radishes due to the tedious and time-consuming operations of drying, separating, cleaning, and extracting seeds, which required more labor and resulted in high costs. A group of researchers have shown the cost of labor in onion seed production greater than 50 percent (Modi et al., 2015). These insights highlight the varying financial demands of producing different vegetable seeds and underscore the need for cost-reduction strategies for enhancing economic viability.

Table 2: Cost of production of Radish, Onion and Cauliflower seeds				
S.N.	List of particulars	Average cost of production		
		Radish	Onion	Cauliflower
1.	Seed Cost	245.83	577.98	634.67
2.	Fertilizer Cost	1772.74	2204.36	1793.94
3.	Plant Protection	877.14	2189.29	1086.67
4.	Land preparation and sowing	2277.86	2505.86	2308
5.	Intercultural Operation	2508.57	3956.05	3600
6.	Harvesting	1668.57	1855.10	1240
7.	Postharvest Operation	4837.14	3599.29	1420
Total Cost of Production		14187.85	16887.93	12083.28

(Source: Field Survey, 2023).

Variety: Radish-Mino Early, Onion – Red Creole, Cauliflower – Kathmandu Local

Unit: rupees/ropani

3.3 Productivity Analysis

The productivity analysis suggested the average yield of seeds per ropani was the highest for radish, followed by cauliflower and lowest for onions (Table 3). Radish showed the most consistent productivity, which could be a good choice for farmers. The lowest productivity of onion could be attributed to a longer cultivation period and higher susceptibility to diseases. These disparities could help farmers in the selection of vegetables and harness greater profitability.

The productivity of onion was 24.5 kg/ropani which was significantly lower than what Gautam found i.e. 100 kg per ropani, mainly accountable for high disease incidence, requiring protection measures (Gautam, 2020). But the productivity in cauliflower and radish were like Gautam's findings. As compared to a study, the per kg cost was comparable with radish and cauliflower but a marked increase in onion prices from Rs. 465 to about Rs. 689 justifying low production caused by diseases (Shrestha et al., 2021).

Table 3: Productivity analysis of vegetable seeds				
S.N.	Vegetable Seeds	Average value		
		Total cost per ropani (Rs)	Total production per ropani (Kg)	Production cost per kg (Rs)
1.	Radish	14187.85	93.69	151.43
2.	Onion	16887.93	24.5	689.30
3.	Cauliflower	12083.28	47.3	255.46

(Source: Field Survey, 2023).

3.4 Profitability Analysis

The profitability analysis was focused on understanding the viability of seed cultivation and share of profits with respect to three vegetable seeds. The influence of factors such as market prices, input costs and yields on overall returns is clearly shown in the analysis of profits. Cauliflower was observed more profitable with the highest gross margin and benefit-cost ratio of 2.02. It was followed by Radish with a margin of Rs. 6427.14 and a benefit-cost ratio of 1.45 (Table 4). These two seeds have benefited more than the costs incurred in their cultivation indicating a profitable venture. But the picture changes when it comes to onion, cost of production exceeded benefits shown by a benefit-cost ratio of 0.71 and negative gross margin. This showed that farmers were experiencing loss while producing onion seed.

The result reported by Gautam also showed radish and cauliflower as profitable with a B/C ratio of 1.2 and 1.7 respectively (Gautam, 2020). However, there is a huge discrepancy in the gross margin and the B/C ratio of onion. He found the gross margin in onion seed production to be Rs 89410 per ropani with an excellent B/C ratio of 5.1. This difference in the gross margin is due to high fluctuation in the selling price of the onion seed, unlike radish and cauliflower seed which had only a small fluctuation.

Table 4: Comparative Profitability Analysis of Vegetable Seeds					
S.N.	Vegetable seeds	Average (Rupees/Ropani)			B/C Ratio
		Total Cost	Gross Return	Gross Margin	
1.	Radish	14187.85	20615	6427.14	1.45
2.	Onion	16887.93	12000.07	- 4887.86	0.71
3	Cauliflower	12083.28	24466.67	12383.4	2.02

