11. COVID-19, agricultural production, and food value chains

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Over the course of the pandemic, research on how COVID-19 has affected agricultural production and food value chains has evolved: as coronavirus infection rates rose and fell and governments instituted a range of responses, the research focus shifted from projecting what might happen to reflecting on what did happen. Early studies focused on the immediate effects of the lockdowns and other restrictions on food supplies. Later studies began to delve more deeply into the diverse private and public countervailing responses — as governments sought to offset the negative impacts of lockdowns — and their effectiveness in maintaining food supply and demand. The growing number of relatively high-quality studies on agriculture and food supply chains allows for some assessment of factors that appear to have diminished or aggravated the impacts of the pandemic. The analytical framework and the methodology used to develop our findings are summarized in Box 1.

A summary of value chain studies undertaken in low- and middle-income countries during the pandemic (Stoian et al. 2021) categorized them geographically and by topic. Studies of Asian and Pacific countries were most common, followed by Africa, while Latin America and the Caribbean received the least attention. About 80 percent of the publications give significant emphasis to production effects and responses, while less than half emphasize other value chain segments, such as input vendors, traders, processors, and consumers. Studies focusing on Africa are largely oriented to production effects, whereas slightly more than 60 percent of the studies that directly interviewed midstream companies are from Asia. There was good balance across different commodity types, with significant numbers of publications focused on staples, fruits and vegetables, livestock, and fish, but many fewer related to forest and tree crop products. Over time, more studies were conducted on the mitigative responses taken by the public and private sector, but these largely look at what was implemented rather than the effectiveness of such responses. Surprisingly little documentation exists on responses by civil society organizations, despite their prominent role in emergency relief and service delivery for developing country agrifood value chains.

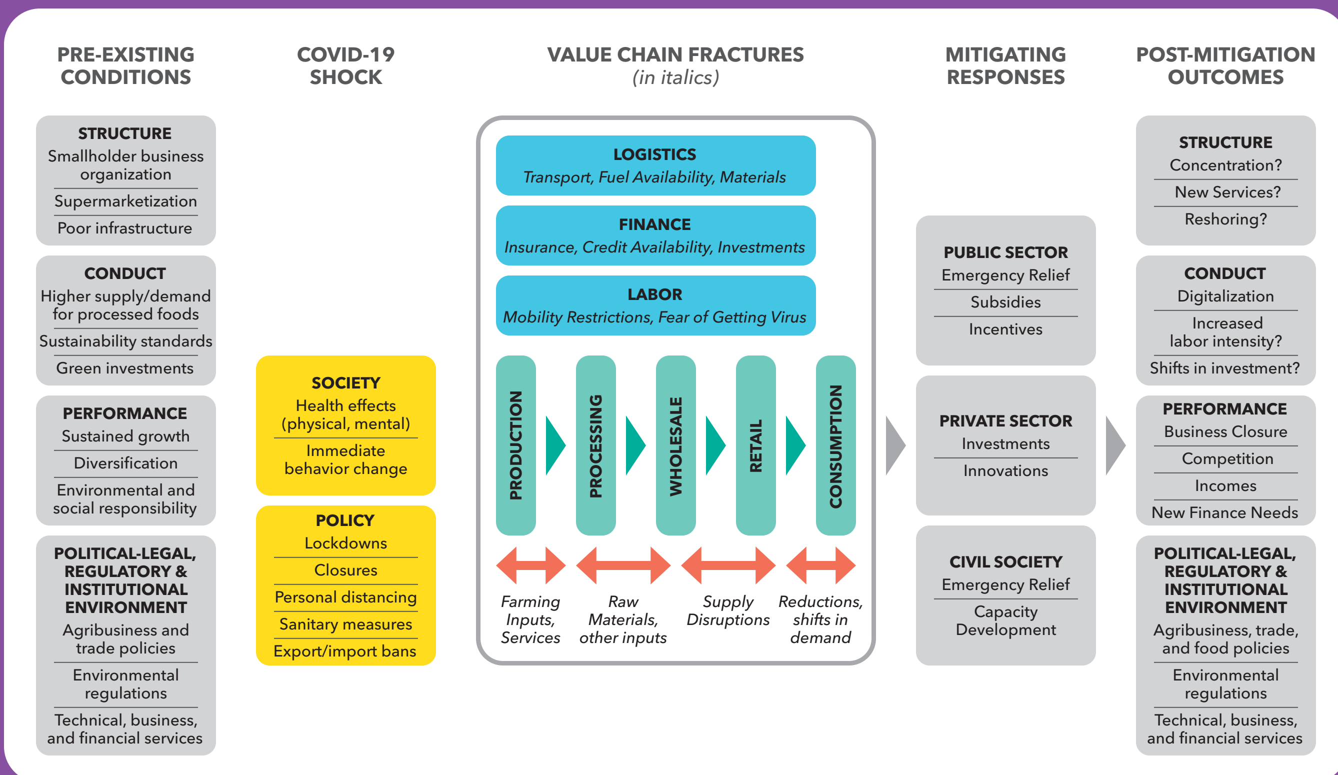
Our review of these studies highlights seven key findings about the impact of the pandemic and pandemic responses on agricultural value chains. The remainder of this chapter is organized around these messages.

