Chapter 7

FOOD VALUE CHAINS
Transformations in Low- and Middle-Income Countries

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Key messages

- In recent decades, food value chains (FVCs) in low- and middle-income countries (LMICs) have expanded dramatically, with major increases in the number of actors, volume and diversity of services and products, and geographic length.
- In the 1970s and 1980s, agrifood systems were dominated by traditional FVCs and parastatal companies. Beginning in the late 1980s, two FVC "revolutions" were sparked by market liberalization, including the dismantling of parastatals and price controls and opening to foreign direct investment; by public infrastructure investments; and by changing food consumption patterns.
- The "quiet revolution" was marked by the rapid expansion of micro, small, and medium enterprises (MSMEs) in the midstream of FVCs, including in wholesale, logistics, processing, and farm input marketing. Research focused on this expansion and the formation of spontaneous clusters of farms and enterprises, the central role of wholesale markets, and the eventual concentration and disintermediation of midstream MSMEs.
- The subsequent modern revolution was marked by the growth of large private enterprises, and concentration of FVC activities among fewer actors. Research has focused on the impacts of the rise of supermarkets, large processors, and agribusiness input firms on farmer technologies and incomes, consumers, and the logistics sector and on competition.

Looking ahead, priorities for researchers and policymakers should include:

- **Innovative FVC structures.** Spontaneous clusters of farms and MSMEs, new types of farm cooperatives, and outsource services are likely to grow in importance. Research should systematically consider where, how, and why these new models emerge and whether they are viable and able to meet market requirements, as well examining the role of policies in their success or failure.
- **Short- and long-term shocks to FVC reliance.** As climate, economic, conflict, and other shocks become more common, increasing the resilience of both individual value chain segments and whole value chains is essential. This will require a better understanding of the differential effect of shocks on FVCs and FVC actors, and of the enabling environment that can best foster private sector investment in resilience, including for farms.
- **Trends in market structures.** Several current trends are likely to continue shaping FVCs. As market concentration continues, research and policy must find an appropriate balance between competition and concentration. To meet growing demand and the need for food safety standards, public and private investments infrastructure, such as wholesale markets and cold chains, will be essential. The emergence of new technologies also calls for policy frameworks and investment to make the most of new opportunities.

Food value chains increasingly link farm production to input providers upstream and to often-distant consumers downstream, passing through a variety of intermediaries including traders, storage providers, processors, wholesalers, and retail enterprises. Over the past 50 years, the economic, demographic, and policy context of food value chains (FVCs) in low- and middle-income countries (LMICs) has changed enormously, with policy research evolving to address this changing context. FVCs have become much more important to the food economies of LMICs as they have become larger in both the volume and diversity of agrifood products. These changes have accompanied two broad phases in agrifood policy and two "revolutions" that have completely reshaped the structure of FVCs in LMICs (Reardon and Timmer 2007). Initial growth in FVCs was advanced by a proliferation of off-farm micro, small, and medium enterprises (MSMEs) and, more recently, by increased concentration in the sector as larger,

modern firms expand their role. Evolving food systems policies have been closely linked to these structural changes. Policy debates and research have also evolved over this period, both influenced by and contributing to the FVC transformation, with policy research providing evidence, analysis, and recommendations to inform policy decisions.

This chapter discusses drivers and patterns in FVC transformation, along with policy research topics and contributions over the past 50 years, and provides a look at future research and policy needs. The chapter first outlines the growth and importance of FVCs to LMIC economies and employment, and then provides a brief overview of the broad transformations of FVCs since 1975, looking first at the pre-liberalization phase, then at the post-liberalization phase, and in the latter, the set of drivers that gave rise to the two FVC revolutions that took place in that phase—the "quiet revolution" and the "modern revolution." For each of these, it examines the patterns, policy issues, and research conducted by IFPRI and collaborating institutions. The final section looks ahead at the key trends that will continue to shape FVCs and the policy and research priorities for the coming years.

The chapter focuses mainly on transformation of domestic FVCs in LMICs, rather than the transformation of global value chains. However, we note that trade policies, foreign direct investment (FDI), and actors from global value chains, such as large food industry and agribusiness companies, have shaped the changes in domestic FVCs.

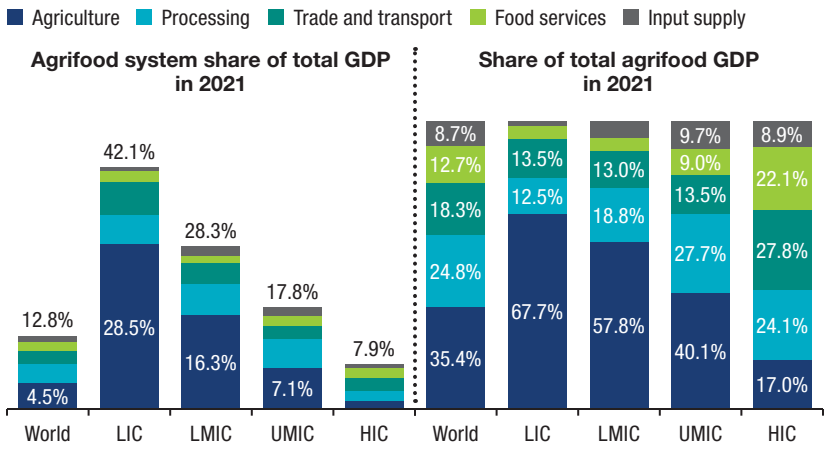
Expansion of domestic food value chains

Growth of FVCs in LMICs, and in their importance in LMIC economies, employment, and diets, has been rapid over the past 50 years.[1] In sub-Saharan Africa (SSA), rural-to-urban FVCs grew 800 percent between 1985 and 2010 (Haggblade 2011), and urban areas now account for about 60 percent of the region's food consumption (Reardon, Echeverría et al. 2019). In India, urban food expenditures increased threefold (in real terms) between 1991 and 2006, supplied by growth in domestic rural-to-urban FVCs (Minten, Reardon, and Vandeplas 2009).

Rural-to-urban FVCs are very important because urban consumers, such as in SSA now purchase nearly all of their food (per World Bank Living Standards Mearurement Study [LSMS] data), of which 80–90 percent comes

1 Growth of FVCs in LMICs has been notably faster than the similar transformation that occurred in the United States in the mid-20th century.

FIGURE 7.1 Agrifood sector value chains



Source: Thurlow et al. 2025.

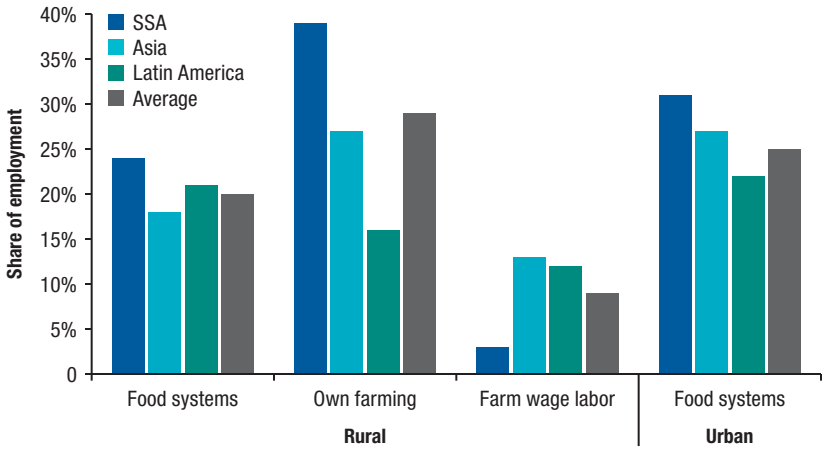
Note: LIC= low-income countries; LMIC = lower-middle-income countries; UMIC = upper-middle-income countries; and HIC = high-income countries.

via FVCs from rural areas and the rest from imports (Liverpool-Tasie et al. 2021). Rural-to-rural urban-to rural FVCs have also become very important in Asia, Latin America, and SSA. By the 2010s, around 60 percent of rural food consumption in SSA came from purchases, including in both unfavorable and favorable agroecological zones and in both poorer and richer countries (Dzanku et al. 2024). India's rural consumers now purchase about 80 percent of their food (Reardon, Mishra et al. 2020).