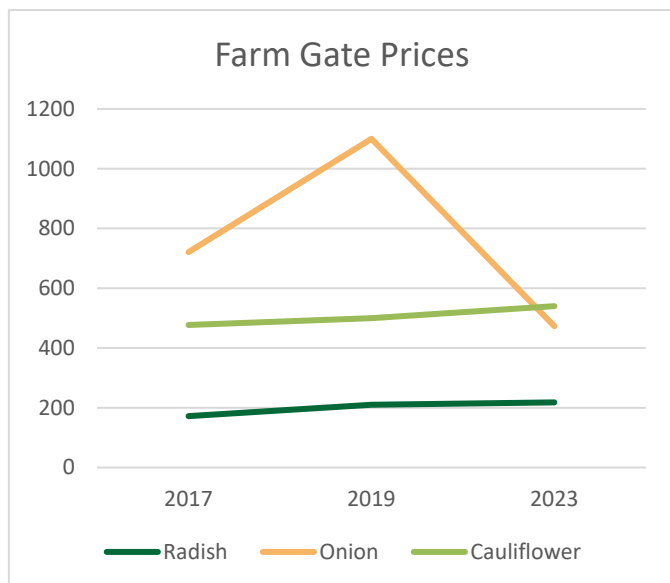
(Source: Field Survey, 2023).

3.5 Trend of Farm-Gate Prices and Benefit-Cost Ratio

The trends of farm-gate prices and B/C ratio from past research, along with our study (2023), provide significant insights into the economic dynamics of vegetable seed production (Shrestha et al., 2021; Gautam,

2020). Market demands, input costs, market information, practices of middlemen played crucial roles in causing price fluctuation. The comparison is presented in the Figure 2 and 3.

3.5.1 Farm-Gate Prices



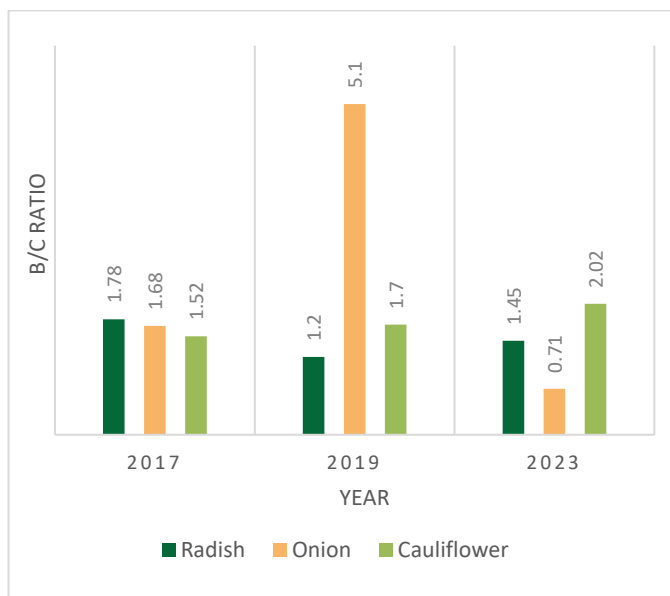
(Source: Shrestha et al., 2021; Gautam, 2020; Field Survey, 2023).

*Shrestha et al., have data of 2017

Figure 2: Comparison of Farm-Gate

The comparison of past research with the field survey (Figure 2) showed that farm gate prices of radish and cauliflower have remained relatively stable and could indicate consistent profits. In the case of onion, the variability of onion was extremely volatile and showed a marked increase followed by a marked decrement. This comparison showed the need to manage price volatility and stabilizing the farm gate prices to ensure sustained profitability for farmers.

3.5.2 Benefit-Cost Ratio



(Source: Shrestha and Dhakal, 2020; Gautam, 2020; Field Survey, 2023).

*Shrestha and Dhakal have data of 2017

Figure 3: Comparison of Benefit-Cost Ratio

The comparison of the B/C ratio over the research and field survey (2017-2023) suggested notable differences in the profitability of various vegetable seeds (Figure 3). The B/C ratio for cauliflower showed a gradual increment with time and indicates profitability. The B/C ratio of radish hovered within the range of 1.2-1.8 suggesting profitability with varying

returns. Onions have been increasing before and was so much more profitable due to farm-gate prices and gross margins. However, the situation is bleak in recent times with high incidence of diseases and lower yields, it cannot even cover the cost of seed production.