1. In most of the cases studied, agricultural production was affected primarily by restrictions on movement affecting labor, availability or costs of inputs, and viability of existing marketing channels.

Reduced access to and higher costs of labor and agricultural inputs are mentioned as important negative effects of the restrictions put in place by governments to reduce the spread of the coronavirus. Labor constraints or high costs were noted by Ethiopian vegetable producers (Minten et al. 2020), Rwandan potato farmers (WCDI 2020), bean farmers in southern Africa (Nchanji, Lutomia, and Karanja

BOX 1 Analytical Framework and Methodology

The methodology behind this synthesis begins with an analytical framework developed by the Value Chain Fractures working group of the CGIAR COVID-19 Hub. The framework is used to develop hypotheses about how pre-existing conditions, along with health-related measures taken by governments, may have shaped the immediate effects of the COVID-19 pandemic; how these effects played out along the different segments of agrifood value chains; and, in turn, how mitigative measures resulted in changes in value chain structures and performance, conduct of chain actors, and adaptations of the enabling environment, as reflected in the framework below:



The hypotheses in the analytical framework and relationships depicted in the diagram informed a template that was used to identify what types of measures and which value chain segments and actors were subjected to study. The template also included information about the studies, such as location, commodity, target markets, mitigating responses, and key findings. Searches were conducted using Google Scholar to identify potential studies for inclusion in the review. These were then screened on criteria such as peer review, use of empirical data, sample design and size, and clarity of methods used in order to remove studies of low methodological robustness. Robust studies were then fully screened and major findings noted in relation to value chain segment and for government interventions and private sector responses, which then permitted the synthesis and development of lessons presented in this chapter.

2021), and Indian farmers of various products (Mahajan et al. 2021). Difficulty in acquiring inputs was mentioned particularly in studies of fish, poultry, and livestock products in several countries, including fish in several countries (Belton et al. 2021) and fodder for livestock production in China (Dai et al. 2020). In Nepal, agrodealers faced shortages of fertilizer which, in turn, affected various value chains (Pradhan 2020). Problems with existing market outlets were another commonly reported difficulty. Local open-air markets, such as cattle markets in northern Kenya, were closed (Wamwere-Njoroge et al. 2021), transportation challenges affected the flow of food from farms to markets, as was the case for bananas in Ecuador, Ghana, and India (Chase and Roux 2020), and some international marketing opportunities were diminished, such as for fish from Peru (Bassett et al. 2021).

2. Smallholder farmers, particularly those who were not organized into cooperatives or farmer associations, had limited ability to overcome the new constraints, and their responses were insufficient to maintain previous levels of productivity or profit.

Studies show that smallholder farmers had little ability to avoid negative consequences from the increased challenges noted above. For example, in many cases, farm production fell as a result of lower productivity or reduced area planted, including in Myanmar (Boughton et al. 2021), Nigeria (Balana et al. 2020), and India (NIAP 2020). However, farmers were able to limit their losses by substituting certain inputs for others, for example family labor was used more and hired labor less, as happened in India (Ceballos, Kannan, and Kramer 2020). Some Ethiopian dairy producers converted raw milk into more durable butter when raw milk sales plummeted (Tesfaye, Habte, and Minten 2020), and fisheries had some success in increasing sales in domestic markets when international markets collapsed (Bassett et al. 2021). In addition, drops in production levels, low farmgate prices, and uncertainties about local retail markets led some farmers to retain more of their production, as happened in Kenya (Odhiambo et al. 2021).