As a country's gross domestic product (GDP) increases, the agrifood system share of GDP falls. As shown in Figure 7.1, the agrifood sector now makes up about 42 percent of GDP in low-income countries (LICs) and only 7.9 percent in high-income countries (HICs) (Thurlow et al. 2025). However, as GDP rises, the share of off-farm segments within the agrifood sector also grows: today, the farm share is 67.7 percent for LICs but only 17 percent for HICs.

Related to this growth, rural and urban household employment data indicate that off-farm food systems employment is growing faster than agricultural employment across all country groups (Figure 7.2). A study (Dolislager et al. 2021) using LSMS survey data from SSA, Asia, and Latin America points to several key findings: for rural areas, food systems employment—in agrifood processing, wholesale, logistics, retail, and food service, mainly in MSMEs

FIGURE 7.2 Agrifood systems employment



Source: Dolislager et al. 2021.

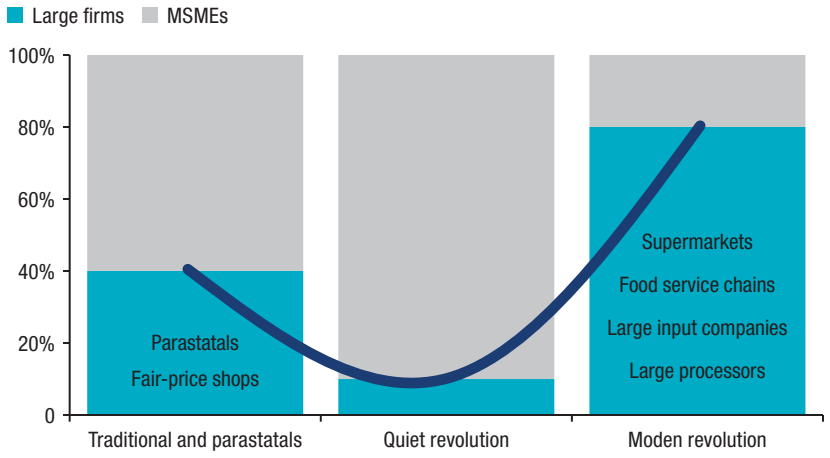
Note: Data cover 178,794 households with 460,654 individuals. sub-Saharan Africa (SSA) is represented by Ethiopia, Malawi, Niger, Nigeria, Tanzania, and Uganda; Asia by Bangladesh, Cambodia, Indonesia, and Nepal; and Latin America by Mexico, Nicaragua, and Peru.

as wage-based or self-employment—now accounts for 20 percent of rural employment (measured in full-time equivalents, or FTEs). The relatively small share in rural Asia (18 percent) indicates that processing and wholesale are more agglomerated in urban areas in Asia than in SSA. The average share of own-farming employment is just slightly higher than food systems employment, at 29 percent, and well above the share of employment as farm wage labor, which averages only 9 percent. The study also found that food systems employment is important in urban areas, averaging 25 percent of FTEs.

Over the past 50 years, there has been a profound transformation of FVCs in LMICs through two broad policy phases, the pre-liberalization (and pre-globalization) phase, roughly 1970–1990, and the post-liberalization (and globalization) phase, roughly 1990 to the present.

During the pre-liberalization phase, FVCs were characterized structurally by a mix of the traditional stage of FVCs (dominated by micro enterprises and spatially short supply chains in a food economy with a limited urban share) and a parastatal segment (including large grain and oilseed processors, public distribution such as grain depots and subsidized "fair price" shops, and state input retailers) coupled with price controls and subsidies, particularly on grains.

FIGURE 7.3 The J-curve of concentration: Stages in FVC transformation



Source: Derived from Reardon (2015).
Note: MSMEs = micro, small, and medium enterprises.

During the post-liberalization phase, FVCs underwent two revolutions (Reardon and Timmer 2007). We discuss the drivers of these revolutions in detail later, but summarize their features here to set the stage:

1. A *quiet revolution*, featuring a rapid proliferation of MSMEs in the midstream segments of FVCs (processing, wholesale, and logistics) and agri-dealers in farm input value chains.[2]

2. A *modern revolution*, featuring the proliferation of supermarket chains, large processors, specialized wholesale firms, and large farm input firms (Reardon and Timmer 2007). These large firms were formed by the privatization of parastatals, by foreign direct investment (FDI), and by expansion of MSMEs.

The above two phases and two revolutions can be illustrated by a J-curve pattern of concentration (Figure 7.3) (Reardon 2015). The left side of the J is the pre-liberalization phase, when FVCs are moderately concentrated—a fragmented sector made up of traditional micro enterprises coexists with a concentrated parastatal sector. The quiet revolution in the hidden middle,

2 See Reardon, Chen et al. (2012) for the idea of the "quiet revolution" of MSMEs; and Reardon (2015) for the term "hidden middle."

post-liberalization, is in the middle of the J-curve, when parastatals have been eliminated, MSMEs proliferate, and the agrifood sector experiences de-concentration. The modern revolution is on the right side of the J-curve, when entry and formation of large firms concentrate the sector.

The timing of the phases and of the associated transformations of FVCs is approximate, as it differs (sometimes years earlier, sometimes years later) by region and country. As a rough approximation, SSA and South Asia are primarily in the middle segment of the J-curve at present, and Central and Eastern Europe and much of Southeast Asia and Latin America are at the early inflection of the third segment of the J-curve or well into it. We structure the rest of the chapter around these policy phases and FVC revolutions.

Pre-liberalization policy phase

Patterns and drivers

The pre-liberalization phase, in the decades preceding the 1990s, was characterized by a mix of traditional FVCs, dominated by micro enterprises and spatially short supply chains, and large-scale state-run agrifood firms (parastatals) combined with policies of price controls and subsidies. For governments, international credit was relatively abundant to support spending on farm and consumer subsidies, parastatals, and public infrastructure up until the structural adjustment era of the 1980s and 1990s (see Chapter 3).

For political economy reasons, governments wanted to ensure consistent and low-cost supplies of food to emerging cities and inputs to farmers. However, governments and many researchers believed that traditional FVCs had serious deficiencies, and in socialist countries, this assumption extended to market mechanisms more generally. It was assumed that the high transaction costs associated with numerous small and disbursed food distributors prevented traditional FVCs from supplying large volumes of food to cities or inputs to farmers. Moreover, the practices of traditional wholesalers were deemed exploitative, with accusations of price gouging harming both farmers and consumers. Given these perceived deficiencies of traditional FVCs and the desire of both governments and donors to ensure that pre- and post-farmgate supply chain contexts were favorable to the emerging Green Revolution in Asia and Latin America and to agricultural growth in LMICs more generally, governments adopted public goods solutions in the form of parastatals, regulations, and subsidies (see Chapters 3 and 17).