3.6 Value Chain Actors

Our study identified input suppliers, producers, traders (Collectors/co-operatives, wholesalers and retailers) and consumer as value chain actors who were involved in the different stages of the value chain like production, marketing and distribution, processing activities that add value to the product and also, the enablers who facilitated the functioning of the process.

3.6.1 Input Suppliers

The input suppliers for vegetable seeds in Rukum (Western Part) were mainly the Vegetable Seed Production Centre (VSPC) and local agro vets. VSPC was mainly responsible for supplying the foundation seeds to the seed farmers. In our study, about 90% of them bought the seeds from VSPC in 2023.

3.6.2 Producers

We found producers as the major actor in the value chain. They were responsible for cultivation, extraction and collection of raw materials for seed cultivation (Mallick et al., 2018). There was lack of knowledge about the modern cropping practices and technologies. The number of new producers was found low as the scenario of vegetable seed production was changing. Development of roads and transportation facilities has linked the district with major cities, and farmers opt to produce fresh vegetables over seed production.

3.6.3 Collectors/Co-operatives

The collectors/co-operatives were the connecting link of producers and wholesalers while marketing the vegetable seeds. Co-operatives were slowly becoming inactive, and the collection of seeds was mainly conducted through collectors. The collectors had a very strong horizontal informal network for negotiating prices with seed producers and the optimal amount paid to the farmers. The process started procuring from farmers within a territory on an individual basis. They determined production inside Rukum (Western Part) and the entire country. After negotiating with seed firms and agro vets to set the price and then only, they used to go to farmers after getting payment from seed firms.

3.6.4 Wholesalers

The wholesalers bought from collectors and sold the seeds to either consumers or retailers in small quantities. They consisted of large agro vets and seed companies from all over the country and had an important role in the value chain of vegetable seeds as they store the seeds for the long time and are responsible for packaging. A large chunk of the value addition came from wholesalers.

3.6.5 Retailers

Retailers bought small quantities of seeds and sold them to consumers. Usually, agro vets from outside the district, agro vets from within the district, and cooperatives served as retailers of vegetable seeds from the study area. Retailers from all over the country sell packaged seeds to consumers and different co-operatives. Retailers were the ones to enjoy largest profit margin in the value chain.

3.6.6 Consumers

End users of vegetable seeds included fresh vegetable growers from across the country. They were the primary actors for whom the producer produced vegetable seeds and retailers were involved in the product's transaction. Retailers used to collect consumer demand and preferences, which they then passed on to producers and input suppliers as demand via the marketing channel.

3.6.7 Enablers

The activities of the enablers were found ranging from production to the final consumption stage. The enablers involved in the value chain of vegetable seed were the Ministry of Agricultural Development (MoAD), Department of Agriculture (DoA), District Agriculture Development Office, Rukum (DADO), Nepal Agricultural Research Council (NARC), National Seed Board (NSB), Seed Quality Control Center (SQCC), VSPC, Prime Minister Agriculture Modernization Project (PMAMP) and Kisanika Lagi Unnat Biu-Bijan Karyakram (KUBK).

3.7 Value Chain Mapping

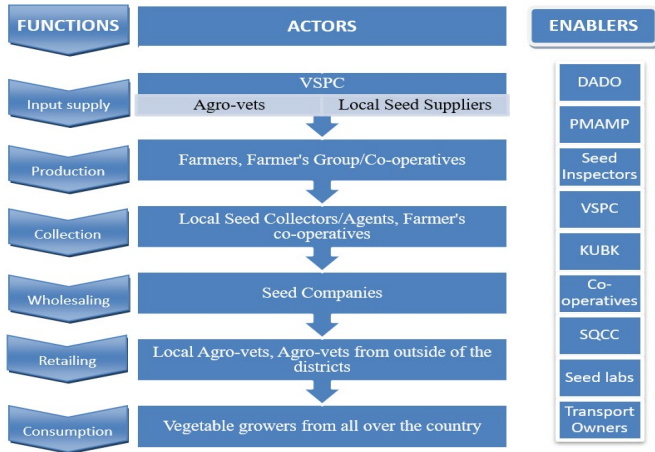


Figure 4: Value Chain map of vegetable seeds in Rukum (Western Part)

* DADO = District Agriculture Development Office, Rukum, VSPC = Vegetable Seed Production Centre, PMAMP = Prime Minister Agriculture Modernization Project, KUBK = Kisanka Lagi Unnat Biu-Bijan Karyakram, SQCC = Seed Quality Control Center.