Pre-existing agricultural practices, organizational structures, and services affected farmers' options and outcomes. For example, tractor hire services could not be deployed easily in areas where they did not already exist, but they were found to be helpful in regions where they were commonly used, as shown in a study of 20 Asian countries (Dixon et al. 2021) and a comparative study of two states in India (Ceballos, Kannan, and Kramer 2020). In Latin America, in cases where smallholders were organized into cooperatives or other collectively owned enterprises, social capital and collective action helped mitigate some of the pandemic's effects, for example, by developing alternative marketing channels for foods (Tittonell et al. 2021). However, overall demand and the price and volume signals received by farmers ultimately dictated the extent to which farmers invested in agricultural production, regardless of pre-existing conditions.

3. Demand shocks have been the most disruptive force.

High-value commodities such as fruits and vegetables, dairy, and other animal products were particularly affected. Unemployment and lower incomes during the pandemic reduced demand for these products, putting downward pressure on their prices. Price fluctuations for all commodities depended on the effects of lockdown and mitigative measures, as well as the effects of reduced income on demand and reduced liquidity on supply. These pandemic-induced effects were weakening by the end of 2020; however, prices for high-value products took longer to recover.

Almost all studies indicate that prices paid to farmers changed as compared to pre-pandemic prices. Interestingly, there are cases of both higher and lower prices. Lower prices were caused by decreased demand for some foods, particularly high-value commodities. Market closures due to lockdowns in production zones also reduced demand and depressed prices, as in the case of some aquatic food markets (Belton et al. 2021). In addition, export restrictions intended to ensure food supplies sometimes resulted in excess domestic supply and thus, lower prices. Finally, movement restrictions that disrupted domestic food trade depressed prices in production zones but increased them in urban areas. Examples include rice in several Asian countries (Bhandari et al. 2020) and several producer prices in Myanmar (Boughton et al. 2021) as well as livestock in Kenya, milk in Tunisia, and maize in producing areas of Malawi and Zambia.

However, in other cases, prices reportedly rose as a result of higher input costs and as the uncertainty created by the pandemic led to some panic buying and hoarding. Examples include steep rises in cereal prices in Sudan (FAO 2021) and the effects of hoarding on rice prices in Bangladesh (FAO 2020b). Transport disruptions caused by border closures slowed down the movement of goods, inducing supply shortages and resulting price hikes. In other cases, such as urban Yangon (Myanmar), higher input and transport costs led to price spikes during the lockdown, but food vendors did not report significant reductions in food supplies (Boughton et al. 2021). In the fish sector, a study across five countries found that retail prices fell due to lower demand while costs of manufactured fish feeds increased, compelling fish businesses to cut other costs (Belton et al. 2021).

In several countries, no marked fluctuations of producer or consumer food prices were observed or, where fluctuations did occur, they were mostly short-lived. Even in a fragile context such as Somalia, the lockdown-induced increase in rice prices was considered brief (FAO 2021b). Studies covering multiple phases of the pandemic found that prices tended to return to pre-pandemic levels, but the pace and level at which that took place varied by commodity-specific demand and supply conditions. The few studies that examined prices across different segments of the value chain showed that the percentage price changes of commodities at retail levels were less than those at farm level, demonstrating the ability of value chains to absorb some of the price variability, as was the case for vegetable value chains in Ethiopia (Hirvonen et al. 2020).

4. Value chain midstream actors, such as traders and processors, faced numerous constraints in accessing commodities from farmers and in maintaining marketing channels and revenues.

Several types of midstream food value chain actors reported challenges during the pandemic. Those involved in handling or processing of agricultural outputs faced reduced supplies of commodities from producers, due to lower marketed output or difficulties in accessing the supplies. At the same time, decreased demand from consumers also forced midstream actors to make adjustments, including immediately reducing their procurement of some commodities, and to consider other adaptations in the short to medium term (see no. 5 below). In addition, although the food sector was largely spared from the strictest lockdown measures imposed by governments, some still faced operating restrictions, such as wholesalers in Nigeria (Liverpool-Tasie, Reardon, and Belton 2021) and agrodealers in Nepal (Pradhan 2020).