The parastatals included large processors that procured food grains and export crops from farmers, public distribution institutions such as grain depots, subsidized "fair price" shops that marketed grains to urban consumers, and state-run farm input firms that supplied inputs and credit to farms in an effort to address market imperfections (Swinnen and Maertens 2007). Support to farmers and consumers was bolstered by the development of public infrastructure to reduce marketing costs, including roads, electricity connections, market information systems, and public wholesale markets (Abbott 1967).

Research themes, policy critiques, and policy implications

For several decades prior to the 1990s, researchers questioned the widespread perception (the "conventional wisdom") that viewed traditional FVCs as anti-competitive, exploitative, and inefficient and that had justified the replacement of traditional FVCs with parastatals. Research in India contradicted this conventional wisdom, demonstrating a high degree of competition in paddy, rice, wheat, and sorghum markets (Lele 1971). In Peru, research showed that small traders were competitive and that their profit margins were commensurate with their high transaction costs and risk levels (Scott 1985). Later studies of traditional small and medium traders, which considered distance from markets, risks, and transaction costs in their analysis, such as an IFPRI study (Minten and Kyle 1999) in the former Zaire, likewise found that the profit margins of small traders largely reflected traders' high costs and risks, rather than excessive profits.

IFPRI researchers tested the market efficiency of traditional FVCs at the subnational (meso) level using tests of spatial market integration—that is, whether price signals and information are transmitted smoothly across markets, such that prices in different markets generally move together. A study in Bangladesh found that overall grain market integration was moderately high, with low integration apparent in less than 10 percent of markets, despite the conventional wisdom that these markets are inefficient (Goletti et al. 1995).

IFPRI researchers also conducted assessments of the cost-effectiveness of subsidies and public retail food distribution programs, which served as the FVC for many urban residents, in targeting poor consumers (see Chapter 11). Extensive research contributions by IFPRI in Egypt were influential in prompting the government to rethink and refine its food distribution systems, particularly in targeting and improving the efficiency of food subsidies (Ahmed and Bouis 2002; Alderman and von Braun 1986).

Post-liberalization policy phase: Drivers of transformation

We first describe the policy and nonpolicy drivers of the two FVC revolutions in this post-liberalization phase, and then discuss the revolution in some depth. Liberalization was introduced in the late 1980s in early-reforming countries and in the 1990s and 2000s in late-reforming countries. The reform was driven by untenable fiscal and trade balance deficits created by the existing public systems, external pressures such as conditionality imposed by the International Monetary Fund and World Bank through structural adjustment programs (see Chapter 3), as well as accumulating evidence that while parastatal systems were inefficient,[3] the domestic private sector was not necessarily inefficient or exploitative (Reardon and Timmer 2007).

Liberalization

Domestic market liberalization was important to both the proliferation of MSMEs and the formation and entry of large private enterprises (LPEs) in FVCs. Liberalization policies included reduction and elimination of price controls and subsidies and a major shift away from parastatals and cheap food policies as countries moved toward liberalized, pro-private-sector food policies (Timmer et al. 1983). A key component of these reforms was the privatization, scaleback, and elimination of parastatals, including state food retail chains, grain procurement systems, farm input depots, and government agrarian banks.

Policies liberalizing foreign trade and FDI introduced in the 1990s and 2000s particularly facilitated the modern revolution through (1) the elimination or reduction of FDI restrictions preventing foreign modern LPEs from entering LMICs; (2) privatization of parastatals, often by selling them to domestic or foreign LPEs; and (3) liberalization of product trade internally and externally.

IFPRI research informed the shift to liberalization in FVCs, with notable success in rice policies. For example in Bangladesh in the late 1990s, IFPRI studies (for example, del Ninno and Dorosh 2001) emphasized the role of private traders in stabilizing rice markets during severe floods and highlighted the negative consequences of government market interventions. This encouraged a shift toward market-driven solutions that included a reduction in government controls, an increased role for private traders, and promotion of free trade, changes that helped Bangladesh better manage the rice market during natural disasters, ultimately leading to more resilient food systems.

3 On Africa, see Delgado and Mellor (1984) and Christensen and Witucki (1982).

As the shift into the post-liberalization phase proceeded, a rich literature on political economy factors emerged that identified country-specific paths to liberalization. This work lies beyond the scope of this chapter but includes studies on the drivers and transition paths from agrifood socialism to liberalization in China, Viet Nam, Central and Eastern Europe, and the former Soviet Union (Swinnen and Rozelle 2006) and on the transition away from parastatals in Asia and Africa (Kherallah et al. 2002; Rashid et al. 2008).

Infrastructure investments

Public infrastructure investments, particularly the development of wholesale markets, roads, and electricity systems, underpinned both FVC revolutions. First, wholesale market investments were made by municipal, state, and national governments, as well as by the private sector. Wholesale markets provide several crucial advantages: they created agglomeration economies that could be served by burgeoning wholesale and logistics MSMEs in the quiet revolution (Reardon, Liverpool-Tasie, and Minten 2021) and later could supply supermarket chains in the modern revolution, as occurred with horticultural FVCs in Central America (Berdegué et al. 2005). Additionally, they formed important nodes linking rural towns to secondary cities and to primary cities through lengthening rural-to-urban FVCs, such as with fish FVCs in Nigeria (see Liverpool-Tasie et al. 2024). Wholesale markets also served to mitigate transaction costs and risk for buyers (including urban food firms, MSMEs, and large firms alike) and for sellers (farmers, rural traders, and processors). For example, public investment in these markets was shown to promote development of the teff FVC in Ethiopia, as well as spurring technological change among teff farmers (see Box 7.1) (Minten, Tamru et al. 2016). Finally, these markets serve as determinants of food safety in the supply of perishable products (Fafchamps et al. 2008). However, while the development of wholesale markets was particularly crucial during the quiet revolution, their significance has tended to decrease in the modern stage as supermarkets increasingly source directly from processors and farmers (Reardon and Timmer 2012).

Second, the development of roads facilitated the lengthening of FVCs. In Bangladesh, for example, feeder roads into rural areas supported the rapid development of the aquaculture FVC, which, in just 10 years, experienced a tripling of midstream MSMEs serving the domestic urban market (Hernández et al. 2018). Research in Ethiopia demonstrated the centrality of highway improvements coupled with MSME investments in larger trucks in reducing transport costs and expanding the teff FVC serving Addis Ababa (Minten, Tamru et al. 2016).

BOX 7.1 The quiet revolution in the Ethiopian teff value chain

Research on the Ethiopian teff value chain, conducted by IFPRI and collaborators from Ethiopia's national agricultural research system, illustrates the developments on the demand and supply side of processed and prepared grains. Traditionally, consumers have bought teff as a grain, cleaned it themselves, had it custom milled, and then prepared enjera at home. Although these practices are still maintained in rural areas and small towns, they have changed in Addis Ababa since the early 2000s. As custom milling and home cleaning of grain declined, consumers began to buy teff flour or prepared enjera, driving a nearly 50 percent increase in teff mills, enjera-making enterprises, and retail outlets in the city's neighborhoods. Wholesale marketing of teff has also surged. Research shows that the marketed surplus of teff increased rapidly over the past decade, and significantly more trade was reported on average in these markets over time. The reported number of trucks increased over the decade by some 70–80 percent across lean and peak periods. Growth in the teff value chain is exceeding urban population growth in Ethiopia, indicating higher consumption levels in the cities, more trade between rural areas that may pass through urban wholesale markets, and growth of transportation by trucks.

