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ORIGINAL RESEARCH ARTICLE



Effects of COVID-19 induced pandemic on the production, trade, and income of smallholder vegetable growers in Kathmandu Valley, Nepal

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ABSTRACT

This study assessed the effects of the COVID-19 pandemic on production, trade and income of smallholder vegetables growers in the Kathmandu valley, Nepal. We made a scenario-based situation analysis of pre-COVID (January to March 2020) and COVID-19 pandemic induced lockdown (April to June 2020) situations. The study used a descriptive research design and employed multistage sampling techniques. One hundred forty-five vegetable growers were surveyed and six focus group discussions were carried out between May to July 2020 in the three municipalities- Chandragiri, Mahalaxmi and Changunarayan of Kathmandu, Lalitpur and Bhaktapur districts respectively. The study showed that the income of smallholders' vegetable growers was decreased by 66.1 percent due to an increase in input price (16.9 percent), a decrease in output price (62.67 percent), and low farm productivity (9.3 percent) in comparison with the pre-COVID period. This paper has figured out the impact pathways that caused the income decline of vegetable growers. The primary constraints to smallholder producers were the absence of local aggregators followed by transportation barriers, limited market opening hours, and mobility obstruction and changed consumers' behavior due to lockdown. Majority of the farmers adjusted to the situations by selling their products at lower prices, free distribution to the local inhabitants, and composting and dumping the surpluses. The study concluded that this kind of analysis is necessary to develop resilient supply chains and extend appropriate support to the smallholder farmers who are critical actor to the supply chains.

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INTRODUCTION

The COVID-19 pandemic is the biggest national health crisis in Nepal's modern history, which has devastating impacts on the economy and the agricultural sector. To curtail the virus spread, the Government of Nepal announced a lockdown starting from 24 April 2020, encouraging producers, traders, processors, and consumers in the value chain to implement stay-at-home order and public health protocols, including social distancing, which impaired the overall food demand and supply systems of Kathmandu valley. The COVID-19 pandemic has endangered the livelihoods of millions of people worldwide, and the negative

impacts of the pandemic on food and nutritional security are deepening globally. This global health crisis is particularly threatening to the global poor, who are already suffering from hunger and malnutrition before the virus hits (Elizabeth Bryan *et al.*, 2020 and UN, 2020). According to FAO and ECLAC (2020), global poverty will increase by 548 million, and there will be an increase in the number of food-insecure people, estimated at 183 million because of the COVID-19. How damaging these impacts turn out to be for food security, nutrition, and farmers and fishers' livelihoods will depend in large part on policy responses over the short, medium, and long term (OECD, 2020). Studies have found that the impacts of COVID-

19 induced pandemic on food production systems are broad, severe, and pervasive. In the context of developing countries, evidence suggests that the effects of the COVID-19 pandemic on agriculture are complex, heterogeneous, and dynamic (Amjath-Babu et al., 2020; Loayza and Pennings, 2020 and Ceballos et al., 2020; Adelodun et al., 2020), and the impact varies for different groups of the rural population, with the highest impact on the farmers (FAO, 2020a).

Studies suggest the multiple pathways that pandemic may have been affecting the global and domestic food systems. According to (ADB, 2020), disruptions to domestic and international food supply chains have undermined food availability and accessibility. Physical distancing and lockdown measures to contain the spread of COVID-19 have posed significant risks to food and nutrition security through disruptions to food production, distribution, and access (Amjath-Babu et al., 2020; FAO, 2020a); affecting both supply and demand channels (Schmidhuber et al., 2020; Khanal et al., 2020). According to (Amjath-Babu et al., 2020), South Asia's food production systems and significantly those reliant on external inputs and human labor are being disrupted by the COVID-19 crisis through multiple pathways.