Food sector companies were also affected by the restrictions in logistic sectors such as transport and packaging. The high cost and limited availability of transport was cited as a significant constraint in numerous studies, including in Ethiopia's vegetable sector (Minten, Mohammed, and Tamru 2020) and among rice millers in Myanmar (Goeb et al. 2020). Labor-intensive formal (or semiformal) companies faced more severe disruptions where movement restrictions were tight and in cases where people moved back to their native villages, as was reported for Ethiopia's vegetable sector (Minten, Mohammed, and Tamru 2020). In Nigeria, the percentage of women employed in fish businesses decreased from 20 percent in February to 2 percent in April 2020 (Liverpool-Tasie, Reardon, and Belton 2021). Food sector companies noted that access to affordable finance was also an issue.

Companies supplying inputs, equipment, or services to farmers also reported drop-offs in business. The reduction in farmers' use of commercial seed and inputs affected the profits of agrodealers. Seed multiplication schemes were similarly affected, as reported for three African countries in one study — Ethiopia, Nigeria, and Uganda (de Boef et al. 2021). Several studies looked at impacts on mechanization services, which reported that usage generally declined in Bangladesh, Ethiopia, and Myanmar in 2020 compared with 2019 (for example, Minten, Mohammed, and Tamru 2020).

At the retail level, formal food stores were largely allowed to remain open if they followed health safety measures, but there were reports that informal vendors, including those selling in wet markets, were subject to closures and other restrictions (see, for example, Burkina Faso, Ghana, and Malawi in IFPRI's COVID-19 Policy Response Portal). Despite these challenges, informal markets continued to play an important role in providing food to consumers, as they did in Southeast Asian countries (Espino et al. 2021). In addition, the food hospitality sector, which includes restaurants and hotels, faced heavy restrictions and reduced demand, which continued even after restrictions were lifted, for example in the Philippines (FAO 2021c).

5. Value chain midstream actors reported use of innovations to try and maintain typical volumes and profits.

Food buyers, handlers, and processors reported adaptations that included reducing production costs, using alternative inputs and introducing flexible labor arrangements, employing alternative product procurement and marketing strategies, relying on informal networks and a range of communication methods, and using digital services (Intini et al. 2020; de Boef et al. 2021; Azra et al. 2021). In addition, companies were forced to piece together different revenue streams, government supports, and strategic borrowing to make ends meet. Use of digital platform services, for example for identifying customers, generally increased, but uptake varied with the development of the sector, and thus differed considerably across countries. Use of these platforms was greater in Asia and Latin America, and especially among larger firms (Apedo-Amah et al. 2020). However, despite advances with online platforms, there is little evidence that they are cost effective for food sector businesses.

6. Governments almost always mitigated the health-based restrictions on movement and gatherings with exemptions granted to the food sector and specific programs to support food supply and demand.

Following early recognition that the initial health-related movement restrictions negatively affected the general economy and could lead to severe consequences for the food system, all governments took additional, countervailing actions to minimize impacts on food availability and access (see IFPRI's COVID-19 Policy Response Portal). First, many low- and middle-income countries did not mandate or enforce lockdowns to the degree that wealthier countries did. Where restrictions were imposed, the agriculture and food sectors were almost always declared "essential" and therefore exempt from lockdowns and many other business restrictions. This appears to have been most effective in protecting segments such as production, wholesale, and formal retail outlets, but it did not cushion the food system as a whole — logistics providers, food service companies, and informal markets often faced disruptive restrictions.

The other major mitigation measures taken by governments were the expansion of existing social protection programs and new economic stimulus packages intended to overcome household income losses. Social protection programs appear to have been successful in reaching many poor consumers and farmers, for example in India (Varshney, Kumar et al. 2020), and in Ethiopia, where the primary social protection program reduced severe food insecurity among poor rural households (Abay et al. 2020).

Governments took many measures to support agricultural production, including reducing import duties on inputs, developing programs to procure critical inputs domestically or from abroad, expanding input subsidies (and use of e-vouchers), providing affordable credit to farmers and food sector companies, and implementing price and market supports (such as procurement programs). In India, for example, wheat prices spiked but recovered quickly due to government procurement support; however, tomato prices remained below the year-on-year average during some of the lockdown months, partly because government marketing regulation was removed for tomatoes (Varshney, Roy, and Meenakshi 2020). These types of government mitigative measures were commonly found in studies in all regions. In many instances, governments undertook several measures in combination, including in Kenya (FAO 2020a) and Myanmar (FAO 2020c).