Source: Minten, Tamru et al. (2016).

Third, the public and private provision of electricity has been crucial to both FVC revolutions. For example, the expansion of the electricity grid played a key role in facilitating the rapid proliferation of cold storage MSMEs in Agra, India, in the 2000s (Reardon, Chen et al. 2012), as did the diffusion of private generators in Bihar (Minten, Reardon et al. 2014).

Rapid growth in urban and rural food demand and markets

Changes in food demand have contributed to—and been driven by—the proliferation of MSMEs in the quiet revolution and of large processors and supermarkets in the modern revolution. When urban areas accounted for a small share of total food consumption before the 1990s, their "demand pull" effect on domestic FVCs was small. With the huge increase in the size and share of the urban population in the past three decades, urban food consumption now accounts for the majority of national food consumption in LMICs.[4] These

4 For an example in Africa, see Liverpool-Tasie et al. (2021); for India, see Reardon, Mishra et al. (2022).

changes deeply affected the growth and composition of FVCs, incentivizing the quiet revolution and the modern revolution, both of which occurred earliest in urban areas.

Rural areas have likewise seen an enormous increase in the share and volume of purchased foods in consumption, with similar impacts on FVCs. In contrast to urban areas, however, the quiet revolution has continued to dominate rural food economies in the post-liberalization period, with the modern revolution emerging later in rural towns, such as supermarket chains spreading into rural towns in Chile (Faiguenbaum et al. 2002) and Indonesia (Reardon, Stamoulis, and Pingali 2007), and e-commerce extending into rural towns in China (Guo et al. 2022).

Change in composition of food demand

Two important changes have occurred in diets, driven on the demand side by increasing incomes and employment outside the home (and thus opportunity cost of time to prepare and process food at home), and on the supply side, by a rapid increase in the supply and accessibility of a greater diversity of foods.

First, starting roughly in the 1990s, diets diversified—the share of grains in overall food consumption declined in both urban and rural areas, while demand increased for animal-source foods, fruits and vegetables, and processed foods (see Chapter 12).[5] By the 2010s, grains made up only one-quarter of food consumption in India (Reardon and Minten 2011) and just over one-third of food expenditures in Ethiopia (Worku et al. 2017).

Second, starting in the 1980s and 1990s, urban and rural households began buying processed foods, spurring growth of processing MSMEs and LPEs, which made processed foods more accessible and further promoted processed food consumption. For example, urban, and eventually rural households, gradually shifted away from growing or buying raw ingredients, such as raw grain, and processing and preparing them at home, instead buying raw grain and having it custom milled by a local MSME, then shifting to buying milled flour and processed foods (such as jarred sauces, bread, noodles, and so on). This final shift tended to entail first buying non-ultra-processed foods such as bread and then adding ultra-processed foods, such as sodas and cookies, to the diet, as well as consuming more meals away from home in food-service MSMEs.[6]

5 For Africa, see Reardon, Liverpool-Tasie et al. (2024); for Asia, see Pingali (2007).

6 For Africa, see Reardon, Tschirley et al. (2021); on food service MSMEs in Tanzania, see Sauer et al. (2021).

Post-liberalization: The quiet revolution

General patterns and research findings

In the quiet revolution, the MSME sector responded strongly to liberalization, better infrastructure, and the increase in demand for nongrain and processed foods. Detailed survey-based research conducted by IFPRI, Michigan State University (MSU), and collaborators from LMIC national agriculture research systems over 20 years has shown that MSMEs have been very dynamic in the midstream segments of FVCs, such as processing, wholesale, logistics, and farm input retailers (agri-dealers), since 1990.

Through investments and the formation of new enterprises, MSMEs have supplied the huge increase in volumes of these products to rural and urban areas (Reardon, Liverpool-Tasie et al. 2024). In Africa, MSME wholesalers supply horticultural and animal-source products to expanding cities as well as to rural purchasers, with studies documenting this supply for milk and vegetables marketed in Addis Ababa (Minten, Habte et al. 2020; Minten, Mohammed, and Tamru 2020); tomatoes in Tanzania, where the number of tomato traders increased sixfold in three decades (Reardon 2024); aquaculture fish sent to Dhaka and other towns in Bangladesh (Hernández et al. 2018); and aquaculture and capture fish supplied from spontaneous clusters of fish capture and farming operations to consumers throughout Nigeria (Liverpool-Tasie et al. 2024).

FVCs lengthened considerably as the urban share of LMIC populations and national food economies grew quickly (see Liverpool-Tasie et al. 2021; Reardon et al. 2020) and induced a large increase in third-party logistics, for example, in the Nigerian maize FVC (Liverpool-Tasie, et al. 2021). While in some cases, such as green leafy vegetables, domestic FVCs remain spatially short or medium in length, many of the FVCs developed by MSMEs are spatially long, such as for tomatoes and fish in Nigeria.[7]

The lengthening of food supply chains from rural to urban areas was facilitated by substantial public investments in roads and growth of the wholesale sector, including (1) an increase in wholesale markets, such as in China (Huang et al. 2007), India (Minten and Reardon 2011), Ethiopia (Minten, Tamru et al. 2016), and Nigeria (Liverpool-Tasie et al. 2021); and (2) the proliferation of urban wholesalers and rural traders, for example increased entry of traders into the market in Madagascar (Barrett 1997).

7 On vegetables in Nigeria, see Liverpool-Tasie et al. (2023, 2024).

BOX 7.2 The quiet revolution in potato value chains in India

In India, government R&D of potato varieties and extension services provided for the new varieties were complemented by subsidies for tubewells and cold storage, as well as major investments in road improvements, the power grid, and communications networks. Research by IFPRI and Michigan State University in Bihar and Agra looked at the impact on potato value chains from farmer to consumer. Following the government investments, growing urban demand for vegetables was met by a significant shift from food grain to potato production in agricultural zones near Agra and in Bihar as well as rapid investment by many MSMEs in refrigerated cold storage. Farmers flocked to the cold storage firms, with the share of farmers using the storage sites in the Agra study area rising from 1 percent in 1999 to 99 percent by 2009. Wholesalers, mainly from Delhi, came and bought directly from local traders or farmers at the cold storage enterprise sites. Investments in cold storage, which de-seasonalized the potato supply, as well as in the new varieties and infrastructure, reduced consumer prices for potatoes, fueling an increase in consumer demand and further growth in the sector.

Source: Reardon, Chen et al. (2012) for Agra; Minten, Reardon et al. (2014) for Bihar.

The rapid spread of MSMEs has not only responded to but also fueled increases in demand for nongrain products. For example, the rapid development of cold storage MSMEs has had a bidirectional impact on potato demand in India (see Box 7.2). Income and population increases in India's large cities in the 1990s and 2000s led to a major increase in the demand for vegetables in general and potatoes in particular. The development of the potato value chain and cold storage options lowered prices for consumers, further increasing demand.