COVID-19 pandemic is affecting a large number of farmers around the world. Low supplies of production inputs (seeds, pesticides, fertilizers, machinery, etc.) and shortage of labor forces complicated the crop production activities (Schmidhuber et al., 2020; FAO, 2020b; and Amjath-Babu et al., 2020). COVID-19 exerted a shock on food demand by lowering consumers' overall purchasing power. For farmers, lower sales revenues that result from price and sales volume changes led to capital shortages (Amjath-Babu et al., 2020). Harvesting was delayed due to the non-availability of labor, field operations were costlier, and farmers faced the problem of sale of farm produce (Deshmukh, 2020). In Odisha (India), farmers spent more on labor to harvest their crops, and distress selling was more prevalent due to the absence of a well-functioning procurement system (Ceballos et al., 2020).

The countrywide lockdown came at a regrettable time for the Nepalese and South-Asian farmers. In the Indo-Gangetic plain areas (*Terai* regions), winter vegetables (gourds, beans, pumpkins, tomato, leafy vegetables), including winter cereals and pulses, were ready for harvest and bring these to the market (Hai-Ying and Chang-wei, 2020). In the hills and mountains, it was the high time for sowing maize and millet, preparing for main season rice planting, and growing monsoon-offseason vegetables considered "Green Gold" of small-scale producers. In these perspectives, this paper aims to examine the impact of COVID-19 induced pandemic on the production and trade of vegetable crops and identify pathways to explain how the pandemic affected the income of smallholder vegetable growers in Kathmandu valley of Nepal. We selected vegetable crops for this study because of their high and regular demand in the market, vegetables are often perishable, and delay in marketing can result in a rapid and significant post-harvest loss causing economic loss to the farmers.

MATERIALS AND METHODS

We made a scenario-based situation analysis of vegetable production and trade in Kathmandu valley (Kathmandu, Bhaktapur, and Lalitpur districts) during pre-COVID (January 2020 to March 2020) and COVID-19 induced lockdown (April 2020 to June 2020) contexts. Three municipalities- Chandragiri Municipality (Kathmandu district), Mahalaxmi Municipality (Lalitpur district), and Changunarayan municipality (Bhaktapur district) were purposively selected because of the large number of vegetable producers in these areas. On the second stage, 145 vegetable growers (55 from Chandragiri; 50 from Mahalaxmi, and 40 from Chandragiri municipalities) were randomly selected, and semi-structured interviews were conducted. The questionnaire was pre-tested in the Focus Group Discussion (FGD) that involved five lead farmers from each study area. The discussion and learning from the FGD were incorporated into the study process. In the survey, the revised questionnaire was administered to the vegetable producers through the trained enumerators' following COVID-19 health protocols issued by the Government of Nepal. The IBM SPSS Statistics 23 and MS-EXCEL was used to analyze the data. The findings were analyzed using descriptive statistics such as percentages, means, frequencies, standard deviations, etc. Pivot table was used for comparing the frequency of pre-COVID and in-COVID lockdown situations.

RESULTS AND DISCUSSION

Socio-economic profiles of the respondents

Table 1 summarizes the socio-economic profiles of the respondents. According to this, 70 percent of the total farms in the study areas were operated by the male farmers and 30 percent by the female. In terms of ethnicity, 58 percent of vegetable producers were indigenous people followed by Chhetries (16 percent), Brahmin (11 percent), Dalits (10 percent), and Madhesis (4 percent). For education, 13 percent of farmers were just literate, 79 percent had education up to grade 12, and 9 percent had graduate and post-graduate level education. Land ownership data indicated that only 7 percent of farmers own land, while 90 percent had operated on leased land. In terms of landholding, 93 percent had to hold less than 1 ha while 7 percent had land parcel more than 1 ha. Landholding size ranged from 0.2 to 3.5 ha. The small landholding is the typical farm characteristics of Nepal. In Kathmandu valley, small parcel size is due to limited land availability for farming and high renting cost. The study found four vegetable crops accounting 90 percent of standing crops in pandemic were tomato, cabbage, cauliflower, and pumpkins.

