

CHAPTER 4

Agrifood Value Chains

Building Resilient Food Systems

BART MINTEN, BEN BELTON, AND THOMAS REARDON

Bart Minten is a senior research fellow and leader of the Myanmar Strategy Support Program, IFPRI. **Ben Belton** is a research fellow, South Asia Regional Office, IFPRI, and an associate professor of international development, Michigan State University. **Thomas Reardon** is university distinguished professor of agricultural, food, and resource economics, Michigan State University, and a nonresident research fellow, IFPRI.



KEY MESSAGES

- Agrifood value chains have transformed in recent years through rapid growth, increased diversity and complexity, and a revolution in logistics, storage, and retail. But they remain vulnerable to a variety of crises, including disease, conflict, and natural disasters. Their resilience varies with the type of shock, the structure of the chain, and the local context.
 - Value chain impacts can evolve over the course of a crisis. During the COVID-19 pandemic, agrifood value chain actors first dealt with lockdowns, then with a downturn in demand, and finally with rising prices.
 - Civil strife, conflict, and natural disasters disrupt food production and markets, often leading to rising food prices. Risks to food security and livelihoods can be reduced through flexible market mechanisms to support value chains as well as appropriate farming techniques and new insurance tools.
 - Small, informal enterprises and women-owned enterprises are often more vulnerable to crisis impacts, as are producers and enterprises with limited market options.
 - Agrifood actors respond to crises with short-term coping strategies and long-term adaptations. Improving coping strategies and pursuing transformation that facilitates adaptation are central to building resilience.
- To ensure agrifood value chains contribute to recovery and resilience, it is crucial to:
- Tailor crisis response to the type of shock, the particular context and value chain, and when possible, different enterprise sizes.
 - Invest in improved and innovative technologies and tools that build resilience, such as climate-smart agriculture and index-based insurance.
 - Create a regulatory and business environment that fosters the development and widespread adoption of value chain innovations, such as e-commerce.
 - Provide opportunities to continue private trading during crises, for example by avoiding trade restrictions and creating safe corridors.
 - Ensure that women are able to take advantage of financial and digital innovations and have viable coping strategies.
 - Conduct careful and frequent monitoring before and during crises to target assistance to crucial value chain nodes.



Agrifood value chains in the world's low- and middle-income countries (LMICs) have expanded rapidly over the past decade, supplying an increasing volume and diversity of food products. This transformation has been driven by the fast growth of urban and peri-urban areas as well as increasing demand from richer and more urban consumers for different, higher-quality, and often more expensive food. More farmers than ever are now connected to agrifood value chains through markets for both agricultural inputs and outputs. These connections are not only increasingly numerous but also increasingly complex, reflecting the greater diversity of products, inputs, and services that farmers buy and sell. Midstream and downstream in agrifood value chains, a "quiet" revolution has occurred in logistics, storage, transport, wholesale, retail, and food services, with fundamental and rapid changes in the structure, conduct, and performance of these value chain segments and the enterprises involved.¹

This transformation provides new opportunities for farmers to increase their income and food security and nutrition,² and is generating revenues

for technology upgrades, improving access to productivity-enhancing inputs and services, and increasing off-farm employment in small and medium enterprises (SMEs) in all value chain segments. At the consumer end, the expansion of value chains is essential for feeding urban residents, who now account for more than half the population in LMICs. But this transformation also brings new challenges. As value chains have become longer, stretching from rural areas to cities and across countries, they have also become more vulnerable to shocks that disrupt markets, including crises created by climate change, disease, and conflict. All these shocks can have major impacts for actors throughout the value chain, and consequently for livelihoods and consumers' food security.

Some research has begun to look at understanding, anticipating, and alleviating the impacts of crises on agrifood value chains. For example, researchers have identified five potential "hotspots" – aspects of value chains that can be particularly vulnerable to crises: (1) physical infrastructure (such as transport and storage), which affects risks to production; (2) geographic length of the supply chain, which affects

potential disruptions such as road washouts along a supply route; (3) perishability of the product, which can make it vulnerable to delivery delays; (4) prevalence and robustness of physical capital, such as storage bins and cold chambers used by traders; and (5) “stranded assets,” that is, assets that are only profitable in a particular end-market that the owner cannot access because of a supply chain shock.³ Beyond these particular vulnerabilities, supply disruptions are determined by the nature and intensity of the shock and the exposure of supply chain actors.⁴

Minimizing the inevitable disruptions will require appropriate policy environments and investments all along the value chain, from the farm to the consumer. In the face of increasingly frequent shocks, the ongoing transformation will be essential to improving the adaptive capacity of agrifood value chains. To boost resilience, governments will need to create a business environment that fosters adaptation and innovation. In the private sector, continued investments in assets and good practices both in input supply chains (such as agro-dealers who provide inputs to farmers) and in the midstream of value chains (including processors, logistics firms, and wholesalers) will be essential to supporting food security during crises.

