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Learning from adversity: Small-scale commercial farming in Nepal amidst COVID-19 pandemic

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Abstract

The COVID-19 pandemic has exposed various shortcomings in Nepal's small-scale commercial farming system. Farmers who were transitioning from subsistence to a market-dependent model faced significant challenges during the pandemic. This has raised concerns about the well-being of these farmers, the sustainability of their farming practices, and their capacity to withstand future shocks. Our paper aims to assess the current resilience of small commercial farmers and identify factors that can enhance their ability to weather external disruptions like COVID-19. We use the case study in Ravi Opi, a farming village located in Dhulikhel Municipality, Nepal to explore the challenges experienced by the small commercial farmers during the pandemic and the strategic responses adopted at the household and institutional levels. Our analysis reveals that the small-scale commercial farming system demonstrated 'buffering capabilities' and 'adaptability,' but not 'transformability.' This is primarily because farmers adopted short-term responses that are necessary for addressing immediate crises, rather than responses that would facilitate longer-term transformation. We argue that there is a lack of adequate state support for farmers in Nepal, which worsened during the pandemic. As a result, farmers resorted to leveraging their community connections for help, which provided short-term relief, and aided in addressing only immediate but not their long-term needs. Our observations underscore the risks associated with the current approach used by subsistence farmers to transition into commercial farming. Based on our findings, we propose that longer-term initiatives involving the government and other stakeholders are essential to strengthen the supply network and promote community-based agriculture extension services. We posit that these initiatives can potentially enhance farmers' resilience and their ability to withstand future disruptions, such as the COVID-19 pandemic.

Keywords: COVID-19, Responses, Small Commercial Farming, Threats

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1. Introduction

The COVID-19 pandemic occurred at a time when the world's food production was already grappling with numerous climatic and non-climatic challenges (FAO, 2021). The pandemic and its consequences such as nationwide lockdowns and transportation restrictions, exacerbated the situation, leading to severe health and economic crises worldwide. As of May 2022, when we conducted research and wrote this paper, more than 6.2 million people had lost their lives worldwide, and millions were suffering with long-term health consequences[4]. A recent report from the International Monetary Fund (IMF) estimated a global economic contraction of 3.3 percent in 2020 (IMF, 2021), exacerbating poverty and food crisis (Sumner et al., 2020). The pandemic posed various threats to Nepal's agriculture and food system, which engages 60.4% of the total population and contributes to 23% of the national GDP. Particularly, small commercial farmers, who are market-dependent and are concentrated near urban centers and emerging towns, faced immense challenges during COVID-19 (Adhikari et al., 2021; Khatri et al., 2023). The studies found that the impact of COVID-19 on the farming system was more pronounced for market-based perishable products (green vegetables, dairy, fruits, and poultry) compared to traditional farming systems and staple products. This has raised critical concerns about the evolving farming system, which is gradually displacing local practices (Dhakal et al., 2022) and rendering it susceptible to shocks like COVID-19.

The COVID-19 pandemic offers an opportunity to reevaluate and redefine the resilience of our farming system for the future. In this paper, we posit that the shift in farming practices from traditional to commercial, especially among small landholders, is heavily influenced by the market system and lacks resilience against external disruptions like COVID-19. Therefore, understanding the circumstances and factors that facilitate resilient farming systems becomes essential for better preparedness. This study addresses how the COVID-19 pandemic has impacted small commercial farmers in Nepal, who were already contending with various climatic and other challenges. Drawing on empirical evidence from small commercial farmers in Nepal, the study identifies the threats they faced, and the response strategies adopted at the household and institutional levels, both state and civic institutions (civic institutions non-state, e.g., NGOs, cooperatives etc.) during the COVID-19 crisis. Through a descriptive analysis of these threats and responses, the study further explores the existing farm resilience and the enabling environment that promotes resilience within the farming system—a critical aspect for preparing for future shocks and uncertainties like the COVID-19 pandemic. The lessons from our study can be instrumental for stakeholders within the farming system, particularly farmers, policymakers, local government, and other supporting agencies, in undertaking preparatory, reactive, and preventive actions in the times ahead.

2. Small commercial farming in Nepal

The Government of Nepal classifies the rural farming population into three distinct groups: small commercial farmers, subsistence farmers, and landless/near-landless farmers. Landless or near-landless farmers are the dominant group who account for 53% of the total population but possess less than 0.50 hectares of land with collective ownership of only 19% (GoN, 2016). Approximately 27% of the farmers engage in 'subsistence farming,' managing land holdings ranging from 0.5

[4] https://www.who.int/emergencies/diseases/novel-coronavirus-2019

to one hectare, which represents 28% of the total available land. Another significant segment, comprising 20% of rural households, are the 'small commercial farmers' with landholdings ranging from one to five hectares or more. Remarkably, this group collectively owns over half of the total available land (GoN, 2016).

The term "small commercial farmers" refers to a specific group of farmers who have either adopted modern agricultural practices or endeavored to transform their traditional farming methods to enhance their income (GoN, 2016). These farmers heavily rely on the market for inputs such as seeds, fertilizer, poultry feed, and pesticides. Additionally, they utilise small-scale farm tools and machinery, including hand tractors, milk chilling chambers, and chaff cutters. Often, they employ hired or reciprocal labor, and sometimes both. It is important to highlight that these farms differ from traditional subsistence farms commonly found in rural areas of developing countries and larger corporate farms that extensively employ machinery in their production processes.

Small commercial farming in Nepal has evolved into a critical component of agriculture in areas surrounding cities and market centers, supporting farmers' livelihoods from subsistence to commercial scales (Gc and Hall, 2020). The growth of small size commercial farming, particularly in the form of vegetable farming in peri-urban rural settings, is driven by rural-to-urban migration, market opportunities and access to extension services (Gurung et al., 2016). Interestingly, even many returning migrant workers, predominantly from Gulf countries, have transitioned into commercial farming upon their return to Nepal (Shrestha, 2020). This shift is driven by the economic potential of vegetable cultivation, which offers higher returns compared to cereal crops like rice (Gurung et al., 2016).

The Government of Nepal regards agricultural commercialisation as a viable means to alleviate poverty and stimulate economic growth (MoALD, 2021). However, agricultural development professionals contend that small farms, challenging terrain, limited access to cost-effective agricultural technologies, insufficient all-weather road connections between cities and rural areas, reliance on seasonal rainfall, constrained agricultural markets, and adherence to traditional farming practices continue to pose significant challenges that hinder agricultural productivity (Aase, 2017; Adhikari, 2017). Furthermore, climate change and evolving demands for agricultural products introduce additional obstacles to sectoral growth.