Pandemic impacts on agricultural inputs and commodity prices

The study showed changes in the price of primary agricultural production inputs before (January 2020 to March 2020) and after lockdown (April 2020 to June 2020). According to our

study, the average price of principal agricultural inputs- urea, diammonium phosphate (DAP), muriate of Potash (MOP), farmyard manure (FYM), seeds, and pesticides rose by 16.97 percent between January 2020 to March 2020 and April 2020 to June 2020. As illustrated in Table 2, the price of Urea, DAP, MoP, and FYM increased by 15.6, 8.9, and 33.9 percent, respectively. Likewise, the average cost of seeds, insecticides, bactericides, and fungicides was increased by 6.1, 32.2, 1, and 24.1 percent, respectively. Similar findings were reported in Tamru et al. (2020) indicating 20% increase in pesticide and fertilizer before and after the pandemic where as the price of seed was increased by 10%. Farmers in the study area during FGD reported an increase in labor price by 1.5 times than in the normal situation. The research conducted among 46 agriculture cooperatives in Shanghai, China found that 65.2% responded reported labor shortage and increase in labor cost, whereas 19.6% responded on lack of agriculture production inputs. During FGD, it was also revealed that the COVID-19 induced disruptions had reduced the production capacity of farm inputs and have led to an increase in price, making these resources inaccessible to smallholder farmers.

However, contrary to the price rise for agricultural inputs, the average price of vegetable crops decreased significantly during the lockdown as shown in Table 3. The result showed that the farmers who sold tomato for Rs. 71.43 per kg in pre-lockdown reported making Rs. 38.45 per kg during the lockdown. Similarly, in lockdown (compared to a normal situation), the cauliflower, cabbage, and pumpkin price declined to Rs. 20.35, Rs. 6.26, and Rs. 11.67 per kg from Rs. 58.1, Rs. 21.7, and Rs. 36.9 per kg respectively. Overall, the average price of vegetables was decreased by 62.67 percent. The farm gate prices of vegetables

Table 1. Respondents' profiles.

Variables	Percentage (n=145)
Land holding (ha)	
0.2 to 1 ha	93
1 to 3.5 ha	7
Land tenure	
Own	7
Leased	90
Both (Owned and Leased)	3
Gender	
Male	70
Female	30
Ethnicity	
Brahmin	11
Chettri	16
Janajati	58
Madhesi	4
Dalit	10
Others	1
Education	
Literate	12
Up to grade 12	79
Graduate and Post-graduate	9

in the Kathmandu valley had crashed because of lower demand. Decline in vegetable produce price was also observed in the research conducted in Ethiopia by in which 100 kg of cabbage was sold at \$9 before lockdown was reduced to \$3 during the lockdown whereas, onion price was reduced from \$0.50 per kg to \$0.30 per kg before and after the lockdown respectively and was found to be 40 % decline in onion price (Tamru et al., 2020).

Impact on vegetable production

During the initial lockdown time, the tomato was the major standing crop for 58.6 percent of farmers, followed by cabbage (15.5 percent), cauliflower (9.9 percent), pumpkin (8.7 percent), and other leafy vegetables (7.3 percent). The pandemic's effect on vegetable production in the study area was analyzed by assessing the first month of crop pick of last year and this year. From April 2020 to June 2019, the average production of tomato, cauliflower, cabbage, and pumpkin per farmer was 1367.8, 2494.8, 1426.8, and 5880.8 kg, respectively, while the production of these crops decreased to 1273.7 kg (tomato), 2417.86 kg (cauliflower), 1125.58 (cabbage) and 5519.17 kg (pumpkin), respectively from April 2020 June 2020. The average production of these commodities was reduced by 9.3% compared to the production from April to June 2019 (Table 4). Pan et al. (2020) concluded that crop production was drastically reduced due to the lockdown induced by covid19 pandemic as 40% of the seed enterprises have remained closed during lockdown and only 3.3% of the seed stores were in regular operation during the lockdown which created shortage of other agriculture production materials. Also, the major crop- wheat, rice and corn production has been hindered during pandemic due to insufficient supply of agri-inputs and obstacle in spring plowing.