MSMEs have also responded to the growing demand for processed foods. Grain millers and food service MSMEs spread rapidly, such as in urban Africa, where an IFPRI study documented the increase in food vendors selling prepared millet and rice dishes in Ouagadougou.[8]

Despite the evidence, this midstream dynamism has not been widely perceived or adequately acknowledged in the policy debate, as governments, donors, and researchers have too often maintained negative views of traders as

8 On grain millers in Africa, see Reardon, Tschirley et al. (2021); on Ouagadougou, see Reardon, Thiombiano, and Delgado (1989).

largely exploitative actors, rather than as dynamic investors. Midstream enterprises were also thought to be few in number, leading to a dearth of input and midstream value chain services. This idea is captured by the term "the missing middle," often heard in international development forums and from donors, governments, and nongovernmental organizations (NGOs). Yet, in view of the sector's dynamism, the midstream is more accurately termed the "hidden middle" (Reardon 2015). As a consequence of this misperception, donors, NGOs, governments, and even international agricultural research centers still promote direct actions and investments to create midstream activity, rather than supporting and leveraging existing local, grassroots innovations.

Policy research and recommendations

Highlights from the policy research literature on the quiet revolution in MSMEs, which continue to be relevant to today's FVCs, include the role of spontaneous clusters, wholesale markets, disintermediation in FVCs, and continued debate about exploitation of farmers in FVCs.

SPONTANEOUS CLUSTERS OF FARMS AND MSMEs

A large body of research in the past 20 years, including important collaborative work of IFPRI with MSU, has focused on the emergence and rapid development of "spontaneous clusters" of farms and off-farm MSMEs. This work has served to balance the public debate that has mainly focused on "managed" clusters, such as agro-parks and special economic zones promoted by governments, donors, NGOs, and large "anchor" companies. Spontaneous clusters, in contrast, grow up organically through the co-location and evolution of MSMEs—primarily those supplying farm inputs and midstream processing of agricultural products—alongside farms (Belton et al. 2024; Reardon, Liverpool-Tasie et al. 2024).

Spontaneous clusters of farms and MSMEs have commonly formed near water sources and highways that connect farming areas to city markets. Off-farm MSMEs providing services to farmers in these clusters have helped to attract more farmers, and rising numbers of farms increase demand for their services. Public investments in roads, electrification, wholesale markets, and certain aspects of governance, such as control of banditry and conflict, favor both the functioning of MSMEs as individual firms and the emergence of spontaneous clusters. This has been shown, for example, in the proliferation of modern cold storage in Bihar and Uttar Pradesh in India and in Bangladesh in the 2000s and 2010s (Minten, Reardon et al. 2014; Reardon, Chen et al. 2012) and for milk chilling centers in Uganda (Van Campenhout et al. 2021) and India

(Burkitbayeva et al. 2023). While government investments in infrastructure have provided important enabling conditions for these clusters, these investments usually were not intentionally designed to support the clusters.

In the Ethiopian Rift Valley, IFPRI conducted research on spontaneous clusters of vegetable farmers and off-farm MSMEs (Minten, Mohammed et al. 2020). Vegetable farmers began production at this site because of good growing conditions (especially easy access to water) and highway links to the growing Addis Ababa market. Wholesalers, logistics firms, and input suppliers as well as agricultural service providers (such as well-digging outfits) moved into the area, creating an agglomeration of services within a decade that supported further expansion of vegetable farming, which now supplies a large share of the vegetables sold in Addis Ababa. Research on aquaculture clusters in Bangladesh and Myanmar also produced evidence of rapid, spontaneous "symbiotic" co-location and proliferation of farms, wholesalers, input suppliers, and transporters.[9]

Research findings also suggest an important link between lengthening of FVCs, the proliferation of MSMEs in those longer chains, and development of spontaneous clusters. For example, a large spontaneous cluster of tomato farmers and related off-farm actors in several states in northern Nigeria sends tomatoes some 500 to 1,000 kilometers to central and southern Nigeria (Liverpool-Tasie et al. 2023).

Finally, research has found that spontaneous clusters can promote farmers' adoption of technology by reducing their transaction costs and thus creating incentives for farmers to commercialize. This was shown, for example, for aquaculture clusters in Bangladesh (Hu et al. 2019).

WHOLESALE MARKETS AND MSME TRADER DYNAMICS

Looking at the role of wholesale markets, IFPRI and collaborators first assessed the impact of government restrictions on direct sales by farmers to these markets. Governments such as India's had restricted sales in wholesale markets to licensed traders prior to liberalization to facilitate monitoring and control of trader margins. IFPRI studies in the 2000s informed the reform of India's 1963 Agricultural Produce Marketing Act, which regulated the marketing of agricultural products in government wholesale markets (Joshi et al. 2004). The research showed that policies to restrict entry into agricultural trade are neither necessary nor useful for ensuring fair prices, and that governments

9 On Bangladesh, see Hernandez et al. (2018) and Hu et al. (2019); on Myanmar, see Belton et al. (2018).

should focus instead on facilitating entry and competition among traders and processors. This finding was supported by detailed trader surveys in Benin, Madagascar, and Malawi showing that marketing costs are nearly proportional to transaction size and that larger traders do not have significantly different profit rates than smaller traders (Fafchamps 2005).

Second, IFPRI research recommended technological and institutional innovations to upgrade wholesale markets and other commodity trading places. One such innovation in which IFPRI research played a crucial role was the Ethiopian Commodity Exchange (Gabre-Madhin 2012).

THE CONTINUING DEBATE ON EXPLOITATION

Research also continued to debunk some tenets of conventional wisdom. For many decades, trader–farmer interactions were depicted in terms of traders' "tying" credit to farmers' agreement to sell them their output, in what has often been viewed as an exploitative relationship (for example, Harriss-White 2008). Recent work shows a decrease in such tied output–credit arrangements, at least in output markets. These arrangements become less advantageous to farmers once they have better access to roads (and thus to competing traders), to cash from rural nonfarm employment, and to digital information that allows them to compare offers. This decrease has been observed, for example, in rice value chains in Bangladesh, China, India, and Viet Nam (Reardon, Chen et al. 2014).

Recent research also shows that informal relations between MSME traders and processors and small farmers can benefit farmers by helping to resolve idiosyncratic market failures. Recent literature on relational contracts (Macchiavello et al. 2022) suggests that these informal arrangements can include provision of transport, credit, and information for small farmers, who primarily rely on upstream and downstream MSMEs for inputs, services, and output sales (Liverpool-Tasie et al. 2020). Research on the Rwanda coffee FVC has provided an example of these relationships (Macchiavello and Morjaria 2021).

CONCENTRATION AND DISINTERMEDIATION IN THE MSME SECTOR

First, as noted above in the J-curve of concentration, after the parastatal era there was a proliferation of MSMEs, followed by increasing concentration as LPEs enterd FVCs and many MSMEs either exited or were acquired by LPEs. In Zimbabwe, for example, the grain processing sector de-concentrated in the early post-liberalization period in the 1990s as MSMEs entered and parastatal plants were sold or eliminated, and then re-concentrated in the 2010s as LPEs acquired processing MSMEs (Reardon, Tschirley et al. 2021; Rubey 1995). In

China, the rapid shuttering of small rice mills, accompanied by a concentration and urbanization of rice mills, occurred in the 2000s (Reardon, Chen et al. 2014).