2.1 Farm resilience and resilient capabilities

The term 'resilience' has gained widespread recognition across various fields of study in recent years. The concept, though initially developed in the field of ecology (Holling, 1973), gradually found application in other disciplines, particularly as an approach to understanding socio-ecological systems (Folke, 2006). In the context of farming, resilience is defined as a system's capacity to absorb change (Darnhofer et al., 2010; Aase, 2017). More specifically, within the realm of farm resilience, it refers to the ability of farms to adapt and respond to climatic, social, and other shocks (Mathijs et al., 2022). Scholars argue that farming operates within a broader socio-ecological system, encompassing biophysical, technical, and social elements. These components are frequently exposed to external factors like market disruptions and internal challenges such as pests and diseases (Walker and Salt, 2006). Consequently, the question of how to enhance and maintain resilience capabilities has become increasingly important in both academic and development spheres (Quinlan et al., 2016).

Resilience capabilities can be broadly categorised into three types (Oxfam, 2017). First, 'absorptive capabilities' involve building buffers and adaptive capacity to absorb shocks and stresses. Darnhofer (2014) refers to it as 'robustness' or 'buffering capability,' which is more related to short-term responses. Second, adaptability or adaptive capability refers to the capacity to change the composition of inputs, production, marketing, and risk management in response to shocks without altering the structures and feedback mechanisms (medium-term response). Third, transformability is the capacity to significantly change the internal structures and feedback mechanisms (long-term response) (Oxfam, 2017; Meuwissen et al., 2021). By building on these conceptual categories of resilience capabilities and applying them to the empirical case study of small commercial farming, we can gain a nuanced understanding of the existing resilience of the farming system. This understanding may help generate valuable insights to shape new approaches to sustainable farming that go beyond seeking short-term solutions (Darnhofer, 2014).

In the following sections, we first characterise the farming systems, accounting for system components, actors, and contexts, while assessing the existing threats faced by farmers. We then explore threats induced by COVID-19 and the response strategies adopted by households and institutions. Lastly, we discuss existing resilience capabilities and the enabling environment that fosters farming system resilience. Our study centers on Ravi Opi, an emerging small commercial farm village in the mid-hills of Nepal.

3. Methods

This paper utilises data generated by the research project 'Institutional Networks and Self-Organised Adaptation: Tracing the Democratic Architectures of Climate Response' (INSA)[5]. For the larger project, data was collected from 30 randomly selected households in each of the eight study sites. As a part of this research, our focus was on analysing the impact of COVID-19 in 'Ravi Opi,' also known as *Harisharn ko Pasal*. Ravi Opi was one of the eight study sites selected for the project and was purposefully chosen for this paper.

The paper relies on both qualitative and quantitative data. Qualitative data collection is specifically focused on methods such as focused group discussions (FGDs - three sessions), in-depth interviews with households and lead farmers (a total of six interviews), and field observations. Whereas, household survey data (30 households) was used for descriptive analysis of threats and responses, as well as changes in household income during the pandemic. FGDs and interviews were instrumental in understanding farming history, gaining insights into its dynamics, changing scenarios, and the existing context. In-depth interviews provided key cases related to threats and responses. To ensure triangulation, informal phone conversations were conducted with local farmers. Secondary sources, including municipality documents and peer-reviewed empirical and theoretical papers, were also incorporated to provide further insights and support the analysis.

4. Study Area

Ravi Opi is 25 kms east of Kathmandu, with the nearest market being Banepa Bazaar (refer to Map 1). It is situated at an altitude ranging from 1280 to 1400 metres and experiences average

[5] The INSA project broadly aimed to study the portfolios of climate risks that different households face, the political channels, and the networks of interaction through which citizens seek state support.

monthly temperatures ranging from 4.28 degree Celsius to 32.41 degree Celsius. Ravi Opi is in the Ward No. 2 of Dhulikhel Municipality and has approximately 68 households and a population of 2659 (Dhulikhel Municipality, 2022) which includes mainly Brahmin and Chhetri (33 households), followed by Dalits (2) and Janajaatis (8). The village is spread across a total area of 20,400 ha of which 5,100 ha is irrigated. Farming is an important source of livelihood of people in the area, with most of the residents being small-scale farmers (77% or 53 out of 68), each owning less than half a hectare of land.

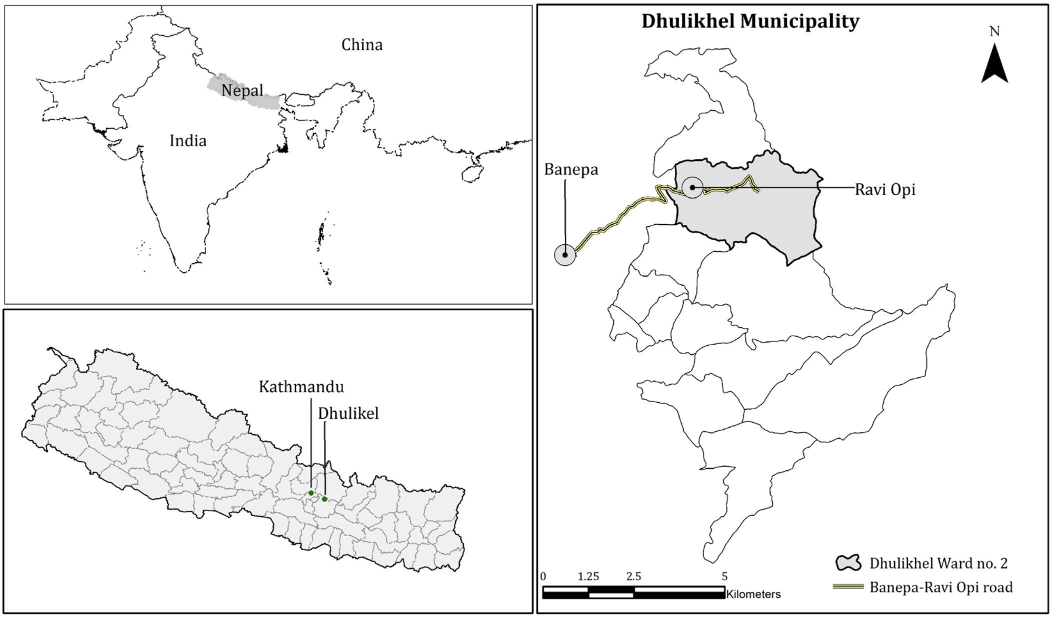


Figure 1: Map showing the location of Ravi Opi

5. Results

5.1 Ravi Opi: Farming system, existing threats, and responses

Ravi Opi's farming system is characterised by an integrated crop-livestock system (see the illustration of farming system in fig.2 sec 5.2), and it has witnessed substantial transformations over the recent decades. Our FGDs revealed a substantial decline in the production of traditional crops such as maize, millet, and rice prompting farmers to shift their focus mainly to vegetable crops and livestock due to higher returns and improved market exposure. Notably, there has been an increase in the use of imported inputs in Ravi Opi. About 80 to 90% of households now use hand tractors (power tillers) instead of oxen for ploughing. Family farming, where family members work on the farm, is a common practice in the village. Moreover, within the close-knit community, particularly among the Dalit community, farmers still engage in reciprocal labour exchange, known locally as '*parma*[6],' with their neighbours (*Chhimecki*). This practice is more prevalent among Dalits than other castes, highlighting the traditional cooperative spirit within the community.