Problems faced by smallholder producers due to COVID-19 induced lockdown

The primary constraints to smallholder producers were- the absence of local aggregators (31.05%) that made farmers compel to give more commission to limited aggregators followed by transportation barrier (29.35%), limited market opening hours (28.57%), mobility obstruction due to lockdown (16.44%) and dominancy of Indian vegetables (8.46%) as illustrated in Table 5. Similarly, traffic restriction and fear of virus spread during making any travel were found to be main problem during pandemic by (Mingzhe and Yu, 2020).

Farmers marketing actions and coping strategies

Majority of the farmers adjusted to the situations by selling their products in the regular wholesale (35.5 percent) and local markets at a lower price (20.2 percent), free distribution to the local inhabitants (17.3 percent), on-farm sale at a lesser price (14.0 percent) and composting and dumping of the surpluses (9.31 percent). Farmer's marketing actions and coping strategies for each commodity are presented in the given in Table 6.

Table 2. Changes in input prices during pre-lockdown and lockdown situations.

Input prices	Pre-lockdown situation (Jan to March 2020)	In-lockdown situation (April to June 2020)	Percentage change
Average of cost of urea (Rs/kg)	31.29	36.18	15.6 %
Average of cost of DAP (Rs/kg)	60.80	66.23	8.9 %
Average of cost of MOP (Rs/kg)	51.10	58.06	13.6 %
Average of cost of farm manure (Rs/kg)	5.31	7.12	33.9 %
Average of cost of tomato seeds (Rs/2gm packet)	301.05	319.47	6.1 %
Average of cost of insecticides Rs/100ml)	175.25	231.75	32.2 %
Average of cost of bactericides (Rs/100g)	141.23	142.68	1.0 %
Average of cost of fungicides (Rs/100g)	266.39	330.52	24.1 %
Total average change			16.9 %

Table 3. Average price of major vegetables during pre-lockdown and lockdown situations.

Price of major vegetables	Average price during Jan to March 2020	Average price during April to June 2020	Percentage change
Average price of tomato (Rs/kg)	71.43	38.45	46.17 %
Average price of cauliflower (Rs/kg)	58.1	20.35	64.97 %
Average price of cabbage (Rs/kg)	21.7	6.26	71.15 %
Average price of pumpkin (Rs/kg)	36.9	11.67	68.37 %
Total average change			62.67 %

Table 4. Impact of lockdown on production of major vegetable crops.

Average production per farmer (kg)	Average production per farmer during April to June 2019	Average production per farmer during April to June 2020	Percentage change
Tomato	1367.8	1273.7	6.88 %
Cauli	2494.8	2417.9	3.09 %
Cabbage	1426.7	1125.6	21.10 %
Pumpkin	5880.8	5519.2	6.15 %
Total average change			9.3 %

Table 5. Problems faced by vegetable growers during pandemic crisis.

Major problem faced by growers	Cauliflower	Tomato	Cabbage	Pumpkin	Total Average
Absence of local aggregators	17.5 %	69.8 %	7.0 %	30.0 %	31.1 %
Dominancy of Indian vegetables	4.8 %		14.0 %	6.7 %	8.5 %
Transportation barrier	28.6 %	11.6%	37.2 %	40.0 %	29.4 %
Mobility obstruction due to lockdown	20.6 %	8.5 %	23.3 %	13.3 %	16.4 %
Limited market opening hour	28.6 %		18.6 %	10.0 %	19.1 %

Table 6. Farmers coping strategies for marketing their produce during crisis.