In this chapter, we review some of the recent evidence on the impact of three different types of crises – pandemics, conflict, and climate change – on the functioning of agrifood value chains and distill some lessons learned for building resilience.

THE COVID-19 PANDEMIC

COVID-19 – and the policies implemented to contain it – constituted an unprecedented shock to value chains worldwide. The challenges faced by agrifood businesses evolved over the course of the pandemic, reflecting policy shifts, the evolution of the disease, and changing economic conditions. In LMICs, threats to value chains progressed from mobility restrictions during the initial lockdowns, to depressed demand as economic activity declined, and most recently to price inflation.

SHOCKS TO VALUE CHAINS

During the first half of 2020, restrictions on transport and human mobility plus temporary closures

of businesses and public institutions disrupted the flow of goods and services along global, regional, national, and subnational supply chains. For example, lockdowns prevented or delayed delivery of produce from farms to markets and inputs from factories to farms. In many cases, these restrictions raised food prices, at least temporarily. The initial containment policies implemented in developing countries often failed to consider the critical role of domestic supply chains in national food systems; in sub-Saharan Africa and India, for example, these supply chains deliver approximately 80 percent of the food consumed (by value).⁵ As a result, lockdowns caused major disruptions to the food supply in many African and Asian countries and for diverse food commodities.

The impacts of initially stringent lockdown policies on transport and mobility were mainly short-lived, however. Businesses soon introduced work-arounds, such as operating on new routes or opening outside of normal business hours, and governments made quick policy adjustments, often prioritizing movement of agrifood products and farm inputs along with medicine and other essential products. Yet despite these adaptations, movement restrictions and related constraints on accessing materials and labor meant that many consumers experienced declines in income and loss of employment, which led to a drop in demand for food products. These impacts affected agrifood businesses directly. For instance, in Nigeria, a survey of enterprises in poultry and fish supply chains found that the main problems early in the pandemic were access to inputs, transport, and markets, along with low consumer demand.⁶

Over time, this set of challenges faded, while rising input costs and financial constraints (that is, inability to access or recoup loans) became more troublesome.⁷ In many places, the combination of reduced consumer demand with rising input and operating costs squeezed the profits of farms and other supporting businesses, causing them to reduce their output or turnover.⁸ Food prices rose as a result of these pandemic impacts, reaching the highest levels in a decade by the end of 2021, before rising even further in 2022 when the Russia-Ukraine war put additional pressure on global fuel and food prices.

RESILIENCE AND VULNERABILITY

Some enterprises were more vulnerable to these COVID-19 disruptions than others, and impacts were often context-specific. Women-led agrifood enterprises were sometimes, but not always, less resilient in the face of pandemic lockdowns than enterprises led by men, varying by country and by product. In Nigeria, for example, women-owned enterprises in poultry and fish value chains were 11 percent more likely to close than those owned by men between 2020 and 2021.⁹ However, a similar study of SMEs in the midstream of potato and fish value chains in Kenya found no significant effect of the owners' gender on changes in business turnover during the pandemic.¹⁰ And a study of agrifood SMEs in 17 countries found that although women-owned firms were more likely to report a production decrease of 30 percent or more as a result of the lockdowns, no differences were reported in business earnings between firms owned by women and men.¹¹

Small, informal firms were sometimes, but not always, less resilient than larger, formal-sector enterprises. As with gender, the findings for firm size and COVID-19 impacts varied by context. In some countries, food enterprises in the informal sector (many of which are small and many owned by women) were disproportionately harmed by containment policies that favored formal businesses such as supermarkets.¹² In Senegal, large, formal, export-oriented vegetable farms fared better under COVID-19 restrictions than small farms and traders supplying domestic markets,¹³ while in Nigeria, larger businesses in poultry and fish supply chains were 13 percent less likely to close than small businesses. On the other hand, smaller vegetable farms in Ethiopia were found to be *less* vulnerable to COVID-19 disruptions than medium-sized farms, because the smaller farms were less reliant on hired labor.¹⁴ This pattern was also identified in Kenya, where smaller firms in the midstream segments of potato and fish value chains proved more resilient (as measured by relative changes in volumes traded) to shocks over the 2019–2021 period than larger businesses, though the very largest businesses surveyed experienced smaller relative reductions in sales.¹⁵