Even before the onset of the COVID-19 pandemic, farmers in Ravi Opi were already grappling with

[6] In the 'Parma', household members assist each other's fields without payment.

multiple climatic challenges, including extreme rainfall, windstorms, extended dry periods, as well as non-climatic threats such as pest and disease outbreaks and market fluctuations. Amidst the pandemic, they encountered the double burden of managing existing pre-covid threats alongside the consequences of COVID-19. Table 1 provides a summary of the existing threats and their corresponding responses. Among the key existing threats and response strategies, managing and controlling insects, pests, and diseases is a critical and common challenge. Over the years, the incidence of pests and diseases in crops has increased, a trend also observed in other parts of the country (Thapa et al., 2021). Farmers have experienced new pests and insects along with the introduction of new seed varieties. For instance, a female farmer from the upper Ravi Opi shared her experience of significant maize crop losses due to fall armyworm[7] in the previous year, which she attributed to the emergence of new insects alongside new seed varieties. The use of chemical pesticides and insecticides has become a regular practice in farming, with farmers typically purchasing pesticides from local agrovet centres located in Banepa and Dhulikhel. In critical cases, municipalities distribute subsidised pesticides. In 2020, the municipality provided chemical pesticides for fall armyworm control. Additionally, farmers also use *Jholmal*, a bio-pesticide/ fertiliser[8].

Frequent and sudden market price fluctuations have been a major challenge for farmers in Ravi Opi. Vegetable prices in large cities are constantly changing due to an imbalance in the supply and demand system. Moreover, domestic production of vegetables alone cannot fulfil the demand which necessitates imports from India and contributes to price fluctuations since import prices in India are not fixed. (The Kathmandu Post, 2018). Market prices are largely determined by intermediary traders rather than actual supply and demand conditions. Consequently, farmers often receive lower prices at the farm compared to the actual vegetable prices in the market. As one male farmer lamented, 'Sometimes we don't even get half of the price than in Kathmandu.' Market price fluctuation is not just unique to Ravi Opi but is widespread throughout Nepal (Timsina and Shivakoti, 2018). To address this issue, The Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED) supports farmers with market information. Group representatives from the eight to nine farmers groups in the village receive daily vegetable prices from Kathmandu through mobile phones. This enables farmers to verify and set their product prices accordingly.

In addition to pests, diseases, and price fluctuations, climate-induced threats also result in agricultural losses. During FGDs, farmers mentioned monsoonal excess rainfall, windstorms, hailstorms, and waterlogging. In the first year of COVID-19, over half of the households reported maize damage due to heavy rainfall and wind. Some of the common responses applied by the farmers included replanting, using damaged crops as fodder, and early harvesting. Despite significant production losses, the crop-livestock system allowed the use of damaged crops for animal feed. Drought is also a common issue, with some farmers collecting grey water and others using tap water for irrigation, despite of the higher costs. While wild animals such as mice, squirrels, and wild boar pose additional challenges, their impact is less here compared to other parts of the country (Koirala et al., 2021).

[7] Fall Armyworm (FAW), *Spodoptera frugiperda* is a lepidopteran insect native to tropical and subtropical regions of the America. The insect's rapid invasion in Nepal has resulted in a serious threat to Nepalese food security with considerable yield losses in maize and other key staple cereal crops.

[8] https://www.icimod.org/jholmal-a-chemical-free-solution-for-farmers-in-kavre/

Table 1 Summary of existing (pre-covid) threats and response strategies in Ravi Opi

Impact Sector	Existing threats	Responses	
		Household level	State and Civic institutional level
Crop production and post-harvesting	Pest and disease in vegetables, food grains and fruits American army worm late blight, *Khapate kira* (a kind of beetle)	a. buy pesticide from agrovet/use chemical pesticide. b. use bio pesticide (like *Jhol mal*, cow milk, urine) c. Use yellow sticker to trap the flies in tomato	a. Fall armyworm pesticide was distributed by Municipality/ward. b. Farmers seek specialised knowledge (suggestions, advice) and inputs (seeds, fertilisers, Insecticides, and pesticides) from the agri and dairy cooperatives.
	Unwanted weeds in crop	a. Replantation	
	Fluctuation and uncertainty of market prices for sale of products	a. Get market information from farmers group	a. CEAPRED supported the farmers by facilitating market information
	Uncertain/low quality of agricultural (local seeds, fertiliser	a. Use hybrid seed and replantation.	
	Wildlife (rats, squirrel, birds, wild boar, monkey)	a. Cultivate spice crops such as garlic, alongside the paddy farm b. Play radio in the field, c. Guard the crops, d. Chase away, e. Burn the mouse hole.	
	Insects in stored grains/seed	a. Drying in sun	
	Extreme rainfall	a. Replantation b. Feed damaged crops to the cattle	

	Windstorm	a. Feed damaged crops to the cattle, b. Early harvest and sun-dry the premature corn	
	Drought/extended dry period	a. Dug a pit to collect graywater b. Use tap water c. Replantation (cucumber seedlings dried up and replanted) d. Made plastic pond to collect rainwater	
	Hailstorm, landslide, water logging,	a. Rebuild farm terrace	
Livestock (Cattle, goat, poultry, marketing)	Livestock illness/Disease in livestock (mastitis in cattle),	a. Seek veterinary care. b. Feed cannabis to goat	
	Lack of feed stock		
	Unexpected livestock death, Damage to cattle shed, Leopard predation		a. Livestock insurance b. Training on goat farming

Source: Field Survey, 2021

5.2 COVID-19 crisis, lockdown, and impact on farming system

In the preceding section, we discussed the emergence of small-scale commercial farming and its response to pre-COVID challenges. In this section, we delve into the threats brought about by the pandemic and how it exacerbated the existing ones. Nepal recorded its first COVID-19 case on January 23, 2020, in a student who had returned from China. In response, Nepal implemented measures such as social distancing, mandatory mask-wearing, border closures, and the suspension of visas for individuals entering the country, beginning on March 10th. A nationwide lockdown was initiated on March 24th and continued until July 21st (Phase I). During Phase I of the lockdown, the supply of both inputs and outputs was severely restricted. Phase II (August 18th – October 22nd) witnessed localised lockdowns linked to local cases, the rules of which were determined by the respective municipalities (Palikas). During this phase, farmers had gradual access to the market. The third lockdown phase (October 23rd – November 1st) was contingent on the number of COVID cases, where areas experiencing higher cases were subjected to lockdown measures. (see Table 2 for the summary of the COVID-19 phases and their characteristics)

Table 2 Different Phases of Covid-19 Lockdown

Phases of Lockdown	**Phase – I**	**Phase – II**	**Phase – III**
Timeline	24th March – 21st July	18th August – 22nd October	23rd October – 1st November
Scale	Nationwide	Nationwide	Municipal
Nature	Strict (nothing was allowed except emergencies)	Moderate	Moderate
Major restriction to farmers	Farmers could not reach the market and the import of the inputs from outside was banned since international borders were closed	Farmers were able to reach the market, but international borders were closed.	Farmers were able to reach the market, but they could not get governmental administrative services for a certain period.