Coping strategy	Cauliflower	Tomato	Cabbage	Pumpkin	Total Average
Sale in regular wholesale market at lower price	20.6 %	79.8 %	11.6 %	30.0 %	35.5 %
Sale in local market at lower price					
Visit to consumer household for sale	14.3 %	12.4 %	20.9 %	33.3 %	20.2 %
	9.5 %		7.0 %	6.7 %	7.7 %
On farm sale at low price	27.0 %	7.8 %	11.6 %	10.0 %	14.1 %
Feed to animals	1.6 %		9.3 %	6.7 %	5.9 %
Composting of the surpluses					
Free distribution to the local inhabitants	14.3 %		7.0 %	6.7 %	9.3 %
	12.7 %		32.6 %	6.7 %	17.3 %

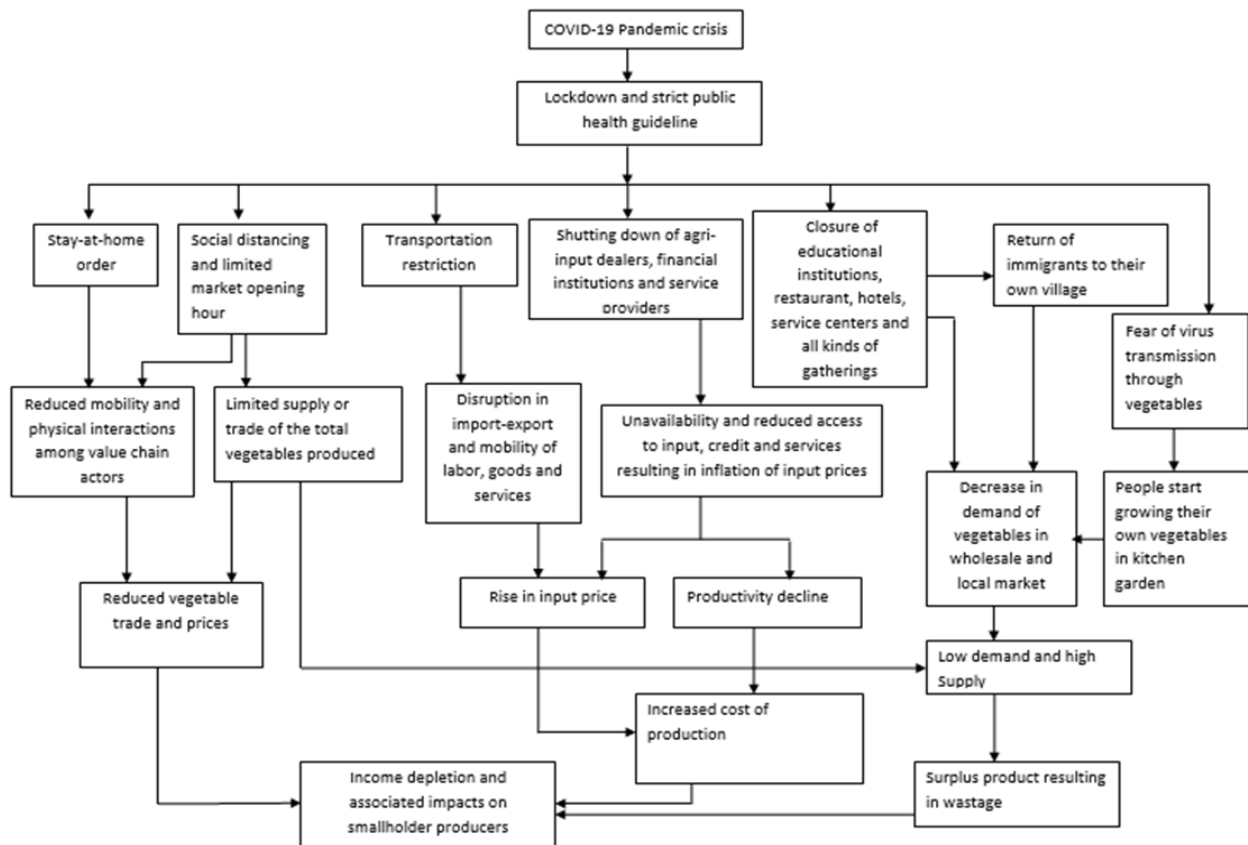


Figure 1. The impact pathways of COVID-19 pandemic in vegetable production system.