To protect the value chain midstream, governments also undertook multiple measures, such as providing financial relief and credit, investing in digital infrastructure and platforms, and providing stimulus packages for certain food value chains, such as fruits and vegetables in Burkina Faso (Andrieu et al. 2021) and fish producers in India (Kumaran et al. 2021). Easing of import restrictions benefited both agricultural input companies and farmers. Some governments invested in new physical market structures that could enable food markets to function while meeting new social distancing measures, as they did in Burkina Faso (Andrieu et al. 2021).

7. Notwithstanding the disruptions and large loss of incomes caused by COVID-19 and the resulting lockdown measures, disruptions in agrifood value chains did not lead to significant food shortages in most countries, due in part to mitigative actions undertaken by public and private actors.

These actions varied in scope and scale of investment. Where countries were able to provide significant direct income support to households to bolster demand, economic outcomes were significantly improved over earlier projections (Chapter 2). Worst-case scenarios involving a collapse of whole food systems and resulting famines have not materialized. The interplay between private sector response, public policy and, in some cases, support from civil society organizations has prevented a massive downturn in agricultural production, mounting food losses and waste due to logistical restrictions, and major disruptions at the retail level. This is shown at the global level (Chapter 10) and in a few national studies. In India, for example, the agriculture sector has done remarkably well, although the pandemic resulted in decline of about 24 percent in GDP during the second quarter of 2020 (Varshney, Roy, and Meenakshi 2020).

Nevertheless, agrifood value chains remain vulnerable, especially in low-income countries and where pre-existing business conditions and shortcomings in political-legal frameworks continue to hamper value chain development. But value chain actors, service providers, and political decision-makers can now draw on diverse experiences and insights to inform mitigative measures and private sector responses in future pandemics. Critical next steps are (1) to better analyze the effects of specific interventions and integrated actions in the agriculture and food sectors on food supply chains and (2) to address known shortcomings in regulatory frameworks and public investments that can bolster resilience.

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References

Abay, K., G. Berhane, J. Hoddinott, and K.T. Hirfrfot. 2020. "COVID-19 and Food Security in Ethiopia: Do Social Protection Programs Protect?" Policy Research Working Paper Number WPS9475. World Bank Group, Washington, DC.

Andrieu, N., L. Hossard, N. Graveline, P. Dugué, P. Guerra, and N. Chirinda. 2021. "Covid-19 Management by Farmers and Policymakers in Burkina Faso, Colombia and France: Lessons for Climate Action." *Agricultural Systems* 190: 103092.

Apedo-Amah, M.C., B. Avdiu, X. Cirera, et al. 2020. "Unmasking the Impact of COVID-19 on Businesses: Firm Level Evidence from Across the World." Policy Research Working Paper No. 9434, World Bank, Washington, DC.

Azra, M.N., N.A. Kasan, R. Othman, G.A.G.R. Noor, S. Mazelan, Z.B. Jamari, G. Sara, and M. Ikhwanuddin. 2021. "Impact of COVID-19 on Aquaculture Sector in Malaysia: Findings from the First National Survey." *Aquaculture Reports* 19: 100568.

Balana, B.B., M.A. Oyeyemi, A.I. Ogunniyi, A. Fasoranti, H. Edeh, J. Aiki, and K.S. Andam. 2020. "The Effects of COVID-19 Policies on Livelihoods and Food Security of Smallholder Farm Households in Nigeria: Descriptive Results from a Phone Survey." IFPRI Discussion Paper No. 1979, International Food Policy Research Institute (IFPRI), Washington, DC.

Bassett, H.R., J. Lau, C. Giordano, S.K. Suri, S. Advani, and S. Sharan. 2021. "Preliminary Lessons from COVID-19 Disruptions of Small-Scale Fishery Supply Chains." *World Development* 143: 105473.

Belton B., L. Rosen, L. Middleton, et al. 2021. "COVID-19 Impacts and Adaptations in Asia and Africa's Aquatic Food Value Chains." Working Paper FISH-2021-02. CGIAR Research Program on Fish Agri-Food Systems, Penang, Malaysia.