Fig 2 illustrates how the farming system of Ravi Opi is structured and how it was affected during COVID-19 pandemic. As shown in the diagram, the farm household is situated within a broader socio-ecological context where trade-offs among the farm components (land, labour, forests, market etc.,) occur, and it has relation with various actors and institutions (Meuwissen et al., 2019). The COVID-19 pandemic did not only impact a single aspect of the farming system but the entire farming system and its context basically in four different but overlapping ways; i. Lockdown, travel restriction, temporary shutdown, village closure etc. ii. COVID infection, quarantine, isolation, hospitalisation, iii. Mandatory social distancing, protection measures, iv. Anxiety and fear of virus transmission. It directly affected the regular works, markets, and productions (both livestock and crops) of the farmers. Additionally, other actors, institutions and the entire system were also affected, thereby causing an indirect impact on farming. The following section discusses and summarises threats associated with COVID-19 crisis and responses undertaken at both farm household and institutional level.

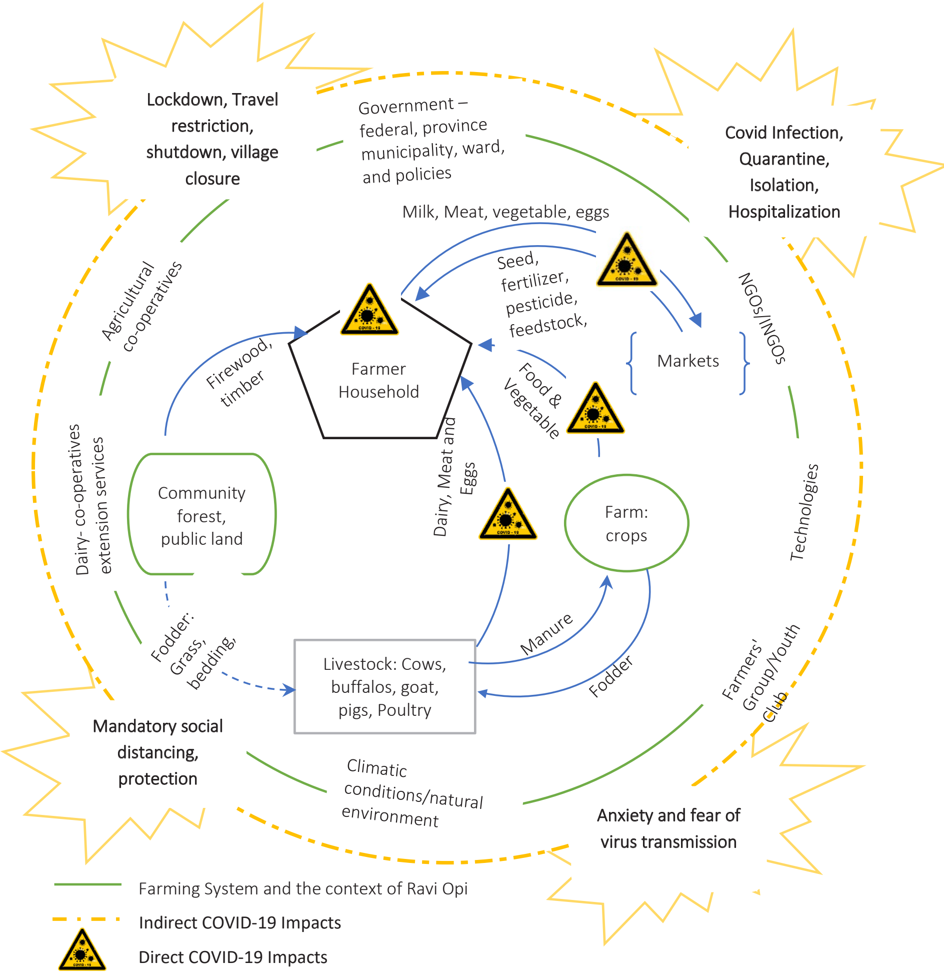


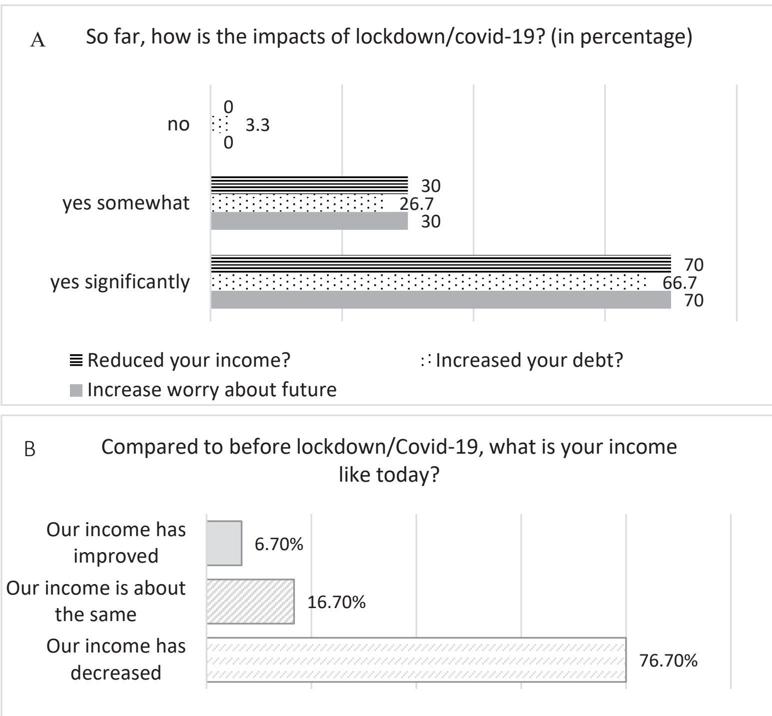
Figure 2 COVID-19 impact on farming system.