It was found that the same actors and facilitators were performing different roles at different stages of the value chain. There was a poor relationship between the actors and enablers which resulted in a weak value chain. This matches with the findings of (Gautam, 2020). None of the farmers had made formal contracts with the seed companies and collectors. The result was further supported by the findings of a group researcher where authors have mentioned the lack of formal contracts and informal contact with local traders being customary practice in the study

area (Shrestha et al., 2021).

It was also found that PMAMP and KUBK were less involved in the value chain of vegetable seed production than they were in the previous years (Shrestha et al., 2021; Pun and Poudyal, 2018). Similarly, the involvement of the United Mission to Nepal (UMN), Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED) and other I/NGOs were involved less frequently than before. At present, the most active and direct facilitators in the value chain were VSPC, which provided foundation seed to agrovets, local seed suppliers and seed producers, and DADO, which provided technical input as well as training and knowledge exchange. In addition, they monitored and inspected the quality of vegetable seeds.

3.8 Cost and Marketing Analysis of Vegetable Seed Production

The costs incurred by traders in the value chain revealed significant facts about the distribution of expenses which is presented in the Table 5. The transportation costs were largely borne by collectors for gathering seeds from farmers and transporting them to major cities while contribution from wholesalers and retailers was very minimal. It was found that the collector collected seeds from the farmers and sold them directly without storing them. Wholesalers store seeds for about 2-3 months further adding to the cost of seed and retailers store them for very short duration.

After collecting seeds from the farmers, initial packaging was done by collector into sacks of 35–50 kilograms. Major contribution was done by seed companies and wholesalers, who added value to the seeds by performing attractive packages and storage functions. Generally, radish seed was packaged into 20-gram packets, while onion and cauliflower seeds were packaged into 10-gram packets. The cost of packing was tremendously high in the vegetable seed value chain since packet, sticker, labor and loss costs were all included in it. Retailers did not bear much of the cost as they receive it from wholesalers and sell pre-packaged seeds. This shows the added value provided by upstream factors in the value chain.

Table 5: Cost incurred by traders in different stages of value chain

Vegetable Seeds	Traders	Transportation Cost (Rs/kg)	Packaging Cost (Rs/kg)	Storage Cost (Rs/kg)	Total Cost Added (Rs/kg)
Radish/ Cauliflower	Collector	12.2	1.78	0	13.98
	Wholesaler	4.4	255.325	5	264.725
	Retailer	0.6	0	2	2.6
Onion	Collector	12.2	1.78	0	13.98
	Wholesaler	4.4	510.65	5	520.05
	Retailer	0.6	0	2	2.6

(Source: Field Survey, 2023).

3.9 Marketing Margin and Producer's Share

The marketing margin for all three vegetable seeds was high with an extremely high marketing margin for cauliflower and onion compared to radish (Table 6). But, if you look at the producers' share, it was extremely low for all the seeds. Such high marketing margins and low share on the

producer's end were because of high packaging costs and because of the handsome margins of retailers. Seed producers who did most of the work were left with the minimum share while the retailers, who didn't add much value to the product, enjoyed the most profit. This showed the traders are setting the price at their own will suggesting lack of monitoring from government and a lack of optimal price setting. Seed producers were unaware of this market situation and had weak negotiating power for higher prices.

Table 6: Marketing margin of different actors and producer's share (Average value, Rs/kg)

S.N.	Vegetable Seeds	Farm Gate Price	Wholesaler's Price	Retailer's Price	Marketing Margin	Producer's Share
1.	Radish	218	750	2000	1782	10.90%
2.	Onion	473	6000	14000	13527	3.38%
3.	Cauliflower	540	5000	11000	10460	4.91%

(Source: Field Survey, 2023).

3.10 Marketing Areas and Marketing Channels

The major marketing areas for vegetable seeds were identified as Kathmandu, Nepalgunj, Dhangadi, Biratnagar, Pokhara, Chitwan, Kavrepalanchowk, Butwal, Dang, Salyan, and Makawanpur. The seeds produced in Rukum (Western Part) were marketed through various seed companies such as Api Himalaya Seeds in Kailali, Live Seed Company in Kavrepalanchowk, Nakkhu Seeds in Lalitpur, Muktinath Krishi Company in Kathmandu, and Shree Ram Seed Company in Chitwan.