Second, IFPRI and MSU research identified "disintermediation" in the MSME trader sector in a number of countries. Disintermediation refers to a reduction in the number of midstream actors between consumers and upstream sellers in the value chain. To illustrate, it can involve a mill or urban wholesaler buying directly from farmers and bypassing the traditional link with the rural (village) trader, or a mill or urban wholesaler selling directly to urban retailers, bypassing the traditional link with a semi-wholesaler who makes the link to the city market. Disintermediation has been found to be closely linked to the rise of third-party logistics, which provides the crucial delivery link for the disintermediating wholesaler or mill. Examples of these phenomena are shown for rice in Bangladesh, China, and India (Reardon, Chen et al. 2014) and maize value chains in Myanmar (Belton et al. 2024).

Post-liberalization: The modern revolution

Conventional wisdom at the start of the post-liberalization phase

Conventional wisdom assumed that conditions in LMICs were unfavorable to investment in and development of modern LPEs. One tenet of this wisdom held that parastatals would crowd out LPEs, a somewhat circular argument given that the rationale for establishing parastatals was that new LPEs would not emerge in LMICs and traditional, local LPEs were too inefficient to meet the needs of growing cities. In addition, it was thought that both foreign LPEs and private domestic investors would consider the market conditions inadequate to create or invest in LPEs. This tenet likewise reflected a circular argument, since during the pre-liberalization phase, strong strictures were placed on FDI to protect both small and large local firms. Last, it was argued that supermarkets would not spread because demand conditions were unfavorable in LMICs and a "supermarket revolution" was considered impossible (for example, see Goldman 1974).

Conventional wisdom also held that, in contrast to the parastatals, LPEs do not aim to provide public goods, and thus domestic LPEs were exploitative and speculative, as would be any foreign LPEs established in LMICs. This assumption, combined with a protectionist perspective and fears of foreign LPEs outcompeting local firms of all sizes, led to FDI regulation that initially slowed investments by foreign LPEs.

Events and research proved much of this conventional wisdom wrong, as we discuss next.

General patterns

The immediate effects of FDI liberalization reforms were huge inflows of FDI from supermarket chains, large processors, large logistics and wholesale distribution firms (often to service FDI food industry firms), and large farm input companies (Reardon and Timmer 2007). For example, Brazil's relaxation of FDI constraints spurred large investments by dairy multinationals such as Nestlé and Parmalat (Farina 2002). Similar experiences have been documented in Poland (Dries and Swinnen 2004).

Historically, FDI had been mainly "vertical" to create export bases, such as tea plantations, but the new wave of FDI was mainly "horizontal," intended to provide services, domestic markets for, and inputs to local FVCs (Awokuse and Reardon 2018). FDI initially flowed from HICs, such as multinational retailers Carrefour and Walmart, which established stores in Brazil; and then from emerging market countries, such as Korean supermarket chains that enter China.

As these LPEs entered the market, they competed with existing firms. New LPEs often acquired legacy LPEs, such as old family firms, and bought up or outcompeted MSMEs over time. In addition, sales of parastatals to domestic firms created LPEs. For example, various milling parastatals were sold to a Tanzania-based company, Bakhresa, allowing it to grow into a regional multinational firm (Reardon, Tschirley et al. 2021). This concentration is shown in the right side of the J-curve in Figure 7.3.

Policy research and recommendations from the modern revolution

Research has examined the development of the modern revolution, both geographically and temporally, and has explored the impacts of policy, the role of restructuring, and effects on nutrition and inclusion, among other topics.

IMPACTS OF POLICY ON THE MODERN REVOLUTION

As LPEs emerged upstream (large input companies), midstream (processors), and downstream (food service chains, supermarkets), research looked at how liberalization of the domestic sector and FDI influenced their expansion. One strand of research focused on the entry of foreign export firms and development of domestic firms and cooperatives that sold to those firms and exported directly, and examined their effects on farmers' cash cropping and food crop

productivity.[10] Another strand of research focused on the entry of foreign multinational firms marketing domestically, such as sugar and dairy processing multinationals in Central and Eastern Europe (Dries and Swinnen 2004; Gow and Swinnen 1998).

RISE OF THIRD-PARTY LOGISTICS AND MODERN-SECTOR DISINTERMEDIATION

Geographic lengthening of both domestic and export FVCs induced a further large increase in third-party logistics enterprises. An important symbiosis developed between supermarkets and large processors and these logistics enterprises, as well as with specialized wholesalers, as has been shown in Asia and Latin America (Reardon, Henson, and Berdegué 2007) and China (Hu et al. 2004).

However, the rise of supermarkets and large processors also sidelined some actors and institutions that had been important in the quiet revolution. For example, the modernization of supermarket procurement systems has reduced the role of traditional wholesale markets and MSME traders, as supermarkets increasingly rely on direct procurement from farms and processors. This modern-sector disintermediation has been documented in Central America (Berdegué et al. 2005) and in Central and Eastern Europe (Reardon and Swinnen 2004).

FVCs, MARKET POWER, AND REGULATIONS

Recent consolidation in agribusiness, food processing, and especially retailing have triggered discussions about the impact of market power. Prior to liberalization, concerns about excessive concentration in FVCs focused on the dominant position of state companies and food processors and related impacts on competition. With price and trade liberalization, and more recently the modern revolution, this discussion has now shifted to implications of concentration in trading, input markets, and the retail sector (Deconinck 2020).

Overall, the welfare effects of concentration in FVCs are more complex, both theoretically and empirically, than often presented (Swinnen and Vandeplas 2010). Concentration may benefit consumers and producers for several reasons, including scale economies in production or R&D, reductions in transaction costs, and countervailing power in value chains. Interest in countervailing power, in particular, has grown as concentration in the retail sector has increased the sector's power in FVCs, which may offset the market power of food processors and traders.

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10 For an example in Guatemala, see von Braun et al. (1989).

Poor consumers may welcome large retailers in their communities since these stores can give them access to cheaper food (and products in general). Growing retail concentration may also benefit consumers in the policy arena. When farmer and agribusiness interests (or consumer and large retailers' interests) are aligned, the size advantage of large companies in collective action and the numbers advantage of farmers and consumer groups can affect policies.

Many complaints of market power problems have come from farmers and smaller food processing companies. However, in this case also, the situation is more complex than it seems. For producers, large retailers may enhance, rather than reduce, competition in traditional markets, where trading is controlled by traditional middlemen. Moreover, markets characterized by vertical coordination and interlinked contracts within FVCs may enhance the bargaining power of farmers, and large downstream firms may have less incentive to wield market power to reduce prices paid to their suppliers (Kuijpers and Swinnen 2016; Sexton 2013; Swinnen and Vandeplas 2011). In all of these cases, there is a trade-off between concentration and both the efficiency effects of the relationships in value chains and their distributional effects. Empirical studies find mixed evidence on the relationship between concentration in FVCs and efficiency and rent distribution (Maertens et al. 2012; Minten et al. 2009).

Relatedly, market power may be an essential, but temporary, component of innovation in FVCs (Zilberman et al. 2019). Creators of new products can take advantage of market power with both upstream and downstream components (buyers and suppliers) of FVCs. This market power can be reflected in contracting terms and the nature of vertical coordination. However, in a dynamic environment, this market power may not last, so there is a trade-off between static and dynamic efficiency.