5.2.1 COVID-19 Impacts and Responses

Amidst the COVID-19 pandemic, farmers confronted a multitude of challenges stemming from the various phases of restrictions imposed. One of the most immediate and pressing issues was the disruption of the supply chain, which had far-reaching implications across the entire production cycle, from cultivation to the sale of products. Some of the key concerns included unavailability of essential inputs, such as seeds, fertilisers, pesticides, animal feed, and fodder. The lockdown led to the closure of nearby markets and input suppliers, including agrovets, making it challenging for farmers to access vital inputs. Even after the lockdown was lifted, the stock of imported seed varieties and animal feed remained depleted due to the sustained closure of international borders. Consequently, farmers were compelled to purchase the agricultural inputs available in the market at exorbitant prices. Another significant issue that surfaced was the shortage of chemical fertilisers, specifically urea and dialkyl phosphates (DAP). This scarcity had a discernible impact on the sowing period, resulting in an overall decline in crop production. It is important to note that the shortage of chemical fertilisers was not just attributed to COVID-19 but it had been a persistent problem, arising from a combination of inefficient supply mechanisms and policy deficiencies, which were further exacerbated by the pandemic.

The pandemic severely disrupted farmers' access to markets, creating significant challenges to sell their agricultural products. Initially, stringent lockdown impacted the sale of perishable items like cucumbers, tomatoes, and cauliflower the most. Even when lockdown restrictions were eased, and transportation of essential goods resumed, farmers were compelled to sell their produce at reduced prices due to the closure of hotels, restaurants, offices, and the significant decline in tourism.

A female farmer from the upper Ravi Opi region shared her experience, lamenting, 'Our cucumbers were ready for harvest and market delivery, but unfortunately, everything ended up rotting on the farm.' Furthermore, the demand for fresh meat, eggs, and poultry plummeted in the city, forcing farmers to sell their animals at significantly lower prices, often at half the usual rates, as they were unable to sustain the cost of feeding their cattle with market bought feed. This had a pronounced effect on household incomes. Our household survey shows that household income dropped substantially due to the pandemic (see fig 3). During our first survey period in May-June 2020, approximately two months after the initial lockdown, roughly 70% of households reported a reduction in their income. In our subsequent survey, conducted a year after the initial lockdown, we revisited the question of farmer's experience with income reduction and found that around 76.70% of the surveyed farmers reported that their income had decreased compared to before the lockdown and the onset of COVID-19 pandemic.



Figures 3: *Experiences of COVID impact on income and dept: (A) Households reported 'no', 'yes somewhat' and 'yes significantly' while asking about the impact of COVID in income reduction, increase debt, and increase worry about future in month 2 after the initial lockdown. (B) Changes in income before the beginning COVID and in the month -10 after the initial lockdown.*

Source: Field Survey, 2021

Farm households employed diverse strategies in response to the shortages of agricultural inputs. In addressing the immediate scarcity of seeds, many farmers turned to their own farm reserves or relied on seeds from the previous year's stock. Another effective approach was to borrow inputs, primarily stock seeds and chemical fertilisers, from neighbouring farmers within their social network. Leveraging community connections within the neighbourhood proved invaluable in obtaining essential vehicle passes for market access and addressing emergencies. Some farmers also adapted by shifting to different crop varieties or changing seed types, such as transitioning from native to hybrid seeds, in response to the prevailing scarcity. For instance, despite their preference for native garlic and onion varieties, they resorted to planting hybrid seeds sourced from local agrovet stores due to the unavailability of native seeds. To address the shortage of chemical fertilisers, farmers increased their utilisation of locally prepared organic fertilisers, such as *jholmal* and manure.

Farmers received limited to no support from neither the federal nor the local governments during the COVID-19 crisis, since their actions were primarily focused on emergency health responses (Joshi et al., 2022). Initial assistance from the local government was also lacking, except for their role in coordinating vehicle passes. However, in April-May 2020, the municipality provided a 50% subsidy on paddy seeds to farmers.

It is important to highlight that in lack of adequate government support, assistance from civic[9] institutions, particularly local agri-cooperatives, and dairy cooperatives, played a crucial role in supporting farmers during the pandemic. For example, a women's cooperative in Hupeykot, Nawalpur[10], initiated an agri-ambulance service to facilitate connections between farmers and consumers. In Ravi Opi, our informants in the FGDs reported that agri cooperatives proactively assisted farmers by arranging seeds, fertilisers, and pesticides, as they had easier access to vehicle passes compared to individual farmers. Similarly, dairy cooperatives, specifically Setidevi Dairy Cooperative and Deurali Dairy Cooperative, played a vital role in regulating and maintaining the supply of raw milk to packaging centres. Both dairy cooperatives have milk collection centres equipped with chilling facilities in the village. During the first month of the COVID-19 pandemic, Deurali Dairy Cooperative, in coordination with the ward office, distributed a bonus subsidy of NPR two per litre (0.015 USD/litre) for a month to compensate for the initial losses incurred by farmers. Table 3 below provides a comprehensive list of the various threats associated with farming and the response strategies implemented at both the household and institutional levels.

[9] Civic institutions refer to non-state institutions (both local and international) e.g., cooperatives, NGOs, INGOs.

[10] https://www.heifer.org/blog/during-covid-19-lockdown-nepal-cooperative-connects-farmers-and-customers-with-innovative-agri-ambulance-.html

Table 3 Summary of the threats (during-covid) and response strategies in Ravi Opi.

Impact Sectors	COVID-19 induced threats	Responses	
		Household level	**State and Civic institutional**
Crops farming: agri-inputs (seed, fertiliser, pesticide, manure, labour) and their supplies, market, and availability	Lack of/difficulty accessing seeds/ increased price of vegetable seed/ Shortage of seeds (both hybrid and local)	a. Rely on stored/ old seeds. b. Borrow/buy seeds from neighbours/ friends. c. Taking vehicle pass /help from people (neighbours) who have vehicle pass for buying agri-inputs. d. Pay high cost for vegetable seed. e. Change crop seed variety.	a. Received paddy seed in 50% subsidy from the ward office in May (threat occurred in June – Khumal – 4 seed variety.) The municipality coordinated with ward to provide paddy seed in subsidy. b. Received vehicle pass to travel to the larger market (Banepa/ Kathmandu) to get seeds
	Lack of/difficulty accessing fertiliser	a. Buy fertiliser from a local cooperative. b. Use bio fertiliser (like *Jholmal*, cow milk, urine), and use manure. c. taking vehicle pass / help from people who have vehicle pass for buying agri-inputs. d. relying on stock from previous year and use minimal amount	a. Local agri-cooperative coordinated to bring seeds. b. Buy fertiliser from a local cooperative. c. ICIMOD supported/trained farmers to prepare bio-pesticide
	Lack of/difficulty accessing chemical pesticide (Ammonium sulphate, Urea)	a. use bio pesticide (like *Jhol* mal, cow milk, urine) b. Get pesticides from lead farmers. c. Use previous stock	a. Get help from agro-vet (private) b. Cooperative coordinated to get chemical fertiliser.
	Shortage of poultry manure (in poultry farm)	a. Bought local poultry manure from neighbour and used in minimal amount	