Bhandari, H., J. Balie, V. Pede, and N. Meah. 2020. *Impact of COVID-19 on the Rice Value Chain (RVC) in Asia*. IRRI Policy Brief. Manila: International Rice Research Institute.

Boughton, D., J. Goeb, I. Lambrecht, et al. 2021. "Impacts of COVID-19 on Agricultural Production and Food Systems in Late Transforming Southeast Asia: The Case of Myanmar." *Agricultural Systems* 188: 103026.

Ceballos, F., S. Kannan, and B. Kramer. 2020. "Impacts of a National Lockdown on Smallholder Farmers' Income and Food Security: Empirical Evidence from Two States in India." *World Development* 136: 105069.

Chase, R., and N. Roux. 2020. "How COVID-19 is Impacting Banana-Producing Countries." *Alliance of Bioversity International and CIAT Blog*, June 30.

Dai, R., H. Feng, J. Hu, Q. Jin, H. Li, R. Wang, R. Wang, L. Xu, and X. Zhang. 2020. "The Impact of COVID-19 on Small and Medium-Sized Enterprises: Evidence from Two-Wave Phone Surveys in China." CGD Working Paper 549, Center for Global Development, Washington, DC.

de Boef, W.S., G.D. Borman, A. Gupta, et al. 2021. "Rapid Assessments of the Impact of COVID-19 on the Availability of Quality Seed to Farmers: Advocating Immediate Practical, Remedial and Preventative Action." *Agricultural Systems* 188: 103037.

Dixon, J.M., J. Weerahewa, J. Hellin, et al. 2021. "Response and Resilience of Asian Agrifood Systems to COVID-19: An Assessment across Twenty-Five Countries and Four Regional Farming and Food Systems." *Agricultural Systems* 193: 103168.

Espino, A., K. Itliong, C.D. Ruba, O. Thy, W.J. Barbon, E. Monville-Oro, S. Gummadi, and J. Gonsalves. 2021. "COVID-19 Impact on Local Agri-food System in Cambodia, Myanmar, and the Philippines: Findings from a Rapid Assessment." CCAFS Working Paper No. 357, CGIAR Research Program on Climate Change, Agriculture and Food Security, Wageningen, the Netherlands.

FAO (Food and Agricultural Organization of the United Nations). 2020a. *National Agrifood Systems and COVID-19 in Kenya: Effects, Policy Responses, and Long-Term Implications*. Policy Brief. Rome.

FAO. 2020b. *Second Rapid Assessment of Food and Nutrition Security in the Context of COVID-19 in Bangladesh: May–July 2020*. Rome.

FAO. 2020c. *National Agrifood Systems and COVID-19 in Myanmar. Effects, Policy Responses and Long-Term Implications*. Policy Brief. Rome.

FAO. 2021a. *The Sudan | Food Supply, Agricultural Livelihoods and Food Security in the Context of COVID-19: Monitoring Report, January 2021*. Rome.

FAO. 2021b. *Somalia – Agricultural Livelihoods and Food Security in the Context of COVID-19: Monitoring Report*. Rome.

FAO. 2021c. *Rapid Assessment of the Impact of COVID-19 on Food Supply Chains in the Philippines. Manila*. Rome.

Goeb, J., N.L.K. Synt, P.P. Zone, and Y. Tang. 2020. *Monitoring the Impact of COVID-19 in Myanmar: Rice Millers–October 2020 Survey Round*. Myanmar Strategy Support Program Policy Note 41. Washington, DC: IFPRI.

Hirvonen, K., B. Mohammed, B. Minten, and S. Tamru. 2020. "Food Marketing Margins during the COVID-19 Pandemic: Evidence from Vegetables in Ethiopia." ESSP Working Paper 150, IFPRI, Washington, DC.

IFPRI (International Food Policy Research Institute). 2020. COVID-19 Policy Response Portal. Accessed November 20, 2021.

Intini, J., W. Belik, A. Cunha, and J. Torres. 2020. "The Role of Wholesalers Markets in the Pandemic: Challenges and Opportunities." The Agrifood System and the Challenges of COVID-19 No. 5, FAO, Santiago.

Kumaran, M., R. Geetha, J. Antony, et al. 2021. "Prospective Impact of Corona Virus Disease (COVID-19) Related Lockdown on Shrimp Aquaculture Sector in India: A Sectoral Assessment." *Aquaculture* 531: 735922.