EFFECTS OF SUPERMARKETS ON NUTRITION

In conventional wisdom, supermarkets were thought to have several drawbacks. First, it was thought that introduction of supermarkets food prices would have impacts on LMIC consumers and be unaffordable for some. This idea has been challenged for a number of LMICs (Minten and Reardon 2008), including India (Minten et al. 2010). Modern retail at first may price its products high when it serves a niche market, but it eventually uses its economies of scale in procurement and marketing to lower prices to gain market share beyond the middle class by including the poor.

Second, supermarkets were thought to drive purchases of ultra-processed food. This belief has been disproved, for example, in Kenya, where researchers found no significant difference between the range of foods, especially processed foods, sold by small retailers and supermarket chains alike (Demmler et al. 2018).

Third, it was thought that supermarkets do not sell healthy foods such as fruits and vegetables. While this is the case in the early stages of supermarket penetration, over time, supermarkets shift into these products and even reduce their cost to poor consumers (Minten and Reardon 2008).

INCLUSION OR EXCLUSION

There has been debate over whether (and under what conditions) the modern transformation of the food industry has led to inclusion of small farmers, rural laborers, and small processors and of women and youth, or whether it has led to exclusion of these groups. In general, research tells a mixed story (Reardon, Barrett et al. 2009). Many case studies provide evidence of substantial inclusion, such as small farmers in the Polish dairy sector (Dries and Swinnen 2004); in export horticulture in Senegal (Maertens and Swinnen 2009); for sugar in Central Europe (Gow and Swinnen 1998); and in Madagascar (Minten, Randrianarison et al. 2009). Some studies show that inclusion is conditional on rights to resources, as shown for women's ownership of sugarcane plots in Uganda (Ambler et al. 2022). A synthesis of research on women and inequality in FVCs in Africa and Asia finds that women often face significant constraints to FVC participation (Quisumbing et al. 2021).

Inclusion has often been a result of resource provision contracts implemented by large firms to resolve idiosyncratic market failures that affect small farms. Indeed, the spread of modern firms throughout FVCs has increased farm technology adoption, quality upgrading, and product differentiation, as well as net incomes, as these firms use contracts and private standards to incentivize farms and processors to supply the needed volumes, quality, and safety traits of products (Barrett et al. 2012; Swinnen 2007; Swinnen and Kuijpers 2019).

However, there are also cases where company standards imposed by large firms on farms have led to exclusion and even shuttering of small farms, as occurred in Brazil's dairy sector (Farina 2002). In view of these mixed results, the policy issue has been whether and how to assist small farms and other actors to upgrade to meet the requirements of large enterprises. This research parallels the work on relational contracts for the quiet revolution.

Looking forward

Dramatic changes have occurred in LMIC food systems over the past 50 years. In 1975, when IFPRI was founded, food systems were largely in the traditional stage, urban populations were small, and subsistence agriculture was the norm, with only pockets of commercialization and intensification. Looking forward to the coming decades, we expect that some current trends will persist and can envision the accompanying food policy challenges and opportunities, although unexpected changes and challenges are also likely. In this section, we look at the most rapidly occurring trends and related policy and research needs.

Innovative FVC structures

Three types of innovative FVC structures discussed in this chapter are likely to grow in importance and merit increased attention.

SPONTANEOUS CLUSTERS

Spontaneous clusters, already important to supplying domestic and some export markets in Asia and Africa, are likely to expand in size and number as domestic and intraregional demand for diverse non-grain products grows in the coming decades. Research and policy attention to many aspects of these clusters are needed (Belton et al. 2024; Reardon, Liverpool-Tasie et al. 2024): (1) the policy and nonpolicy drivers of their growth and constraints to their formation and development; (2) effects of these "agglomeration economies" on the growth and innovation of firms and farms, such as technology innovation among farms;[11] (3) their governance, institutions, and informal coordination and how these affect transaction costs within and between clusters and the urban markets;[12] (4) their influence on nutrition within clusters and in the markets they supply, such as their effect on the cost of nutrient-dense foods to consumers;[13] (5) their effects on inclusiveness, especially the dynamics of entry and growth of employment for youth and women; and (6) their effects on food safety and the environment, as well as the related impacts of institutional arrangements such as land and water access in the cluster.

FARM CLUSTERS OR NEW COOPERATIVES

Farm cooperatives are an age-old structure aggregating farmers to source inputs, receive extension, or provide market outputs. Traditional location-based and

11 For an example in Bangladesh, see Hu et al. (2019).

12 On Peru, see Escobal and Cavero (2012).

13 On fish in Malawi, see Muhonda et al. (2024).

state-established and -managed cooperatives have declined over the decades and been replaced by a new generation of cooperatives and managed clusters. These are set up by smaller groups of farms with the objectives of meeting market requirements, enforcing use of technologies, and meeting quality and safety standards. They are emerging and spreading in LMICs, supported by large food and input companies that are, for example, seeking group certification for global market access.[14]

Research has identified particular cases of these new cooperatives, but a more systematic understanding is needed of where, how, and why these clusters emerge and of whether they are viable or profitable and able to meet market requirements. Research should consider these questions as well as examining the role of policies in the success or failure of these new groups. One interesting case showed the rapid diffusion of these new cooperatives in Chile and Brazil in the 1990s, but most proved unprofitable and folded (Berdegue 2001; Farina 2002). While these new cooperatives are often seen as a panacea for farmers' problems, they frequently encounter issues with organizational sustainability and profitability (Narayanan et al. 2025).

AGRICULTURAL OUTSOURCE SERVICE ENTERPRISES

As important suppliers in many LMIC markets, these services help farmers reach both cost-sensitive commoditized product markets as well as quality- and safety-sensitive markets. Outsource services will likely continue to spread geographically and into new sectors, such as animal products. Importantly, they will continue to expand the use of locally innovative technologies, such as rice combines, drones, and fruit tree hormone treatment. As the sophistication and cost of new technologies, including equipment such as drones, will likely be unaffordable for individual small farmers, these farmers are expected to increasingly turn to outsource services instead. Research and policy attention is needed to build understanding of several aspects of these service enterprises (Awokuse et al. 2024; Belton et al. 2024): (1) the spread of these services and the "business ecosystem" of policy and nonpolicy enabling factors that condition their emergence and development; (2) technological changes (such as adoption of robotics) in these enterprises and their innovative organizational relations, for example, with agricultural input and equipment companies (such as their emerging contract relationships with multinational firms); (3) the evolving business models of these firms, including their relationships

14 On shrimp in Bangladesh, see Narayanan et al. (2025).

with farmer cooperatives; and (4) ways to optimize inclusiveness, such as rural employment and environmental impacts of these firms.

Short- and long-term shocks to FVC resilience

FVCs will increasingly need to cope with shocks, including extreme weather events, local and international conflicts, epidemics, rising cybercrime, and trade policy and other economic disruptions (see Chapters 13 and 16). Debate around building FVC resilience has largely focused on government policies, regulations, and public investments to strengthen resilience and to help farms and firms cope with shocks. While this focus remains important, the formulation and effectiveness of policies can be enhanced by partnering with both large and small private sector firms and by considering these firms' strategies and actions for managing risks and coping with shocks.