During the early stages of the pandemic, shorter supply chains (in terms of distance from farms to

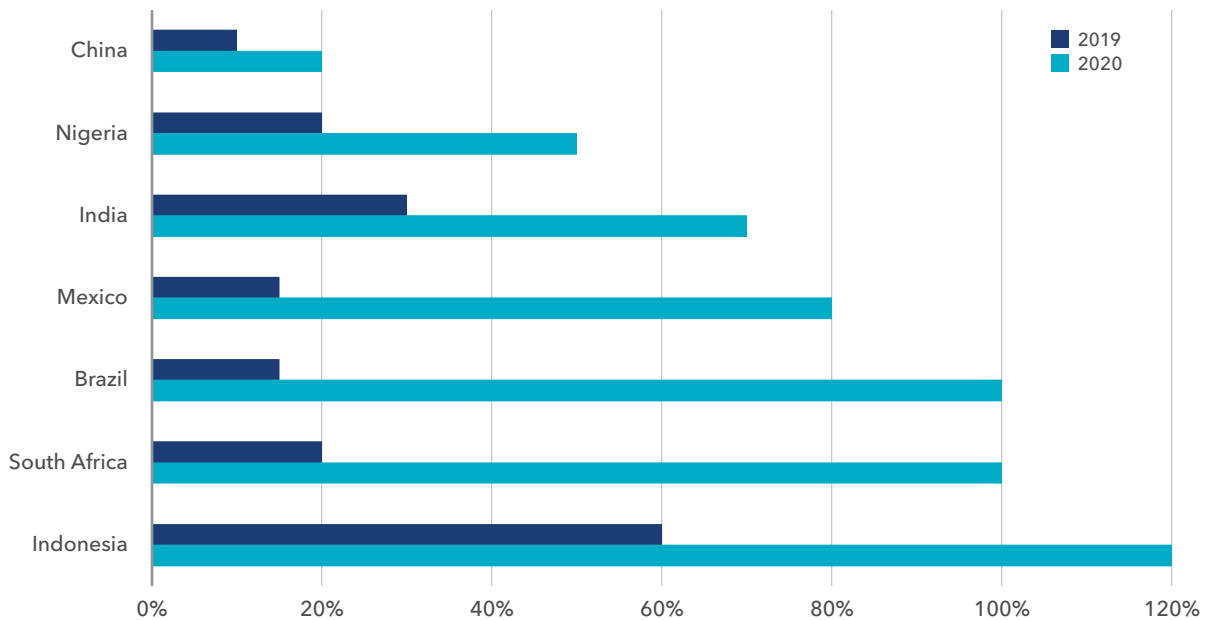
consumers) were expected to be more resilient than longer ones,¹⁶ but their response has proven more complex. In Ethiopia, vegetable farmers who faced less competition from other areas (whether domestic or international) due to pandemic-related trade restrictions benefited through higher prices for their produce, while those who could no longer access markets within the country fared worse.¹⁷ Among Australian agrifood businesses, those with both domestic and global value chain partners proved more resilient than those with only global business partners.¹⁸ However, even in highly export-oriented sectors, firms with multiple potential buyers tended to weather the crisis well. For example, the Norwegian salmon industry was able to redirect products to alternative national markets and target alternative market segments by changing product forms, such as from fresh to frozen fish.¹⁹ In contrast, supply chains delivering products to a single end-market, whether domestic or for export, were likely to suffer serious disruption, particularly where gluts of seasonal production coincided with movement restrictions, as happened with potatoes in Kenya.²⁰

RESPONDING TO THE CRISIS

To address the diverse challenges related to the pandemic, businesses across all segments of agrifood value chains made two broad sets of adaptations: (1) short-term coping strategies, such as pausing or reducing business activities, minimizing operating costs, drawing down savings, or borrowing; and (2) longer-term or more proactive adaptations, such as the adoption of digital technologies, operational diversification, or increasing use of contracts (for example, retailers and processors signed contracts with farmers to reduce market risk for both parties).