	Difficulty hiring labourers for farm activities/ Lack of labour at peak time of farming (paddy and potato farming)/ High cost of farm labour.	a. Reciprocal labour exchange (*perma*) b. Rely on family labour. c. Pay high cost for agri-labour in the field. d. Use power tiller (hand tractor)	
	Lack of market for selling agri-products Decrease in market price of vegetable	a. Sold products at lower price/ to the middlemen.	a. Got travel pass/vehicle pass from the local government to take their products to the market and collectively taken the products to the nearest market
	market shock (significant decrease) in prices for sale of products		
Livestock farming: Inputs (feedstock), market price of the product	Increased price feedstock/ Inability to buy feedstock	a. Sold t cow, goat, chicken. b. Use home stock grains – maize floor. c. Increase the use of crop residue/grasses to fulfil the demand of feedstock (collect grasses from public land -riverside	
	Market price decreased/ fluctuation and uncertainty (milk, poultry, meat, and eggs)	a. Sold at half price (mainly – chicken)	a. Subsidy/bonus distributed to dairy farmers from
	Could not sell livestock products on time		
Farmers and family health	Fear of being infected from COVID-19	a. Use home remedyPCR test, Self-Isolation b. Follow safety measures	
	Unable to go to hospital/ difficulty getting medicine	a. Took help from my neighbour. b. Use homemade medicines	
	COVID-19 infection	c. Taken to hospital, Isolation	

Source: Field Survey, 2021

6. Understanding farm resilience capabilities in Ravi Opi

The COVID-19 pandemic significantly impacted the functioning, performance, and output of farming systems, resulting in a substantial decrease in farmers' income. The purpose of our research was to assess the capacity of farm households and farming systems to absorb or adapt to the shocks brought about by COVID-19. This analysis ultimately aims to provide insights into the current level of resilience within these farming communities. As defined by Darnhofer (2014), resilience within a farming system can be comprehended by examining its buffering (absorptive), adaptive, and transformative capabilities. Buffering capability is associated with a short-term response to shocks (ibid.). Many of the responses employed to address various threats are short-term in nature and proven to be effective temporarily. For instance, practices like borrowing agricultural inputs from neighbours, labour exchange (known as *Parma*), seeking assistance from neighbours for vehicle passes, and relying on local farmers' groups can be categorised as examples of 'buffering (absorptive) capability'. Notably, these practices have been ingrained in the village's traditions for generations. Furthermore, a study has suggested that these informal and native practices of mutualism and solidarity can significantly enhance farmers' immediate absorptive capacity in dealing with disruptions such as COVID-19 (Leach et al., 2021). Similarly, local cooperatives played a buffering role in aiding farmers to combat the COVID-19 crisis, primarily by coordinating input supply and facilitating access to markets.

Adaptive capacity refers to the ability to make alterations in input composition, production methods, and marketing strategies, typically involving medium-term responses (Darnhofer, 2014). Farmers in the Ravi Opi region demonstrated instances of such 'adaptive capacity' in various scenarios. For instance, they adjusted by changing crop or seed varieties. Traditionally, farmers preferred cultivating native varieties of spice seeds (such as garlic and onion) for their higher economic returns. However, due to lockdown restrictions preventing access to their preferred seeds, farmers shifted from native to imported varieties that were available at the time.

Similarly, when faced with a shortage of chemical fertilisers during the crisis, farmers increased their reliance on organic manure as a substitute. Additionally, to adapt to the immediate shortage of imported animal feedstock, farmers began using crop residue and soft grass in animal feed preparation. These cases align with the concept of 'farming flexibility', where farmers can pivot between different inputs and technologies, enhancing their adaptability to changing circumstances (Aase, 2017).

Longer-term responses are associated with what can be termed 'transformability' (Meuwissen et al., 2019). This concept involves making substantial shifts from existing systems to new pathways or introducing novel components within the system itself (Walker et al., 2004). Our analysis indicates that during the COVID-19 pandemic, there were no significant long-term responses observed at either the individual or institutional level. However, a few practices initiated in the village in recent years demonstrate the potential for the farming system's transformability, which proved valuable in assisting farmers during the crisis. For example, farmers had previously received training in the preparation of bio-fertilisers and bio-pesticides, which could be locally crafted from a mixture of cow urine, dung, locally available herbs, and water. When faced with an acute shortage of chemical fertilisers and pesticides, farmers were able to address the problem by using locally produced bio-fertilisers and bio-pesticides. Similarly, as mentioned earlier, the pre-existing vegetable market information and communication system enabled farmers to access daily price information. Additionally, the presence of raw milk chilling centres in the community played a vital role in ensuring a consistent milk supply. This facility allowed farmers to store raw milk for several days within the village, even when regular transportation was disrupted. These recently introduced facilities and actions that proved effective during the crisis reflect the potential for transformability within the system. They are indicators of a system's ability to adapt and become more resilient when confronted with shocks (Sediri et al., 2020). However, it is important to note that the COVID-19 crisis also exposed various weaknesses within the existing farming system, and small commercial farmers faced significant challenges in coping with both existing and pandemic-related threats.

7. Current trends and future of farming: Policy perspectives

The data from the Ministry of Agriculture of Nepal indicates a substantial shift away from subsistence farming practices towards the adoption of marketable crop varieties, hybrid seeds, chemical fertilisers, and modern tools (GoN, 2016). This transition has led to improved farm productivity and profitability for farming households (Gc and Hall, 2020). Yet, it has also given rise to a narrative that perceives imported inputs and practices as 'superior,' while native methods/ practices are often labelled as 'inferior' (Dhakal et al., 2022). Consequently, agricultural practices have become increasingly reliant on these imported inputs, leading to heightened volatility within farming systems (Holmelin, 2021). For example, the increased use of hand tractors or power tillers running on fossil fuels poses a risk during international border closures, as farmers become overly dependent on global markets. Similarly, hybrid seeds, designed to increase production, demand specific inputs and care. Without the necessary resources and attention, there is a heightened risk of crop failure (Rahman and Hossain, 2003).

The market-oriented approach has turned farmers into consumers of the market, as their entire production is geared towards commercial sale. As a result, farmers who previously cultivated essential food items for household consumption on their farms now rely on the market for these necessities. While this approach may boost immediate income, it also escalates investment costs and introduces uncertainty into the production system, due to global dependencies (Holmelin, 2021). Considering these dynamics, it is imperative to reflect upon the evolving farming practices and prioritise the creation of a farm resilience-enabling environment within the farming system. Such an approach will better prepare us to mitigate and adapt to future threats, fostering a more sustainable and secure agricultural future.

Undoubtedly, the future remains uncertain, and the precise evolution or transformation of farming systems to thrive in the years ahead eludes us. However, the COVID-19 pandemic has underscored the critical importance of bolstering resilience within our existing farming systems to pave the way for a more secure future. It is a well-founded argument that the presence of various supporting actors and institutions, including policy makers, technology providers, implementing agencies, retailers, and consumers, alongside their networks and performances, significantly influence the resilience capabilities of farming systems (Mathijs and Wauters, 2020).