In the study area, multiple marketing channels were identified through which the seeds were delivered to vegetable growers across the country (Table 7). The most followed marketing channel in the study area was producer-collector/co-operative-wholesaler-retailer-consumer. It was found that 76.2% of the seed producers sold seeds to local seed collectors, and 14.3% of the farmers sold through cooperatives. Gautam reported that 39.36% of farmers used to sell through cooperatives (Gautam, 2020). This decrease in percentage was because most of the cooperatives are inactive at present, and most of the farmers sell through collectors.

Table 7: Marketing Channels of Vegetable Seeds in Rukum (Western Part)

S.N.	Marketing channel
1.	Producer - Consumer
2.	Producer - Retailer - Consumer
3.	Producer - Wholesaler - Consumer
4.	Producer - Wholesaler - Retailer - Consumer
5.	Producer - Collector/Co-operative - Wholesaler - Retailer - Consumer

(Source: Field Survey, 2023).

3.11 SWOT Analysis at Producer's Level

SWOT analysis at producer's level was done by Focus Group Discussions (FGDs) in the study area participated by seed producers, authorities of District Agriculture Development Office (DADO) and Vegetable Seed Production Centre (VSPC). It is presented in the Table 8. The favorable climatic condition and large involvement of seed companies and agrovets were the major strengths. On the contrary, lack of knowledge on seed cultivation and lack of storage and processing facilities were identified as the weaknesses. The youth employment and presence of experienced farmers were the opportunities for the sector while uncertain price volatility and increasing incidence of diseases were the major threats.

Table 8: SWOT analysis at producer's level

Strengths	Weaknesses
<ul style="list-style-type: none"> ➤ Favorable climatic condition. ➤ Presence of farmer's group and farmer's co-operative. ➤ National recognition as a major vegetable seed production pocket area. ➤ Large involvement of seed companies and agro vets. ➤ Presence of indigenous knowledge on curing and grading. 	<ul style="list-style-type: none"> ➤ High cost of production. ➤ Fragmented land. ➤ Lack of knowledge about pest and disease management. ➤ Lack of field inspectors in the district. ➤ Out-migrating population. ➤ Lack of storage and processing facilities. ➤ Lack of market information on price and market demand.
Opportunities	Threats
<ul style="list-style-type: none"> ➤ Easy availability of foundation seed via. VSPC. ➤ Increased accessibility because of the Mid-hill highway. ➤ Youth employment at the local level. ➤ Presence of experienced farmers to guide new seed producers. ➤ Group marketing and contract farming. 	<ul style="list-style-type: none"> ➤ Decreasing quality of the seeds. ➤ Uncertainty of price. ➤ Increasing incidence of diseases. ➤ Decreasing domestic demand for local vegetable seeds. ➤ Competition with imported seeds. ➤ Seed collectors fix the price to farmers only after they sell to the market.

4. CONCLUSIONS

The economic analysis revealed the variability in cost of production, and profit margin on the back of vulnerability to pests and diseases of seed crops. For the research area, onion seemed to have the lowest benefit-cost ratio as well as the lowest gross margin. It did not come across as a profitable venture for farmers. The selection of radish and cauliflower seeds made more sense since the B/C ratio was greater than 1 and positive gross margin. Comparison with past research also showed the change in trends of farm gate prices and B/C ratio of the seed crops. The study has shown retailers in the value chain were where the marketing margin was enjoyed the most. Being unaware of the market rate and conditions, producers are limited to 3-10% of the share of the margin which is very low compared to the amount of work they put. Major big cities in Nepal are the marketing areas of the seeds produced in Rukum (Western Part) and the most followed marketing channel was found to be producer-collector-wholesaler-retailer-consumer. SWOT analysis of seed producers identified the information seed farmers need to be educated on.

The enhancement of sustainability and profitability of the vegetable sector in Rukum (Western Part) is the major goal. It is imperative that

governments and NGOs should conduct field inspections to ensure farmers know and follow the protocols that improve the quality of seeds. The establishment of a Minimum Support Price by the government can go a long way in protecting farmers in volatile market conditions. Contract farming and frequent training for farmers will help stabilize their income and foster a more resilient seed industry.

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