Deep and abrupt changes in business practices, products, or technologies that substantially alter supply chains have been termed “pivoting.”²¹ Pivoting may be pursued as a short-term coping mechanism or as a long-term adaptation action and strategy. Pivots by food industry firms during the COVID-19 pandemic were focused primarily on marketing channels (such as shifting from in-store or in-restaurant sales to e-commerce) and technologies (such as shifting from labor- to capital-intensive

FIGURE 1 E-commerce yearly growth rates in 2019 (before COVID-19) and 2020



Source: Data from V. Vardhan, "Impact of the COVID-19 Pandemic on Retailing in Emerging Countries," Powerpoint presentation by Euromonitor International, October 2020, cited in T. Reardon, A. Heiman, L. Lu, C.S.R. Nuthalapati, R. Vos, and D. Zilberman, "'Pivoting' by Food Industry Firms to Cope with COVID-19 in Developing Regions: E-commerce and 'Copivoting' Delivery Intermediaries," *Agricultural Economics* 52, 3 (2021): 459-475.

technologies). Perhaps the most significant of these pivots was the boom in e-commerce for food retail sales in many LMICs, as consumers sought to prevent infection by avoiding public places. Although food e-commerce and associated online platforms and logistics infrastructure were growing prior to the pandemic, most notably in China, the pandemic dramatically boosted their expansion across multiple regions, albeit unevenly, with rapid growth in parts of Latin America, Southeast Asia, and India, and slower growth in much of sub-Saharan Africa (Figure 1). The differences in regional expansion are explained by the basic enabling conditions for these businesses in the different regions – hard infrastructure like roads that allowed fulfillment of digital orders, and soft infrastructure like business regulations that did not fetter the establishment of new enterprises in this sector.

Uptake of digital information and communication technologies (ICT) by smaller actors and individuals in food value chains also accelerated significantly. For instance, in Kenya, the use of "mobile money" for making transactions and of phones, social media, and online marketplaces to

search for buyers or sellers increased in the wake of the pandemic.²² Similar changes, though starting from a lower base, have also been observed in Nigeria.²³ In India, accepting digital payment via QR codes became very common, even among the smallest retail businesses.²⁴

Signs of a partial business recovery were evident in most countries in 2021 despite the severity of the Delta variant of COVID-19, which predominated by mid-year. In LMICs, this business resilience reflects in part the nature of the small farms and firms that make up the bulk of the food system. These enterprises typically have low overhead and few hired workers, which allowed them to scale back operations and persist through times of crisis. However, their coping strategies, including drawing down savings and borrowing, likely exacted a heavy cost in terms of human welfare and eroded their capacity to adapt to future shocks. The largest businesses have been best placed to adapt proactively through pivots – such as the reconfiguration of supply chains and diffusion of e-commerce – often facilitated by co-pivots by other supply chain actors such as logistics providers.²⁵ These

disparities may have contributed to increasing concentration in ownership and market shares in some instances.²⁶ However, many smaller farms and firms were also quick to adopt or increase their use of ICT to overcome coordination problems and reduce the need for physical contact during the crisis, and they look set to continue on this path.

CIVIL STRIFE AND CONFLICTS

Most of the world's extreme poor live in fragile states.²⁷ Yet despite the enormous importance of these areas for global food security, relatively little research has examined how agrifood value chains respond and adapt in such contexts. Food prices and the affordability of food are particularly critical in these settings. Some research has shown that rising food prices are often the cause of violent conflict and unrest, and there are significant linkages and feedback loops between violence and food prices. Here we briefly discuss two conflicts – one international (the Russia-Ukraine war), which has global implications, and one with largely domestic impacts (Myanmar).

RUSSIA-UKRAINE WAR

The recent war in Ukraine has highlighted the vulnerability of global agrifood value chains to conflict. International commodity markets were already volatile before the war began, as a result of the COVID-19 pandemic and weather shocks that reduced harvests. Food prices were at their highest level in a decade, and international fertilizer prices had increased by 125 percent in the preceding year, due to high prices for natural gas and coal (used as feedstock and energy sources in ammonia production).²⁸ High energy prices and a global shortage of containers also led to a substantial increase in international shipping costs in 2021. When Russia invaded Ukraine in February 2022, food prices increased rapidly, especially wheat prices, which rose by more than 40 percent in just two months. By July, they had returned to pre-conflict levels, but to date remain well above the historical average. Fertilizer prices also increased, given that Russia and Belarus were major fertilizer suppliers,²⁹ which has sparked serious concerns about food security, especially in LMICs.