DIFFERENTIATED POLICIES

Shocks typically affect all segments of FVCs (de Brauw and Pacillo 2022) but often cause disproportionate harm to rural zones, which are least able to prepare for or cope with shocks. As a result, events such as weather shocks deepen poverty both directly, through effects on farm production, and indirectly, as FVC actors such as traders, processors, and retailers shift procurement away from areas deemed vulnerable to shocks (Reardon and Zilberman 2018). Shocks also have a disproportionate effect on FVCs in the transitional stage, which tend to be geographically long but also structurally fragmented (dominated by small firms), meaning they have less capacity than large firms to manage risks and recuperate from shocks (Reardon and Vos 2021). Policymakers will need to ensure that entire FVCs as well as individual segments (such as farmers) are resilient and adaptable, with policies that promote stability and the capacity to handle a variety of shocks (see Chapter 13). Both researchers and policymakers need a better understanding of the differential impacts of shocks by FVC type and segment, as well as in vulnerable zones, to better craft appropriate policy and investment strategies.

ENABLING ENVIRONMENT FOR PRIVATE SECTOR ADAPTATION

Research and policy should increasingly consider and promote an enabling environment that allows private sector enterprises, whether small or large, to pivot to new technologies and practices, as well as sourcing and marketing strategies, in the face of shocks. This increases the resilience of FVCs overall: for example, during the COVID-19 pandemic, firms changed their

sourcing and marketing geographies, helped their suppliers to weather the shock, and rapidly adopted e-commerce and other digital solutions (Reardon and Swinnen 2020). Food industry and agribusiness firms generally undertake a wide range of actions to adapt to shocks, such as using third-party logistics firms as partners in reconfiguring supply chains to minimize damages (Reardon and Vos 2021).

PRIVATE SECTOR SUPPORT FOR FARM AND FVC RESILIENCE

Both large and small private sector FVC firms could increase their role in supporting small farmers' resilience in the face of shocks and even in mitigating farmers' contributions to shocks by helping to reduce their environmental footprint (Swinnen et al. 2024). While the policy debate around promoting adoption of climate-smart agriculture by farmers has focused on government policies, the importance of the private sector in enabling and encouraging farms to be shock resilient has been poorly understood and underappreciated. Going forward, research and policy should increasingly engage the private sector as partners in building farmers' resilience. Private sector firms have a business incentive to support resilience in order to ensure consistent supply from farmers (Swinnen et al. 2024). In past decades, firms have demonstrated their capacity to convert this incentive into concrete measures to assist farmers or to impose requirements on their suppliers by providing price premiums, information, loans, access to inputs, and other measures to help farmers meet the market's volume and quality requirements. This same power is being applied to help, and also require, farmers to stabilize their supplies to FVCs, such as by investing in small-scale irrigation.

COMPETITION POLICIES

While private sector influence can benefit FVC resilience, large firms can be expected to wield greater influence than smaller firms over their suppliers, which can endanger the fair distribution of income (Swinnen et al. 2024). Addressing this issue requires transparent and effective competition policies and regulations. This risk was recognized in earlier FVC innovations made by large firms and gave rise to legislation such as the European Union's Unfair Trade Practices (UTP) regulations. Public sector policy can complement private sector assistance by redirecting existing "non-green" subsidies to support better information and traceability infrastructure and by establishing compensation policies to address social concerns and political constraints arising throughout FVCs (Swinnen et al. 2024).

Opportunities and challenges related to changing market structures

FVC actors and the governments that support and regulate them will face both opportunities and challenges from a continuation of current trends in market structures, including ongoing concentration, a shift toward larger food markets in urban and rural areas, and the rapid growth in demand for diverse food products. Each of these has implications for forward-looking policy research and policies.

CONCENTRATION AND COMPETITION

As more countries move from the transitional stage to the modern stage of FVCs, wherein larger firms play a prominent role in inputs, processing, marketing, and retailing, more policy attention to competition and concentration in FVCs is needed. FVCs are generally becoming more concentrated, though at varying rates for different countries, products, and FVC segments. Policy debate has focused on how concentration affects the inclusion of small-scale firms and farms, consumer prices, and FVC innovation, with research showing that the results are mixed, depending on conditions. Notable benefits for both farmers and consumers can arise from the formation of large-scale firms, but reduced competition can also lead to negative impacts.

Different regulatory approaches are possible, including competition policies, the use of standards (either public regulations or private or NGO standards), or new types of regulations such as the UTP rules, which focus on the nature of transactions and contracting across the supply chain to ensure fair practices and efficient outcomes. Yet, farmers have often been unsatisfied with these competition regulations. Their demand for regulation often emerges when shocks trigger changes in vertical relationships and conditions. For example, recent food price volatility has contributed to farmer complaints about asymmetric price transmission within FVCs. Given the conceptual and empirical nuances and complexities, as well as the relative scarcity of rigorous studies on concentration and competition, especially in LMICs, future food policy research should give this area substantial attention, especially the specifics of how concentration and competition affect outcomes for producers and consumers.

NEW INVESTMENT IN PUBLIC INFRASTRUCTURE

Urbanization will continue to be a key factor driving transformation of FVCs and related policy challenges. Over the next 25 years, the urban population is projected to grow by 2.5 billion people, which will significantly contribute to FVC growth. Rural purchases of food have grown quickly as a share

of consumption and total volume over the past several decades, and will continue to be a key driver of FVC growth in coming years. Diet diversification beyond basic grains will continue (see Chapter 12), with horticulture, animal feed, animal products, and oil seeds playing a central role in future FVCs, with potentially positive impacts on nutrition outcomes.

These rapidly growing, vast food markets will require increased investments in wholesale markets; transportation infrastructure, particularly to link rural and urban areas; electricity systems; and fuel provision. For consumers, these investments tend to make food more affordable by reducing transportation costs. For midstream enterprises—those we have termed the hidden middle, including wholesalers, third-party logistics firms, processors, and agri-dealer input firms—these investments create an enabling business environment and should be a major priority in the decades to come. Given the growing importance of these agents in shaping efficient, equitable, safe, and resilient food systems, further study of their roles, operations, and public investment needs is essential.

FOOD SAFETY AND AFFORDABILITY

Rapid development of perishable food FVCs will require increased attention to food safety. Researchers and policymakers should focus on ensuring the safe and affordable delivery of the growing quantity of traded perishable food, from both national and international sources, within an increasingly volatile environment. Meeting growing demand for fruits and vegetables, fish, dairy, and meat will also require large-scale private and public investment in cold chain infrastructure. Gaining a better understanding of the role of cold chains and how they can be designed to generate beneficial outcomes will be crucial for these settings, as has been done for dairy products in Africa (Van Campenhout et al. 2021) and potato value chains in Asia (Reardon, Chen et al. 2012).

NEW TECHNOLOGIES

The rise of new technologies—such as artificial intelligence, smartphones, drones, genetic improvements, and other innovations—combined with agricultural labor scarcity will accelerate transformation in all segments of FVCs, with demand for these technologies growing over time. Moreover, these new technologies have potential to greatly reduce the link between modernization, consolidation, and technology upgrading, allowing for "modernization without consolidation." Recent innovations include technologies and technology services, such as outsource services, which allow small farmers (and off-farm enterprises) to enjoy economies of scale, machine and agronomic upgrading,

and information systems that previously were only accessible to medium and large firms. This evolution partly reflects the innovative technologies themselves, such as small-scale irrigation linked to meso-scale solar electrical grids. Policymakers will need to design frameworks, supported by relevant research, that facilitate the safe, ethical, and efficient adoption of these new technologies in ways that maximize benefits while minimizing the risks.

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