One of the fundamental principles to enhance farm resilience as advocated by Mathijs et al. (2022), emphasises the need to shift priorities towards fostering more durable, longer-term alternatives, rather than fixating on short-term solutions. The seismic disruptions caused by the COVID-19 crisis reverberated through the agricultural supply chain, exposing a glaring deficiency in coordination among its various actors (Singh et al., 2013). This lack of coordination surfaced as one of the principal bottlenecks. For instance, in the case of Ravi Opi, the supply chain for raw milk exhibited a relatively robust structure compared to that of vegetables and other products. This resilience can be attributed to the involvement of dairy cooperatives, which bridged the gap between producers and consumers by ensuring a steady supply of raw milk. In contrast, the supply chain for vegetable products remained fragmented, with farmers either responsible for transporting their products to markets themselves or relying on intermediaries to collect them. In addition to supply chain disruption, many threats remained persistently daunting for farmers. All of these threats must be acknowledged as they constitute essential lessons that can inform our future endeavours.

The government possesses the potential to enact policies that foster connectivity and collaboration among the multiple actors involved in the agricultural supply chain, including producers, intermediaries, retailers, and consumers, among others. Furthermore, harnessing the power of information technologies or digital innovations within supply chain management stands out as a highly recommended strategy to fortify the resilience of supply chains (Kumar et al., 2020). Evidence from studies shows that the online platforms helped farmers to reach out to the consumers and supply chain actors during the pandemic (Galhotra and Dewan, 2020).

Simultaneously, it is imperative to foster private sector investments in community-based agricultural extension services, which assume a paramount role during crises. For instance, investments in local-level, small-scale agri-processing or packaging centres for perishable products like fresh milk, meat, poultry, and vegetables can yield multifaceted benefits for farmers. Proper packaging is indispensable for perishables, as it extends product shelf life and safeguards against food spoilage. Similarly, the COVID-19 crisis has underscored the necessity for maintaining a buffer stock of essential inputs, such as community-based seed banks or fertiliser reserves, within the community to mitigate the immediate fallout from unexpected shocks. This endeavour could be spearheaded by local farmers' associations or agricultural cooperatives, ensuring uninterrupted access to seeds during crises.

Access to cold storage facilities and their efficient use can be important for vegetable and fruit farmers, given the high perishability and susceptibility to postharvest losses associated with these commodities. However, its viability and the actual requirements for a particular location must be assessed. Evidence from developing countries underscores that precooling and cold storage facilities can significantly enhance farmers' returns and contribute to food and nutrition security (Makule et al., 2022; Minten et al., 2014). This infrastructure assumes paramount importance during crises like COVID-19, enabling farmers to store their harvest-ready produce when market access faces temporary disruptions. Local governments and other supporting actors and institutions within the farming system can play a pivotal role in assisting communities in establishing community-based or community-level cold storage facilities, thereby augmenting the buffering capacity of farmers.

8. Conclusion

Farmers in Ravi Opi exhibited a commendable degree of resilience and adapted to some extent in response to the challenges posed by the COVID-19 pandemic. However, this crisis also unveiled a host of shortcomings within the existing farming system. The resilience capabilities at play were not uniform across all individual farm households, given their differing socio-economic, political, and institutional contexts. Nevertheless, the overarching reality was that all farm households found themselves exposed to a range of threats, including (i) difficulties in accessing imported agricultural inputs (fertilisers, pesticides, seeds, feed, etc.), (ii) a slump in local markets coupled with price fluctuations, (iii) a reduction in farm-based income, (iv) concerns about COVID-19 infections and transmission, and (v) challenges in hiring labour during crucial planting periods.

In response to the COVID-19-induced challenges, households implemented a range of actions, which were predominantly short-term and medium-term measures geared toward immediate buffering and adaptation to the crisis. Acts of reciprocity at the neighbourhood "*Chhimeki*" level proved invaluable in addressing immediate needs. Civic institutions such as farmers' groups, agricultural cooperatives, and NGOs also played pivotal roles in assisting farmers during this critical period. Cooperatives, in particular, coordinated efforts to maintain the functionality of the supply chain. Government-led responses, on the other hand, were relatively scarce, this was mainly because the government efforts were more focused on immediate disease control and mitigation measures. In light of these observations, we contend that while short-term responses are essential for dealing with immediate crises, fostering resilience in the future would also require the government to spearhead longer-term initiatives through comprehensive planning, policies, and agricultural extension services.

The COVID-19 crisis serves as a stark reminder that the path of agricultural commercialisation may prove to be unsustainable and susceptible to severe shocks unless stakeholders take proactive measures to instil resilience in farming practices. The prevailing perspective in mainstream agricultural development, as envisioned by the government through initiatives like the Agricultural Development Strategy (ADS) and flagship programs like the Prime Minister's Agriculture Modernization Project (PMAMP), emphasises commercialisation, specialisation, and mechanisation. These approaches might result in achieving immediate economic growth and enhanced productivity, but they are likely to enhance market dependencies for inputs, thereby leaving the farmers more susceptible to future shocks. It is therefore imperative to reevaluate the current approach and identify a more suitable pathway that fosters the coexistence of commercialisation and sustainability in agriculture.

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References

Aase, T.H., 2017. *Climate change and the future of himalayan farming*, Oxford University Press.

Adhikari, B., 2017. *Agricultural innovation in Arun valley of the Himalayan region* M.Phil thesis, University of Norway.

Adhikari, J., Timsina, J., Khadka, S.R., Ghale, Y. and Ojha, H., 2021. COVID-19 impacts on agriculture and food systems in Nepal: Implications for SDGs. *Agricultural Systems,* 186**,** 102990.

Darnhofer, I., 2014. Resilience and why it matters for farm management. *European Review of Agricultural Economics,* 41**,** pp.461-484.

Darnhofer, I., Fairweather, J. and Moller, H., 2010. Assessing a farm's sustainability: Insights from resilience thinking. *International journal of agricultural sustainability,* 8**,** pp.186-198.

Dhakal, B., Chand, N., Shrestha, A., Dhakal, N., Karki, K. B., Shrestha, H. L., Bhandari, P. L., Adhikari, B., Shrestha, S. K. and Regmi, S. P., 2022. How policy and development agencies led to the degradation of indigenous resources, institutions, and social-ecological systems in Nepal: Some insights and opinions. *Conservation,* 2**,** pp.134-173.

Dhulikhel Municipality, 2022. *Ward Profile, ward no. 2* [Online]. Available: https://dhulikhelmun.gov.np/en/ward-profile [Accessed 12 May 2023].

FAO, 2021. *The State of Food and Agriculture 2021*, Food and Agriculture Organization.