While the countries most dependent on wheat imports from Ukraine and Russia were directly affected, the impact of the war on agrifood value chains has been global, affecting many LMICs that import wheat and leading to spillover effects on other value chains.³⁰ As with the food crises in 2007/08 and 2010, some countries have tried to shield themselves from rising food prices by implementing export restrictions or lowering import restrictions. These trade policy interventions only aggravate the global problem by escalating disruptions of global agrifood value chains and food price volatility.³¹ Price-insulating policies adopted by a number of countries in the wake of the Ukraine crisis have contributed to high volatility in world prices, as price risks were transferred from one group of countries to another.³² However, some unambiguously beneficial trade policies have also been adopted in the crisis, such as the creation of safe corridors that can help reduce the impact of the conflict – including the Black Sea Grain Initiative, which has allowed grain exports from Ukraine's seaports.

CONFLICT IN MYANMAR

In Myanmar, civil strife has disrupted domestic agrifood value chains. Myanmar's military seized control in a coup in February 2021, setting the country on a path toward widespread violence, insecurity, and major economic contraction. In protest, Myanmar's people organized a national Civil Disobedience Movement and worker strikes that disrupted service delivery for both public institutions and private businesses. Banks discontinued in-person services and faced severe liquidity shortages, limiting businesses' ability to pay employees and suppliers as well as individuals' access to their money. Cumulatively, these disruptions had major economic consequences – GDP declined by 18 percent and the poverty rate increased by between 8 and 18 percentage points.³³

The value chain for rice, Myanmar's primary staple food, is the country's biggest and is closely linked to the banking and transport sectors. In the aftermath of the coup, a number of challenges arose in the rice value chain, as banks were short of cash and transport was complicated by lack of drivers, lack of fuel or high costs of fuel, and road blocks.

Nonetheless, rice processing and trade continued, ensuring that rice was available in most retail markets, and processing margins remained largely stable – demonstrating the value chain’s resilience to such major shocks.³⁴ This resilience reflects the ability of value chain actors to adapt to new conditions. For example, to address the impact of the banking crisis, millers began using a modified *hundi* payment system to sell rice, whereby a sale is negotiated and payment is transferred from a trusted third party with available cash. However, as the margin increased between the price that rice millers received and the price that retailers charged consumers, average retail prices rose by 11 percent, implying welfare losses of almost US\$500 million for the country (equivalent to 3 percent of agricultural GDP). Despite the knot of problems that must be addressed in such settings, there are policy tools that can help. For example, easing transport restrictions and facilitating cheap and safe trade of food products can reduce food price inflation, ensure higher farm prices, and thus improve welfare.³⁵

NATURAL CALAMITIES

Natural calamities, such as floods and droughts, cause major disruptions in agrifood value chains, as the recent disastrous flooding in Pakistan has reminded the world. Such extreme weather events are occurring with greater frequency, and the shocks can affect a wide area. For example, floods in Bangladesh in 1998 covered two-thirds of the country, causing severe damage to the country’s rice crop. However, widespread food insecurity was avoided, as Bangladesh’s rice markets adjusted to the loss of domestic production through significant commercial rice imports from India. Because Bangladesh had liberalized trade in the early 1990s, private traders were assured that sufficient rice imports would be available.³⁶ In Ethiopia, where drought is common, the worst impacts may be avoided by adopting appropriate agricultural practices. A study found that training farmers in the production and conservation of livestock fodder as well as in soil and water conservation practices – good practices even in normal times – was crucial for strengthening farmers’ capacity to adapt to and cope with drought.³⁷

The increasing frequency of natural calamities that affect agrifood systems has generated significant interest and experimentation with innovative index-based agricultural insurance products to reduce the risk faced by farmers. While globally about half of all farms are covered by agricultural insurance, a substantial number of farms in LMICs are left out.³⁸ Index-based insurance products are generally perceived to be too expensive for smaller farms in these settings, and uptake has been low. Given the importance of such risk-reducing products in increasing the resilience of agrifood value chains, one promising option for improving uptake is to bundle these insurance products with stress-tolerant seed varieties, risk-oriented credit/savings products, or extension services.³⁹ However, despite innovations and new opportunities created by advances in remotely-sensed data systems, digital technologies, smartphones, and e-banking, insurance for catastrophic risks is expected to remain unaffordable for most farmers and thus is an inequitable form of safety net,⁴⁰ leaving many farmers dependent on disaster assistance in catastrophic years.