Liverpool-Tasie, L.S.O., T. Reardon, and B. Belton. 2021. "Essential Non-essentials: COVID-19 Policy Missteps in Nigeria Rooted in Persistent Myths about African Food Supply Chains." *Applied Economic Perspectives and Policy* 43 (1): 205–224.

Mahajan, K., and S. Tomar. 2021. "COVID-19 and Supply Chain Disruption: Evidence from Food Markets in India." *American Journal of Agricultural Economics* 103 (1): 35–52.

Minten, B., B. Mohammed, and S. Tamru. 2020. "Emerging Medium-Scale Tenant Farming, Gig Economies, and the COVID-19 Disruption: The Case of Commercial Vegetable Clusters in Ethiopia." *European Journal of Development Research* 32 (5): 1402–1429.

Nchanji, E., C.K. Lutomia, and D. Karanja. 2021. "Immediate Impacts of COVID-19 Measures on Bean Production, Distribution, and Food Security in Eastern Africa." *Journal of Agriculture, Food Systems, and Community Development* 10 (2): 259–263.

NIAP (National Institute for Agricultural Economics and Policy). 2020. "COVID-19 Lockdown and Indian Agriculture: Options to Reduce the Impact." Working Paper, National Institute for Agricultural Economics and Policy, Indian Council of Agricultural Research, New Delhi.

Odhiambo, K., J. Lewis, N. Tefera, A. Thomas, M. Meroni, M. Dimou, and F. Rembold. 2021. *Impacts of COVID-19 and Desert Locusts on Smallholder Farmers Food Systems and Value Chains in Kenya*. Luxembourg: European Union.

Pradhan, B. 2020. "Gauging the Impact of COVID-19 Lockdown on Farming Communities and Agribusinesses in Nepal." *CIMMYT Blog*, July 8.

Stoian, D., P. Marenya, J. Donovan, and G. Pamerneckyte. 2021. "Fractures and Resilience of Agri-food Value Chain in the Context of COVID-19: A Review of Recent Evidence." CIFOR-ICRAF Working Paper 2. CIFOR, Bogor, Indonesia, and World Agroforestry, Nairobi, Kenya.

Tesfaye, A., Y. Habte, and B. Minten. 2020. "COVID-19 Is Shifting Consumption and Disrupting Dairy Value Chains in Ethiopia." In *COVID-19 and Global Food Security*, edited by J. Swinnen and J. McDermott, 42–45. Washington, DC: IFPRI.

Tittonell, P., M. Fernandez, V.E. El Mujtar, et al. 2021. "Emerging Responses to the COVID-19 Crisis from Family Farming and the Agroecology Movement in Latin America: A Rediscovery of Food, Farmers and Collective Action." *Agricultural Systems* 190: 103098.

Varshney, D., D. Roy, and J.V. Meenakshi. 2020. "Impact of COVID-19 on Agricultural Markets: Assessing the Roles of Commodity Characteristics, Disease Caseload and Market Reforms." *Indian Economic Review* 55 (1): 83–103.

Varshney, D., A. Kumar, A. Mishra, S. Rashid, and P.K. Joshi. 2020. "Could Pradhan Mantri Garib Kalyan Yojana (PM-GKY) Mitigate COVID-19 Shocks in the Agricultural Sector." IFPRI Discussion Paper 1990, IFPRI, Washington, DC.

Varshney, D., A. Kumar, A.K. Mishra, S. Rashid, and P.K. Joshi. 2021. "COVID-19, Government Transfer Payments, and Investment Decisions in Farming Business: Evidence from Northern India." *Applied Economic Perspectives and Policy* 43 (1): 248–269.

WCDI (Wageningen Centre for Development Innovation). 2020. *Potato Alert: Rwanda, Number 1*. Wageningen, Netherlands: Wageningen University and Research and SNV Netherlands Development Organisation.

Wamwere-Njoroge, G., J.M. Makau, E. Rutsimba, et al. 2021. *Feed the Future Accelerated Value Chain Development (AVCD) Program: Effect of COVID-19 on Livestock Value Chain Actors and Food Systems in Northern Kenya*. 2021. Nairobi: International Livestock Research Institute.