Impact pathways

The impact pathways are shown in Figure 1. The first COVID-19 case in Nepal was confirmed on January 23, 2020, when a 31-year-old student returned from Wuhan on January 9 and tested positive for the disease. The government announced a nationwide lockdown on March 24, 2020, to stop the coronavirus from spreading out of control. The first phase of absolute lockdown lasted till June 14, 2020. During this period, the country's market places were closed. Almost all shops are shuttered, borders were closed, supply chains were obstructed, and people were asked to stay-at-homes, maintain social distancing, wear a mask, follow regular handwashing, and avoid gatherings of all kinds. Transportation was restricted, market opening hours were limited, agro-input shops were closed, financial institutions and service offices were closed, and schools, restaurants, hotels, which were major consumption avenues, were fully closed. This lockdown caused immigrants' returning to their village at a high rate, resulting in labor shortage and a decreased demand for vegetables in the valley. Similarly, people's threat to the pandemic created a consciousness among people to grow their foods, which became another factor for decreased demand for vegetables. Low demand followed by constant supply resulted in the surplus products, which was later used for composting or dumped in the field. The closure of agriculture supply centers resulted in the unavailability of input, which caused inflation in price and reduced productivity, leading to increased production cost. The decreased demand, surplus farm product supply followed by the high production cost, and low revenue caused the income depletion and associated impacts on smallholder produce.

Conclusion

This study is probably the first of its kind in Nepal to systematically assess and describe the effects of pandemic induced lockdown on smallholders' agriculture. This kind of analysis is necessary to develop resilient supply chains and extend appropriate strategies to support smallholder farmers who are critical actor to the supply chains. The empirical data showed that smallholders' vegetable growers had to survive and continue engage in production activities on the one-third of their normal income. During pandemic the price of agricultural inputs were rose and on the contrary, price of commodities they sold was decreased coupled with a decline in productivity. They distributed their products free-of-cost to local residents and even they had to dump the unsold surpluses. The key lessons of this study are as follows:

- To reduce and mitigate the pandemic impacts on small-scale producers and to continue supply chains running, both global and country interventions are necessary from state and non-state actors. Such supports might include direct cash transfer, provision of subsidized production inputs (seeds, fertilizers, tools etc.) those reaching at their farm place, mobilization of social capitals of farmers cooperatives and groups in direct selling of farmers' produce and improve post-harvest technologies and provide home-based solutions for processing and storage of surplus products combining with modern tools and techniques.

- Long food supply chains involving multiple intermediaries were observed extremely vulnerable during pandemic in terms of the probability of disease transmission and farmer-consumer welfare. Therefore, re-adjustment of conventional supply chains is necessary to increase the robustness and resiliency in the existing supply chains.
- Alternative marketing strategies such as e-commerce, cooperative-run outlets and farmers alliance operated marketing shops those evolved during pandemic need to be strengthened to improve farmers and consumers welfare and maintain short but robust supply chains.
- Smallholder farmers who are already susceptible to crisis as a result of their limited resources possession, weak financing capacity and limited access to basic healthcare facilities, it is often the responsibility of the government to protect them. Government's readiness to implement appropriate measures to care for this community is highly needed.
- "Vegetable Basket Project" implemented by Ministry of Agriculture of China was very effectively run. In this project several vegetable baskets centers (sheds) were run by government in the peri urban locations with sufficient space to maintain social distance and implement the government issued health protocols. In the pandemic, the center facilitated for demand collection from city residents simply based on total population and collected products directly from farmers and supplying these to city areas. A similar approach can be taken for present and future crisis.
- A large number of youths, who lost their jobs in domestic and global markets and returned to rural areas, should be gainfully employed in agriculture sector by providing reliable technical and financial support. These human resources should also be promoted for aggregation and selling of agricultural products.

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