LESSONS LEARNED

A number of lessons can be drawn from the responses of agrifood value chains to these different crises.

AGRIFOOD VALUE CHAINS HAVE GENERALLY PROVEN QUITE RESILIENT TO SHOCKS, THOUGH IN WAYS THAT ARE HETEROGENOUS AND CONTEXT SPECIFIC.

The type of crisis – driven by climate, civil strife, pandemic, or other shocks – affects value chains’ resilience. The resilience of agrifood value chains has sometimes come from direct policy interventions, as seen in exemptions of food service industries from lockdowns in the case of the COVID-19 pandemic. Structural differences in value chains can make one value chain more resilient than others. In particular, small informal firms may be more vulnerable or face greater constraints in their response than large formal firms. Thus, interventions and policies should be tailored not only to the type of crisis but also to the specific context, value chain, and if possible, size of the enterprise affected.

IMPROVED AND NEW TECHNOLOGIES HAVE AN IMPORTANT ROLE TO PLAY IN ENSURING GREATER RESILIENCE OF VALUE CHAINS. Proactive investments are needed to establish widespread availability of usable knowledge and shock-resistant technologies, such as climate-smart technologies and practices, and relevant ICT. In the past, breeding efforts by international research organizations have led to lower yield volatility,⁴¹ and today the development of new agricultural technologies again has an important role to play in improving risk management. In addition, appropriate insurance instruments and risk mitigation strategies should be facilitated, with public sector interventions playing a crucial role.

A REGULATORY AND BUSINESS ENVIRONMENT NEEDS TO BE CREATED (OR EXISTING ENVIRONMENTS REFORMED) TO ALLOW SHOCK-RESPONSIVE INNOVATIONS TO DEVELOP AND SPREAD IN THE FACE OF CRISIS. In some cases, this means reducing or eliminating constraints, such as unnecessary requirements or “red tape”; in other cases, it means making public investments in fundamentals such as roads, wholesale markets, and electrification. During the COVID-19 pandemic, the accelerated take-off of e-commerce and the quick spread of alternative payment systems – such as mobile money and informal transfer systems – showed the contribution of such innovations to value chains’ resilience. While contract farming and commodity exchanges could also have more important roles to play in price risk management, their growth in LMICs has been hampered by contract enforcement issues, liquidity problems, and high transaction costs, among other issues.⁴²

ENSURING CONTINUED PRIVATE TRADING OPPORTUNITIES IS IMPORTANT FOR OVERCOMING CRISES. These opportunities help value chain actors to diversify suppliers and customers and to work around local constraints, including restrictive trade policies implemented in response to crises. Such trade barriers often lead to higher price volatility and higher margins in agricultural markets, and should therefore be avoided. Keeping transportation and appropriate logistics functioning is crucial for maintaining trade in agricultural inputs

and outputs, which are typically transported over long distances in both transitional and modern markets. For example, the creation of safe corridors for agrifood products – as seen in the case of the Ukraine war – can sometimes reduce impacts of disturbances.

ATTENTION TO GENDER IS IMPORTANT, AS WOMEN OFTEN SUFFER GREATER SETBACKS FROM CRISES. Ensuring that women retain access to productive opportunities across various nodes in value chains can limit the impact on food security and livelihoods. For example, women must be able to take advantage of digital agriculture and finance innovations as well as training in food safety and other food technology practices. Moreover, women often draw down their savings more quickly than men during crises; to address this, further research is needed on women’s coping strategies and ways to improve them.

CAREFUL AND FREQUENT MONITORING, BOTH BEFORE AND DURING CRISES, CAN SUPPORT BETTER TARGETING OF INTERVENTIONS TO CRUCIAL VALUE CHAIN NODES. Given the rapid evolution of crisis situations, updated information on where and when shocks occur and whom they affect is often lacking, including information on road closures, price changes, and product scarcities (see Chapter 2). Before a shock occurs, countries can undertake hazard assessments of their value chains to be better prepared and build resilience in advance. Detailed guidance on such risk assessments for value chains is available.⁴³ During crises, frequent surveys on important impacts are feasible, given widespread mobile phone use. These phone surveys have been shown to be useful⁴⁴ and should be encouraged. For example, the World Food Programme is increasingly using such surveys in crisis situations, although monitoring of value chain agents remains limited.⁴⁵ In addition, the increasing availability of big data and improved methodologies to effectively use such data has great potential for better monitoring in these fast-changing situations.