Folke, C., 2006. Resilience: The emergence of a perspective for social–ecological systems analyses. *Global Environmental Change,* 16**,** pp.253-267.

Galhotra, B. and Dewan, A., 2020. Impact of COVID-19 on digital platforms and change in e-commerce shopping trends. 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), 2020. IEEE, pp.861-866.

GC, R.K. and Hall, R.P., 2020. The commercialization of smallholder farming—A case study from the rural western middle hills of Nepal. *Agriculture,* 10.

GoN, 2016. Agriculture Development Strategy (ADS). Nepal: Ministry of Agricultural Development, Government of Nepal.

Gurung, B., Thapa, R., Gautam, D., Karki, K. and Regmi, P., 2016. Commercial vegetable farming: An approach for poverty reduction in Nepal. *Agronomy Journal of Nepal,* 4**,** pp.92-106.

Holling, C. S., 1973. Resilience and stability of ecological systems. *Annual Review of Ecology Systematics,* 4**,** pp.1-23.

Holmelin, N.B., 2021. National specialization policy versus farmers' priorities: Balancing subsistence farming and cash cropping in Nepal. *Journal of Rural Studies,* 83**,** pp.71-80.

IMF, 2021. World economic outlook, 2021: Managing divergent recoveries. Assessed from https://www.imf.org/en/Publications/WEO/Issues/2021/03/23/world-economic-outlook-april-2021 on 30 of May 2022. *International Monetary Fund.* Washington, DC.

Joshi, T., Poudel, R.P., Kafle, K., Bhattarai, B., Prasai, B.P. and Adhikari, S., 2022. Assessing the impacts of the COVID-19 pandemics on sustainable development goals in Nepal. *Frontiers in Sustainable Food Systems***,** 151.

Khatri, D., Marquardt, K., Fischer, H., Khatri, S., Singh, D. and Poudel, D.P., 2023. Why is farming important for rural livelihood security in the global south? COVID-19 and changing rural livelihoods in Nepal's mid-hills. *Frontiers in Human Dynamics,* 5**,** 1143700.

Koirala, S., Garber, P.A., Somasundaram, D., Katuwal, H.B., Ren, B., Huang, C. and Li, M., 2021. Factors affecting the crop raiding behavior of wild rhesus macaques in Nepal: Implications for wildlife management. *Journal of Environmental Management,* 297**,** 113331.

Kumar, A., Padhee, A.K. and Kumar, S., 2020. How Indian agriculture should change after COVID-19. *Food Security,* 12**,** pp.837-840.

Leach, M., MacGregor, H., Scoones, I. and Wilkinson, A., 2021. Post-pandemic transformations: How and why COVID-19 requires us to rethink development. *World Development,* 138**,** 105233.

Makule, E., Dimoso, N. and Tassou, S., 2022. Precooling and cold storage methods for fruits and vegetables in sub-saharan Africa—A Review. *Horticulture,* 8**,** p.776.

Mathijs, Erik et al., 2022. A resilience-enabling environment for farming systems: Patterns and principles, In: M. Meuwissen, P.H. Feindt, A. Garrido, E. Mathijs, B. Soriano, J. Urquhart and A. Spiegel, eds. 2022. *Resilient and sustainable farming systems in Europe: Exploring diversity and pathways*. Cambridge:Cambridge University Press, pp.302-320.

Mathijs, E. and Wauters, E., 2020. Making farming systems truly resilient. *EuroChoices,* 19**,** pp.72-76.

Meuwissen, M.P., Feindt, P. H., Slijper, T., Spiegel, A., Finger, R., de Mey, Y., Paas, W., Termeer, K. J., Poortvliet, P. M. and Peneva, M., 2021. Impact of Covid-19 on farming systems in Europe through the lens of resilience thinking. *Agricultural Systems,* 191**,** 103152.

Meuwissen, M.P., Feindt, P. H., Spiegel, A., Termeer, C. J., Mathijs, E., de Mey, Y., Finger, R., Balmann, A., Wauters, E. and Urquhart, J., 2019. A framework to assess the resilience of farming systems. *Agricultural Systems,* 176**,** 102656.

Minten, B., Reardon, T., Singh, K.M. and Sutradhar, R., 2014. The new and changing roles of cold storages in the potato supply chain in Bihar. *Economic Political Weekly***,** pp.98-108.

MoALD, 2021. Selected Indicators of Nepalese Agriculture. Singhdarbar, Kathmandu, Nepal: Government of Nepal, Ministry of Agriculture and Livestock Development.

Oxfam, 2017. The future is a choice: Absorb, adapt, transform resilience capacities. *UK: Oxfam GB.*

Quinlan, A.E., Berbés-Blázquez, M., Haider, L.J. and Peterson, G.D., 2016. Measuring and assessing resilience: Broadening understanding through multiple disciplinary perspectives. *Journal of Applied Ecology,* 53**,** pp.677-687.

Rahman, S. and Hossain, M.Z., 2003. Pesticide demand in hybrid seed production technology. *Journal of Food Agriculture Environment,* 1**,** pp.174-179.

Sediri, S., Trommetter, M., Frascaria-Lacoste, N. and Fernández-Manjarrés, J., 2020. Transformability as a wicked problem: A cautionary tale? *Sustainability,* 12**,** 5895.

Shrestha, P. M., 2020. Returning migrant workers can be lured into profitable commercial agriculture, experts say. *The Kathmandu Post*.

Singh, O., Singh, P., Singh, H., Singh, R. and Regmi, K.R., 2013. A value chain analysis of vegetables: A case study of Palpa District, Nepal. *Economic Affairs,* 58**,** pp.135-146.

Sumner, A., Hoy, C. and Ortiz-Juarez, E., 2020. *Estimates of the impact of COVID-19 on global poverty*, WIDER working paper.

Thapa, S., Piras, G., Thapa, S., Goswami, A., Bhandari, P. and Dahal, B., 2021. Study on farmers' Pest management strategy, knowledge on pesticide safety and practice of pesticide use at Bhaktapur district, Nepal. *Cogent Food Agriculture,* 7**,** 1916168.

The Kathmandu Post, 2018. Fresh veggie prices double in past year. [Online] May 30, 2018. Available :https://kathmandupost.com/money/2018/05/30/fresh-veggie-prices-double-in-past-year.

Timsina, K.P. and Shivakoti, G.P., 2018. Vegetables production and marketing: Practice and perception of vegetable seed producers and fresh growers in Nepal. *Agriculture and Food Security,* 7, pp.1-9.

Walker, B., Holling, C.S., Carpenter, S.R. and Kinzig, A., 2004. Resilience, adaptability, and transformability in social–ecological systems. *Ecology society,* 9.

Walker, B. and Salt, D., 2006. Resilience thinking: Sustaining ecosystems and people in a changing world. Island Press.